

THE THERAPEUTIC EFFICACY OF INVASIVE NEEDLING TECHNIQUES IN THE MANAGEMENT OF MYOFASCIAL PAIN AND DYSFUNCTION SYNDROME.

A dissertation submitted in partial compliance with the
requirements for a Master's Degree in Technology in the
department of Chiropractic at Technikon Natal.

by RICHARD JOHN BROOME

I, Richard Broome, do hereby declare that this work is my own,
both in conception and execution, except where otherwise
indicated in the text.

✓ RICHARD BROOME

14/2/96

DATE

Approved for final submission

DR A. V. PEERS M.DipC (SA)

14/2/96

DATE

DEDICATION

This research is dedicated to my parents Angela and Peter Broome.

Mom and Dad, thank you for all you have done for me. Without your unselfish contribution I would never have made it this far.

I love you and I hope I have made you proud.

ACKNOWLEDGEMENTS

DR ANTHONY PEERS

Tony, thank you for your help and supervision. Your time, input and effort are greatly appreciated

MR JACQUES DE KLERK

Without your help, my statistics would have been even a bigger headache. Thanks a lot for your time, patience and guidance.

MRS ALLISON BENTON

Thank you for all your help. You reduced the pressures by looking after the financial details, helping with the computer problems and being a good friend.

THE CLINIC STAFF OF TECHNIKON NATAL

Thank you for all the work you did when scheduling patients and looking after the clinical side of things.

THE PATIENTS WHO TOOK PART IN THIS STUDY

You may never see the results but without your contribution all this would not have been possible. Thank you.

MY FRIENDS

Thanks for all your help and support. A special mention must be made here of my closest friend Mark Wassung. Thanks Mark for all you have done for me over the years, your friendship has been outstanding. Your dedication to your own work has been an inspiration to me, and your ideas have taught me to always consider the alternate approach.

ABSTRACT

Myofascial trigger points are a frequently overlooked and misunderstood phenomenon in medical curricula, yet with correct diagnosis and appropriate treatment the prognosis is usually excellent. Many effective treatments have been devised for myofascial trigger points, but the problem is that there is very little research to substantiate which of these treatments are the most effective. The aim of this randomised uncontrolled study was to justify the hypotheses which stated that both dry needling and saline injection would prove to be effective in the treatment of myofascial trigger points, with saline injection proving to be the most effective of the two.

Patients were obtained for this study by convenience sampling, whereby any patients presenting to the Chiropractic Clinic at Technikon Natal with neck, upper back or shoulder pains were considered for the study. Of these patients, only those who conformed to the specified delimitations and diagnostic criteria were accepted. The sample size of thirty patients was randomly divided into two treatment groups of fifteen, one of which received saline injection and the other dry needling of active myofascial trigger points. Both groups were educated with regards to the nature and perpetuating factors of the condition, and were instructed to follow a specific stretching programme.

Each patient had to undergo a maximum of five treatments within a three week period, followed by an assessment consultation to determine the effectiveness of the treatment. A follow-up consultation was scheduled one month later to evaluate the long term effects of the treatment.

Subjective information regarding the patient's progress was collected by three questionnaires: the numerical rating scale, McGill pain questionnaire and pain disability index. Objective information was gathered with the aid of an algometer. Readings were taken at each consultation before treatment commenced. The information used for statistical purposes was that data gathered at the first treatment consultation, the assessment consultation and the follow-up consultation.

The data was analysed using Wilcoxon's paired signed rank test for intra-group analysis and the Mann-Whitney U test for inter-group analysis. The statistical level of significance was set at 5% for both of these tests. Results were displayed with the aid of tables.

Hypothesis one and two were accepted as the results showed significant improvement for each group with regards to subjective and objective findings. Hypothesis three was rejected as there proved to be no statistically significant difference between the effects of the two treatment groups. This study showed that both types of treatment are very effective in the management of

myofascial pain and dysfunction syndrome, but neither treatment protocol was found to be more effective than the other.

This study supports the findings of authors who state that it is the effect of the needle, and not the injection of any substances, that is of importance in trigger point therapy. Using the results and personal experiences of this study as a basis, I would recommend that in a practice setting, dry needling be the invasive needling of choice for myofascial trigger points due to the fact that it is quicker, more economical, patients seem to prefer it to other forms of invasive needling and it's effectiveness in eliminating trigger points has been proven.

TABLE OF CONTENTS

	Dedication.....	i
	Acknowledgements.....	ii
	Abstract.....	iv
	Table of Contents.....	vii
	List of Appendices.....	ix
	List of tables.....	x
	Definition of Terms.....	xiv
CHAPTER ONE	INTRODUCTION.....	1
CHAPTER TWO	REVIEW OF THE RELATED LITERATURE.....	8
2.1	Introduction.....	9
2.2	Aetiology.....	10
2.3	Prevalence.....	12
2.4	Perpetuating factors.....	14
2.5	Development of Trigger Points.....	15
2.6	Clinical Presentation.....	18
2.6.1	Symptoms.....	18
2.6.2	Signs.....	20
2.7	Diagnosis.....	21
2.8	Treatment.....	24
2.9	Measurement Techniques.....	32

2.10	Muscle Overview.....	33
2.10.1	Trapezius.....	33
2.10.2	Levator Scapulae.....	36
2.10.3	Rhomboidius Major and Minor.....	37
2.10.4	Supraspinatus.....	38
2.10.5	Infraspinatus.....	39
2.10.6	Teres Major.....	41
2.10.7	Teres Minor.....	42
2.10.8	Pectoralis Major.....	42
2.11	Summary.....	44
CHAPTER THREE	MATERIALS AND METHODS.....	45
CHAPTER FOUR	RESULTS.....	61
CHAPTER FIVE	DISCUSSION.....	80
CHAPTER SIX	CONCLUSIONS AND RECOMMENDATIONS.....	90
	REFERENCES.....	93

LIST OF APPENDICES

A	TREATMENT GROUPS
B	CASE HISTORY FORM
C	PHYSICAL EXAMINATION FORM
D	CERVICAL SPINE EXAMINATION FORM
E	PAIN DRAWINGS
F	NUMERICAL RATING SCALE
G	McGILL PAIN QUESTIONNAIRE
H	PAIN DISABILITY INDEX
I	OSWESTRY LOW BACK DISABILITY INDEX
J	NECK DISABILITY INDEX
K	VALIDITY ANALYSIS
L	ALGOMETER SPECIFICATIONS
M	MUSCLE STRETCHES

LIST OF TABLES

TABLE 4.1	62
Demographical Data	
 TABLE 4.2	 64
The mean values and results of the Wilcoxon's paired signed rank test for the algometer readings of the two groups during the period between the initial consultation and the assessment consultation.	
 TABLE 4.3	 65
The mean values and results of the Wilcoxon's paired signed rank test for the algometer readings of the two groups during the period between the assessment consultation and the follow-up consultation.	
 TABLE 4.4	 66
The mean values and the results of Wilcoxon's paired signed rank test for the Numerical Rating Scale readings of the two groups during the period between the initial consultation and the assessment consultation.	

TABLE 4.5 67

The mean values and the results of Wilcoxon's paired signed rank test for the Numerical Rating Scale readings of the two groups during the period between the assessment consultation and the follow-up consultation.

TABLE 4.6 68

The mean values and results of the Wilcoxon's paired signed rank test for the McGill Pain Questionnaire readings of the two groups during the period between the initial consultation and the assessment consultation.

TABLE 4.7 69

The mean values and results of the Wilcoxon's paired signed rank test for the McGill Pain Questionnaire readings of the two groups during the period between the assessment consultation and the follow-up consultation.

TABLE 4.8 70

The mean values and results of the Wilcoxon's paired signed rank test for the Pain Disability Index readings of the two groups during the period between the initial consultation and the assessment consultation.

TABLE 4.9	71
The mean values and results of the Wilcoxon's paired signed rank test for the Pain Disability Index readings of the two groups during the period between the assessment consultation and the follow-up consultation.	
TABLE 4.10	72
The mean values and results of the Mann-Whitney U test comparing the algometer readings of both groups, firstly at the initial consultation and then at the assessment consultation.	
TABLE 4.11	73
The mean values and results of the Mann-Whitney U test comparing the algometer readings of both groups, firstly at the assessment consultation and then at the follow-up consultation.	
TABLE 4.12	74
The mean values and results of the Mann-Whitney U test comparing the Numerical Rating Scale readings of both groups, firstly at the initial consultation and then at the assessment consultation.	
TABLE 4.13	75
The mean values and results of the Mann-Whitney U test comparing the Numerical Rating Scale readings of both groups, firstly at the assessment consultation and then at the follow-up consultation.	

TABLE 4.14	76
------------------	----

The mean values and results of the Mann-Whitney U test comparing the McGill Pain Questionnaire readings of both groups, firstly at the initial consultation and then at the assessment consultation.

TABLE 4.15	77
------------------	----

The mean values and results of the Mann-Whitney U test comparing the McGill Pain Questionnaire readings of both groups, firstly at the assessment consultation and then at the follow-up consultation.

TABLE 4.16	78
------------------	----

The mean values and results of the Mann-Whitney U test comparing the Pain Disability Index readings of both groups, firstly at the initial consultation and then at the assessment consultation.

TABLE 4.17	79
------------------	----

The mean values and results of the Mann-Whitney U test comparing the Pain Disability Index readings of both groups, firstly at the assessment consultation and then at the follow-up consultation.

DEFINITION OF TERMS

MYOFASCIAL PAIN AND DYSFUNCTION SYNDROME

Pain syndrome characterized by pain in regional muscles and their fascia, accompanied by trigger points that refer pain and/or autonomic phenomena in a pattern specific for each muscle.

ACTIVE MYOFASCIAL TRIGGER POINT

A focus of hyperirritability in a muscle or its fascia that is symptomatic with respect to pain; it refers a pattern of pain at rest and/or on motion that is specific for that muscle. An active trigger point is always tender, prevents full lengthening of the muscle, weakens the muscle, usually refers pain on direct compression, mediates a local twitch response of muscle fibres when adequately stimulated and often produces specific referred autonomic phenomena, generally in its pain reference zone (Travell and Simons 1983: 1).

REFERRED PAIN

Pain that arises in a trigger point, but is felt at a distance often entirely remote from its source. The pattern of pain is reproducibly related to its site of origin (Travell and Simons 1983: 4).

INVASIVE NEEDLING TECHNIQUES

A recognised mode of treatment for active myofascial trigger points that encompasses either a dry needling or saline injection technique.

DRY NEEDLING TECHNIQUE

An invasive needling technique that involves specific and repeated insertion of an acupuncture needle into an active trigger point, using different angles of penetration of the trigger point whilst maintaining the original source of entry into the skin.

SALINE INJECTION TECHNIQUE

An invasive needling technique that involves specific and repeated insertion of a small gauge hypodermic needle into an active trigger point, using different angles of penetration of the trigger point whilst maintaining the original source of entry into the skin. A small amount of saline solution is injected into the trigger point with each penetration.

OBJECTIVE CLINICAL FINDINGS

Diagnostic procedures that objectively assess the condition of the patient, as perceived by the practitioner. This was achieved through the use of an algometer, which determined the degree of irritability of the trigger point by assessing the trigger points sensitivity to pressure.

SUBJECTIVE CLINICAL FINDINGS

Diagnostic procedures that subjectively assess the condition of the patient, as perceived by the patient. This will be achieved through the use of questionnaires.

CHAPTER ONE

INTRODUCTION

1. INTRODUCTION

Travell and Simons (1983: 5) report that myofascial trigger points are amongst the most common cause of musculoskeletal pain seen in medical practice, yet, despite their frequency of occurrence, they are a poorly recognised and an inadequately managed phenomenon.

The frequency of occurrence of myofascial trigger points is not surprising since, according to Gatterman (1990: 285), skeletal muscles account for 40 percent or more of the total body weight. Although muscle tissues are extremely subject to the wear and tear caused by normal daily activities, little emphasis has been placed on the pathophysiology of muscles in both chiropractic and medical curricula (joints, bones, bursae and nerves are usually the focus of attention), which could be the cause of myofascial trigger points being overlooked when a diagnosis is made or a treatment protocol devised.

Sandman (1981) supports this by mentioning that myofascial pain syndromes are often a common source of frustration to doctors as well as patients, even though prognosis is usually excellent with correct diagnosis and proper management. Unrecognised and incorrectly treated myofascial pain syndromes are also a major cause of industrial lost time, resulting in applications for compensation totalling millions of dollars annually (Travell and

Simons 1983: 6). The appreciable portion of chronic myofascial pain can easily be relieved by their diagnosis and appropriate treatment.

Myofascial pain syndromes are characterised by hypersensitive trigger points, described as hyperirritable loci within a taut band of skeletal muscle, located in the muscular tissue and/or its fascia. The spot is painful on compression and can induce referred pain and autonomic phenomena in a pattern particular for the muscles in which they are located (Travell and Simons 1983: 12). The myofascial pain syndrome may present as a wide variety of clinical symptoms which, according to Simons (1976) and Sola et al. (1956), include pain, stiffness, reduced ranges of motion in joints, weakness, insomnia and autonomic dysfunction. The major complaint on the part of the patient is pain that may vary from mild discomfort to severe and incapacitating pain.

The same author goes on to say that the most common predisposing factor seems to be mechanical stress, be it acute or chronic, a view supported by Gatterman (1990: 285) and Travell and Simons (1983: 103). For this reason, the most common sites of myofascial trigger points are in the postural stabilizers of the upper back and the rotator muscles of the hips and shoulders, as these are the areas of the body subjected to the most stresses.

Most current authors are consistent in their approach to myofascial pain syndromes with regards to definition of the

disorder, mechanism of dysfunction, signs and symptoms experienced and diagnostic procedure, but there tends to be less consistency when treatment of the problem is discussed. Treatment procedures must be aimed at the disruption, desensitization or elimination of these trigger points by suppressing their neural hyperactivity. Treatment parameters must also take into account the causative and perpetuating factors of the trigger points so as to prevent a re-occurrence of the condition.

The available literature pertaining to the treatment of myofascial pain and dysfunction syndrome contains a variety of methods that are recommended by the various contributing authors, all of which conform to the principles of a treatment as discussed above. The problem, to date, is that there is little research to support the favouring of one treatment type over another. All the treatment types have been proven to be effective in the treatment of myofascial trigger points (Mance et al. 1986) and favouring of one treatment type over another seems to be based along the lines of familiarity of the treatment or personal preferences.

Travell and Simons (1983: 27,63-64,75-76) advocate stretch and spray techniques or anaesthetic injections as the treatment of choice, while Haldeman (1992: 523) states that the most common form of treatment is ischaemic compression. Lewit and Simons (1984) promote the use of the post-isometric relaxation

technique, which they advocate may be useful in addition to, or in place of the other techniques available.

According to Murphy (1989), the best results are achieved by using a combination of electrotherapies (ultrasound, high-voltage stimulation or transcutaneous electrical nerve stimulation) and spray and stretch techniques. Murphy (1989) also states that, in the opinion of other clinicians, dry needling produces the same results as an anaesthetic injection, but he personally has had more consistent success with the latter.

Lewit (1979) stresses that when needling a trigger point it is the mechanical effect of the needle that produces the most effective results. He suggests that the long lasting therapeutic benefits previously ascribed to anaesthetic injections may in fact have been due to the so called "needle effect" and not due to the action of the anaesthetic. Similar conclusions were drawn by Baldry (1989: 36), after observations of various forms of invasive treatments. He states that it does not matter what substance is injected into the trigger points as it is the mechanical effect of the needle that produces the results. These views are supported by Sola (1981) and Garvey et al. (1989).

Frost et al. (1980) did a double-blind comparison of anaesthetic and saline injections into trigger points and found that the saline injection produced better results. In direct contrast to this, Simons (1976) states that anaesthetic injection is more

effective than saline injection which is in turn more effective than dry needling, however this is a personal opinion and is not based on any clinical trials.

Other less common forms of treatment include rest, moist hot packs and deep massage (Mance et al. 1986).

Invasive needling techniques are a widely used form of treatment for myofascial pain syndrome but information on the most effective types is needed. To date there is no study to compare the effects of dry needling and saline injection, but both have been proven to be more effective than anaesthetic injections.

The purpose of this investigation was to determine the effects of dry needle and saline injection techniques into active myofascial trigger points in terms of objective clinical findings and the patients' perception of the treatments in order to determine a more effective approach in the elimination of myofascial trigger points as associated with myofascial pain and dysfunction syndromes. The objectives to be achieved included the measurement of alterations to both the subjective and objective presentation of the patient with respect to pain and physical dysfunction. These measurements could then be statistically compared to determine the more effective treatment of the two.

Invasive needling of trigger points is a technique which is both easy to learn and use. All myofascial treatment techniques are

similar in that a diagnosis of the condition has to be made and the trigger points located. The only difference is in what is done to the trigger points once they are located. Present knowledge and scope of the myofascial pain syndrome by the doctor can be easily adapted when changing from one treatment type to another more effective type. Practitioners treating myofascial trigger points can therefore chose a treatment knowing that it is likely to produce better results than the other forms of treatment available, and this can only be of benefit to the patients being treated as a more effective treatment will result in a quicker recovery with greater long term effects.

CHAPTER TWO

REVIEW OF THE RELATED
LITERATURE

2. REVIEW OF THE RELATED LITERATURE

2.1 INTRODUCTION

According to Sandman (1981), Myofascial Pain Syndromes are often a common source of frustration to physicians and patients alike, even though prognosis may be excellent with correct diagnosis and proper management. Travell and Simons (1983: 6) state that the need for an effective treatment for this common and debilitating disorder has been recognised and various techniques have been developed, but all vary with degree of effectiveness.

One of the problems in the past has been the multitude of names given to essentially the same disorder by the variety of authors studying muscle pain. Simons (1975) and Travell and Simons (1983: 9-11) list terms such as fibrositis, fibrositis syndrome, myogelosis, interstitial myofibrositis, muscular rheumatism, non-articular rheumatism, myofasciitis, myalgia and myofascial pain syndrome as an example of the diversity.

This problem of diversity has been quelled to a large degree by the specialization of Travell and Simons in the field of the Myofascial Pain and Dysfunction Syndrome. These two authors have taken the lead in researching the syndrome, with view to the establishment of effective treatment protocols and general management of the condition.

2.2 AETIOLOGY

Mance et al. (1986) perceives trauma to be the major cause of myofascial pain syndrome as it biologically initiates pain, as seen in the increased concentration of acid mucopolysaccharides, water, chloride and mast cells in the area. Sandman (1981) supports this concept by stating that it is generally accepted that organic pathology occurs at the point of sustained contracture, along with a decrease in blood supply and accumulation of metabolites. Thus the process is initially due to a neuromuscular dysfunction, a view supported by Murphy (1989). Other factors that have an effect are prolapsed intervertebral discs, bone or joint disease, immobilization, systemic infection and emotional stress or visceral lesions such as coronary thrombosis and endocrine imbalance. (Mance 1986, Rubin 1981)

Baldry (1989: 40) cites trauma inflicted on the muscle by direct injury, sudden strain or excessive or unusual exercise as the main cause of trigger point development. Environmental extremes or variants, immobilization, prolonged nervous tension and febrile illness are other less common causes. A similar classification of aetiology, under the headings of septic or toxic influences, injury and climate, is described by Telling (1935), indicating consistency in findings despite there being 54 years difference in publication dates.

According to Travell and Simons (1983: 103-155), Bennett (1986) and Simons (1976), mechanical stress, trauma that causes bleeding (acute strain or injury), acute overextension, chronic strain, excess fatigue, poor posture and varying psychological factors are the most commonly noted factors for aetiology of myofascial pain.

Gatterman (1990: 286-287) states that trauma and microtrauma to the muscles results in myofascial pain. Certain factors such as: inadequate nutrition; joint laxity; job frustrations; abuse (physical, sexual or psychological); poor fitness; allergies; metabolic abnormalities and unresolved domestic problems do not themselves cause myofascial pain but affect the muscles in a way that predisposes them to this trauma. It is a view that varies slightly to that of the authors cited above. Thus the patient presenting with trigger points frequently gives a history of a traumatic incident producing muscle strain.

Sandman and Backstrom (1984) state that a patient's pain may be psychogenic in nature. Psychogenic factors such as depression, tension, anxiety, irrational belief systems, type-A behaviour patterns and learned helplessness have been identified as a viable component of myofascial pain syndrome. Such stress, be it primary or secondary, can cause changes in the physiological function of the muscle. The mechanism of this change is discussed later in the literature review.

A variety of stress-inducing stimuli, emotional or physical, may be implicated in the onset of myofascial pain, and the power of these stimuli to effect the individual is moderated by the genetics, personality, conditioning, psychological and physiological state of the individual. (Sola 1981)

The psychological aspect is recognised by authors such as Goldenberg (1987), Travell and Simons (1983: 54) and Payne et al. (1982), but it is only part of a whole process resulting in the final presentation of pain, myofascial or other. Good (1950) suggests that some of the cause of psychogenic stress may be due to doctors not being able to make a diagnosis or relieve the condition. Gelb (1980) mentions the psychological component in the development of chronic pain, but says that physical, treatable causes exist apart from the emotional aspects.

2.3 PREVALENCE

Travell and Simons (1983: 5) state that myofascial trigger points are extremely common, affecting everyone's life at one time or other. In an asymptomatic group of 200 young adults, Sola et al. (1955) found focal tenderness representing latent trigger points in the shoulder girdles of 54% of the females and 45% of the males. Sixty-two percent of the subjects with positive findings had more than one trigger point, and 12.5% demonstrated referred pain patterns.

Gelb (1980) found that 71% of a healthy general population of dental patients suffered from chronic pain, which was broken down to 43% suffering from chronic headaches, 17% experiencing neck pain and 11% having both.

Individuals of any sex and of any age can develop trigger points, but it has been found to be most common between the ages of 31 and 55 years. Sedentary middle aged women appear to be most vulnerable to the condition. People who exercise their muscles on a daily basis are less likely to develop active trigger points than those more sedentary people who indulge in occasional physical activity. The likelihood of developing active trigger points appears to increase with age up to the more active middle years. As activity becomes less strenuous in the later years, latent trigger points exhibiting more stiffness and restricted motion tend to predominate. Latent trigger points are more common than active trigger points. (Travell and Simons 1983: 5, 13, Yunus et al. 1988 and Goldberg 1987)

The areas most commonly affected in the body are those subjected to the most stresses: the postural stabilizers of the upper back and the rotator muscles of the shoulder girdle (trapezius, levator scapulae and infraspinatus) and the lower trunk and hip (quadratus lumborum, gluteus medius and tensor fascia lata) (Gatterman 1990: 285, Sola 1981 and Travell and Simons 1983: 13). In the 1955 survey performed by Sola et al. it was found that of all the trigger points noted in the 200 asymptomatic people,

84.7% occurred in four muscles: trapezius, levator scapula, infraspinatus and the scalenes.

2.4 PERPETUATING FACTORS

Travell and Simons (1983: 103-155) and Graff-Radford et al. (1987) highlighted several groups of perpetuating factors. In any treatment of myofascial pain these factors must be taken into consideration and corrected or eliminated to ensure effective treatment of the condition, a view also held by Sandman (1981):

- 1) Mechanical stresses: skeletal asymmetry, poor posture, poorly designed furniture, muscle abuse and prolonged joint or muscle immobilization.
- 2) Nutritional deficiencies: vitamins B1, B6, B12 and C, folic acid, calcium, potassium and iron (elements that are needed for normal muscle metabolism).
- 3) Endocrine and metabolic inadequacies: hypometabolism due to hypothyroidism, hyperuricaemia and hypoglycaemia. This includes anything that impairs muscle metabolism, such as anaemia or hypoxia.
- 4) Psychological factors: tension incurred through stress or anxiety, and depression.
- 5) Chronic infection: bacterial, viral or parasitic.
- 6) Other factors: allergies, sleep disorders, radiculopathy, fatigue and cold damp weather.

The initiating factors themselves may become perpetuating factors, and without correcting them it may become impossible to resolve the patient's problem (Murphy 1989). In some patients, elimination of these factors results in complete relief of the pain without any further treatment of the muscles.

Gatterman (1990: 287) lists perpetuating factors as: psychological stressors; nutritional inadequacies; metabolic inadequacies; inactivity; chronic infections; mechanical stressors and unresolved anger, while Simons (1976) divides them into three groups: physical factors; medical factors and pathophysiological factors.

2.5 DEVELOPMENT OF TRIGGER POINTS

Gatterman (1990: 291), Travell and Simons (1983: 32-37) and Sandman (1981) propose the following to explain the development of trigger points:

The many aetiological factors discussed previously interact to create myofascial trigger points by the following process. Trauma to the muscle from acute or chronic strain results in tissue damage. This often includes disruption of the sarcoplasmic reticulum which results in the release of stored calcium and the inability of the damaged sarcoplasmic reticulum to remove it from the site of injury. The chronic stress of the resultant sustained contraction, or excessive fatigue during repeated contractions,

may cause a vulnerable region of the muscle to become disproportionately strained, repeating this same process.

This availability of extra calcium, in the presence of normal amounts of ATP, results in sustained contraction of the local contractile elements and eventual fatigue of the sarcomere. This contractile activity would persist, despite the absence of action potentials, as long as calcium and ATP are present. The sustained contractile force could in turn produce the tension and hardness of the fibres that compromise the palpable band.

Local tenderness and referred pain occur when nerve endings in the area of trauma are sensitised by accumulation of substances produced by the following mechanisms:

- small blood vessels are disrupted and release platelets which in turn release serotonin.
- mast cells containing histamine are damaged when connective tissue is disrupted, resulting in the release of histamine.
- metabolites such as prostaglandins aggregate due to the sustained contraction impeding blood flow to the area.

The reduced local blood flow resulting from the sustained contractions is compounded by vasoconstriction from autonomic nerves that are activated because of trigger point sensory-fibre input to the central nervous system. Further consequences of sustained contraction are that it creates a region of

uncontrolled metabolism that can result in additional mast cell liberation of histamine and the subsequent depletion of local ATP. A progressive failure of relaxation eventually results in muscle contracture due to the energy (required from splitting ATP) not being available to "recock" the contractile mechanism.

A self-perpetuating local muscular condition is created, which is painful, resists stretching, and results in decreased range of motion and generalized disability.

Normal function may be restored by stretching all of the involved muscle fibres far enough apart to eliminate contraction. Only then can enough ATP accumulate to restore the sarcoplasmic reticulum to normal. Once this has happened the renewed circulation can begin to slowly remove the build-up of metabolites.

The way in which stress may cause changes in the physiological function of muscle is discussed by Sandman (1984) and Gelb (1980). The mechanism accounts for the clinical phenomena responsible for the initial neuromuscular dysfunction phase of myofascial pain. Stress evokes the brain to increase production of serotonin, epinephrine, norepinephrine, acetylcholine and dopamine. The increase in these neurotransmitters results in increased excitation of nerve cells. This increased neurological input causes the individual to tighten and draw the shoulders upward and forward for extended periods of time. The sustained

muscle contraction associated with this posture results in damage to the sarcoplasmic reticulum and decreased blood flow, initiating the same mechanism described by the various authors above.

2.6 CLINICAL PRESENTATION

2.6.1 SYMPTOMS

Authors such as Yunus et al. (1988), Sandman (1981) and Sola et al. (1955) all support a variety of symptoms, most of which are listed below, but it is Travell and Simons (1983: 13-15) that give the most concise and complete description of the symptoms pertaining to myofascial pain syndrome:

- Pain is referred from trigger points in characteristic patterns that are specific for each muscle.
- 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.
- Any of the perpetuating factors may increase trigger point irritability from a latent to an active level.

- Phenomena (other than pain) such as localized sweating, vasoconstriction, lacrimation, salivation, pilomotor activity and proprioceptive disturbances may also be caused by myofascial trigger points.
- The clinical features of myofascial trigger point activity normally outlast the precipitating event.
- Active trigger points vary in irritability at any given time.
- Muscle stiffness and weakness may be the result of the activity of myofascial trigger points.

Gatterman (1990: 295) and Travell and Simons (1983: 12-14) describe the pain from trigger points as dull, aching and varying in intensity from a mild discomfort to severe and incapacitating pain. The referred pain that trigger points produces does not follow segmental or neurological patterns but is specific for each individual muscle. Myofascial problems also produce weakness of the affected muscle as well as disrupting sleep.

Myofascial pain is aggravated by intense or increased use of the muscle, passive stretching of the muscle, pressure on the trigger point, prolonged periods of muscle shortening, repeated contraction of the muscle, cold drafts and cold, damp conditions. The pain is ameliorated by rest, passive stretching, application of moist heat over the trigger point, short periods of light activity and specific myofascial therapies. (Travell 1983: 53-54, Yunus et al. 1981).

Trigger points respond to any stress factors, especially those of psychic origin, but the consistency of the pain patterns and other symptoms indicates that the condition is not solely of a psychological nature (Sola et al. 1955).

2.6.2 SIGNS

Gatterman (1990: 296) and Travell and Simons (1983: 16-17) list the same types of clinical observations on patient examination:

- An increase in pain is caused by passive or active stretching of the affected muscle when active trigger points are present.
- The stretch range of motion of the muscle is reduced.
- Resisted isometric contraction of the affected muscle increases the pain.
- The muscle exhibits a weakened maximum contractile force.
- Deep tenderness and dysaesthesia are commonly referred by the trigger points to the zone of referred pain.
- Disturbances of non sensory function are sometimes induced in the pain referral zone.
- Muscles adjacent to active trigger points may also feel tense to palpation.
- The trigger point is found in a palpable band as a well defined area of intense tenderness.
- A jump sign is usually elicited by applying digital pressure to an active trigger point.

- Snapping palpation of an active trigger point frequently produces a local twitch response.
- Pressure on an irritable trigger point usually causes or increases pain in the referral zone of that trigger point.
- The skin of some patients exhibits dermographia or panniculosis in the area overlying active Trigger points.

Mance et al (1986) states that there are three types of hardening felt on palpation of trigger points: nodular, spindle shaped and rope-like. Pressure over this area produces pain felt in the zone of reference. The muscles exhibit protective spasm which causes reduced ranges of motion.

Wolfe (1986) mentions criteria such as a jump sign, "ropy" muscle consistency (palpable band), dermographia, stiffness and local tenderness as being characteristic of myofascial pain. According to Murphy (1989), palpation at the site of point tenderness produces referred pain to a secondary area and induces a local twitch response of the palpated muscle and a jump sign where the patient recoils from the pain.

2.7 DIAGNOSIS

Sandman (1981) regards pain as the most important criterion in trigger point diagnosis. The reason for this is that standard diagnostic procedure, laboratory work and radiography show no signs of bone or joint pathology and there are no measurable

metabolic changes (confirmed by Yunus et al. 1986). Thus the diagnostic guidelines to follow are the patients pain and distribution of pain on palpatory examination, and limitation of movement or restriction of motion of the affected areas.

A thorough history is therefore a vital aspect in the diagnosis of trigger points, and must reveal the nature, extent and location of the pain. Diagnosis is difficult due to the fact that the majority of factors involved tend to be subjective. Keeping this in mind, a list of characteristics, all of which must be present in order to diagnose a trigger point, has been devised by Travell and Simons (1983: 18-19):

- either a history of rapid onset during or shortly following acute overload stress, or a history of gradual onset with chronic overload of the affected muscle
- a pattern of pain referred from the trigger point that is characteristic for that muscle in which it is located
- weakness of the affected muscle with associated restriction in its 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 produced by needling or snapping palpation of the trigger point
- reproduction of the characteristic pain patterns by needling or palpating the trigger point

- elimination of the clinical presentation by specific trigger point therapy.

Most other authors specifying diagnostic procedure relating to myofascial pain syndrome (such as Sandman 1981, Wolfe 1986 and Sola 1981) support some or most of the above criteria, with pain being the key factor and twitch responses, jump signs and dermographia commonly mentioned.

In order to achieve an objective assessment for the diagnosis of trigger points, Fischer (1987) advocates pressure threshold measurement using an algometer for quantitative measurement of local tenderness. "This method has been proven to be useful for diagnosis of tender spots and trigger points and their clinical management, particularly in the assessment of treatment results." As trigger points cause weakness of muscles, a hand-held dynamometer may also be used to confirm the diagnosis of myofascial pain syndrome.

Other objective methods that may be used are a goniometer to assess for loss of ranges of motion (Sandman 1981), EMG studies to show the absence of electromyographic activity within tense muscle fibres (Sandman 1984) and thermography to document vasomotor disturbances in the area of the trigger point (Fischer 1987).

2.8 TREATMENT

Gatterman (1990: 286, 296-297) states that chiropractic therapy is one of the most effective measures in the treatment of myofascial pain syndromes. Chiropractic care along with stretching, light aerobic exercise, adequate rest and relaxation, and changes in attitude and lifestyle can bring much relief to sufferers of myofascial pain. Physical techniques such as ischaemic compression, needle therapy and stretch techniques are effective in disrupting the local neural circuits responsible for the self-perpetuation of the pain cycle

According to the special review by Simons (1976), there are 35 recommended treatments for myofascial pain syndrome which are divided into 6 categories: physical therapy, injection, spray, medical management, drugs and surgery. Of these, the treatments that were repeatedly reported to provide marked pain relief were massage, procaine injection and ethyl chloride spray. Mance et al. (1986) rate these same three treatments as the most common and effective, with injection therapy being the most widely used of the three.

There is a lot of difference in opinion when it comes to advocating the treatment of choice for myofascial pain syndrome. Each author has his technique and reasons why he uses it, but this tends to be based on lines of familiarity and personal

preferences. There is little statistical evidence to support the use of one treatment type over another.

Ischaemic compression is one of the oldest and most common techniques used for the treatment of muscle pain (Haldeman 1992: 523, Gatterman 1990: 296). This technique was developed by Lange in 1921 and consists of sustained pressure over the trigger point with sufficient force and for a long enough time (usually 10-20 seconds) to inactivate it. Pressure is applied when the muscle is relaxed and stretched, and slowly increased as the trigger point deactivates. A hot pack is usually applied to the area after treatment, followed by stretching of the involved muscles (Travell and Simons 1983: 86-87, Gatterman 1990: 296).

Travell and Simons (1983: 63-65) describe the stretch and spray technique as the "workhorse" of myofascial therapy. It inactivates trigger points quicker and with less discomfort than injection or ischaemic compression. This treatment involves a jet of vapocoolant being sprayed in parallel sweeps along the entire length of the muscle which is held in a position of passive stretch. The efficacy of this technique is supported by Rubin (1981) and Mance et al. (1986).

The technique of invasive needling, as described by Sola (1981) and Travell and Simons (1983: 84), is consistent for dry needle or for injection of substances. The trigger point is located by palpation. The needle is inserted 1-2cm away and directed towards

the trigger point such that the needle approaches the trigger point at an angle of about 30 degrees to the skin. When the needle penetrates the trigger point the patient usually experiences the referred pain and twitch responses of the involved muscle. A fanning technique is used, where the needle is repeatedly withdrawn out of the trigger point and re-directed to penetrate a new part of the trigger point. This assures maximum coverage of the area of the trigger point. With substance injection, a small amount of fluid is injected at each penetration so that each trigger point receives a total of 0.5-2cc of fluid.

Invasive needling techniques are increasing in popularity with regard to myofascial trigger point therapy. Travell and Simons (1983: 79-80) postulate several mechanisms that may contribute to the deactivation of trigger points by injection. The needle may **mechanically disrupt** the muscle fibres or nerve endings, which are sensory and motor components of the feedback cycle that sustains abnormal muscle activity. The needles may also disrupt the muscle fibres and result in the **release of intracellular potassium** which could cause a depolarization block of reverberating nerve fibres. Injected fluid helps to "**wash out**" or **dilute** any nerve-sensitizing substances and thus reduce the irritability of the trigger point. Procaine injection has a **local vasodilation** effect that increases the circulation at the trigger point, supplying nutrients and removing metabolites (a view

supported by Good 1950 and 1951). Local anaesthetics may **interrupt feedback mechanisms** between the trigger point and the nervous system.

Adverse reactions to invasive needling are only noted for anaesthetic injections. Procaine toxicity is due to a high blood level of the drug, while anaphylaxis may result from even a minimal dose (Travell and Simons 1983: 80). There is no suspected risk of adverse reactions to the dry needle or saline injections used in this study.

Travell and Simons (1983: 75) advocate the use of procaine injection for invasive needling of Trigger points. It is stated that the local anaesthetic reduces the soreness of the trigger point injection, as compared with isotonic saline and dry needling. Procaine is a short term anaesthetic that wears off by the time the patient leaves the office, and it has the lowest systemic toxicity of commonly used local anaesthetics. In the experience of Travell and Simons (1983:76), precise dry needling of trigger points approaches but does not quite equal the therapeutic effectiveness of procaine injection, however they cite no comparative clinical trials to back these claims. No comparison between the effectiveness of saline injection and procaine injection is mentioned.

Of the three types of injection most commonly used, it is the opinion of Simons (1976) that procaine injection is slightly more

effective than saline injection which is in turn slightly more effective than dry needling (again this is an opinion which is not based on comparative clinical trials). Good (1950 and 1951) and Yunus et al. (1981) are others who support the use of anaesthetic injection for trigger point therapy.

Martin (1952) decided to use saline in place of anaesthetics for the injection of trigger points, as he was weary of the possibility of hypersensitive reaction to the anaesthetic. He found that they gave equally good results but was unable to explain why. These findings were reinforced by Frost et al., who performed a double blind comparison of anaesthetic and saline injections into Trigger points. Of the saline patients, 80% reported recovery as compared to 52% of the anaesthetic patients. Thus the flushing effect, rather than the pharmacological effect, of the fluid seems to be the functional aspect of the injections.

Conclusions drawn by Baldry (1989: 36), after observations of various forms of invasive treatments, state that it makes no difference as to what substance, or for that matter whether any substance, is inserted into Trigger points. The reason for this is that the effectiveness of such procedures depends entirely on one factor common to all types of injections, namely the mechanically irritating effect of the needle itself.

The results of the study performed by Garvey et al. (1989) showed that the injected substance is not the critical factor in trigger point therapy. The dry needle group showed a better rate of improvement than the two groups receiving anaesthetic injection, reinforcing the belief that the mechanical effect of the needle is the important factor in the deactivation of trigger points.

These results are supported by Lewit (1978), who states that dry needling is highly effective in the treatment of chronic myofascial pain. Of the 312 patients treated by Lewit, immediate analgesia was produced by dry needling in 86.6%. The needle effect (immediate analgesia without hypesthesia) may be produced by precisely needling the most sensitive spot of the trigger point. He further states that long-term therapeutic effects previously ascribed to local anaesthetics may in fact be due to needling. Other advantages put forward by Lewit are that there can be no anaphylactic reaction with dry needle therapy, and one can be sure that the needle is in the most painful part of the trigger point (an effect that is obscured by the diffuse analgesic effect of the anaesthetic). Levine et al. (1976) also demonstrated the effectiveness of the needle effect in a clinical trial.

Sola (1981) advocates the use of invasive needling and sustains the above findings of Baldry, Garvey et al. and Lewit. He also

mentions that saline injection has been proven to produce good results and is gaining support as an effective treatment.

Further support for dry needle therapy comes from MacDonald et al. (1983) and Mendelson et al. (1983) who found that superficial accupuncture was effective in the treatment of low back pain. Although effective, the results achieved here did not appear to be as good as those achieved in other studies that employed specific trigger point needling. The reason for this may be attributed to the fact there is a 71% correlation between the location of accupuncture points and trigger points (Melzack et al. 1977).

Baldry (1989: 37) states that needling with a solid, pointed needle should be the treatment of choice over any treatment using a hypodermic needle (saline or anaesthetic injections). The reasons for this is that the cutting edge of the hypodermic needles cause microtrauma and damage to blood vessels, an undesirable effect in the treatment of myofascial syndrome. The pointed needles are thinner, as they do not need to be hollow, and the likelihood of damage to blood vessels is far less. Both of the treatment groups in this study make use of the needle effect, the difference being the injection of fluid in the saline group which gives the added dimension of the flushing effect of the trigger point. However, the trauma caused by the hypodermic needles may negate the extra benefit afforded by the injection of fluid.

Sandman (1981) emphasises that stretch techniques are important in returning the muscles to their normal maximum length. Without stretching, trigger point therapy would not be nearly as effective. Passive stretching may even inactivate a trigger point without the application of any other form of treatment (Travell and Simons 1983: 89). Lewit (1984) promotes post-isometric relaxation (manually resisted isometric contraction followed by relaxation) as a simple, harmless, non-invasive and effective way of restoring full stretch length to muscles containing trigger point. With 94% of the 244 patients treated with this method experiencing immediate pain relief, and 63% showing lasting relief, it is shown to be a technique that is effective in addition to, or in place of, local anaesthetic injection or dry needling. Stretching may be facilitated by the application of moist heat over the area prior to stretching (Gatterman 1990: 297).

Sandman (1984) stresses the need for addressing the psychological and the physiological aspects of the problem as well as following a daily stretching programme to achieve maximum relief. All factors that perpetuate the increased neurological input must be eliminated. The adequacy of corrective actions (what the patient must do, or avoid, to achieve lasting recovery), which includes a stretch exercise program and the elimination of perpetuating factors, usually determines the duration of relief

experienced after treatment of the involved muscles (Graff-Radford et al. 1987).

2.9 MEASUREMENT TECHNIQUES

According to Fischer (1987), evaluation of the therapeutic efficacy in myofascial pain syndromes is based primarily on subjective assessment of local tenderness, but there are certain methods, such as pressure threshold measurement, that prove to be particularly useful in the objective assessment of treatment results.

Fischer (1986) states that pressure threshold is the minimum pressure that induces pain or discomfort. The algometer (pressure threshold meter) is designed to measure threshold pressure tolerance and tissue compliance in relation to trigger points, and will thus provide objective data for the assessment of the patients condition. Fischer (1987) performed a study on the pressure threshold measurement for diagnosis of trigger points and evaluation of treatment results. The findings were that the effectiveness of the algometer for the documentation of treatment effects had been demonstrated, along with the reliability and reproducibility of results.

The symptoms reported by the patient should also change after trigger point therapy. Questionnaires on symptomatology will provide subjective data for the assessment of the patients

condition. The Numerical Rating Scale, McGill Pain Questionnaire and Pain Disability Index will be used to acquire subjective data. All three of these questionnaires deal with different aspects of pain, therefore they overlap and compliment each other and thus provide a more reliable source of subjective information pertaining to the progress of the patient.

2.10 MUSCLE OVERVIEW

2.10.1 TRAPEZIUS

The trapezius is the muscle most often affected by trigger points. It has three portions to it, namely the upper, middle and lower portions. Six trigger points that refer distinctive pain patterns can be found in this muscle. The muscle is diamond shaped and extends in the midline from the occiput to the 12th thoracic vertebra and reaches laterally to the clavicle, acromion process and the spine of the scapula. Its chief actions are to elevate the shoulders (upper portion), rotate the glenoid fossa upward (upper and middle portion) and retract the scapula (lower portion)

Trigger point 1 is located in the angle of the neck (on the free border of the upper trapezius). It refers pain unilaterally upward along the posterolateral part of the neck to the mastoid process. When more intense the pain extends to the side of the head, centering in the temple and the back of the orbit. It may

also include the angle of the jaw. Symptoms of this trigger point include dizziness or vertigo, tension neckache and temporal headache. It is best needled with the patient supine. The muscle is held in a pincer grip between the thumb and forefinger of the palpating hand, which enables a precise location of the trigger point as well as lifting the muscle off the underlying structures. The needle is directed upwards towards the neck.

Trigger point 2 can be found inferior and lateral to trigger point 1. Its referred pain pattern lies slightly posterior to the pain reference zone of trigger point 1, blending with it at the mastoid process. Symptoms include neck pain and intolerance to the weight of heavy clothing. Needling is performed with the patient lying on the uninvolved side, and the needle is again directed upwards towards the neck.

Trigger point 3 is located in the lower trapezius between the medial border of the scapula and the spinous processes of T6 and T7. It refers pain to the high cervical region of the paraspinal muscles, to the adjacent mastoid area and to the acromion. The pain may also be felt as an area of "soreness" which the patient tends to rub. Trigger points 1 and 2 may develop as satellites within this zone of pain and tenderness referred from trigger point 3. To best accommodate needling, the patient lies on the uninvolved side and the lower trapezius is stretched by swinging

the upper arm forwards and upwards. The needle is directed towards an underlying rib, avoiding the intercostal spaces.

Trigger point 4 is also located in the lower trapezius but it is found overlying the scapula below the spine of the scapula. Pain from this trigger point is burning and is referred along the length of the medial border of the scapula. To needle, the scapula is abducted and elevated to stretch the muscle and the needle is aligned with the lateral fibres of the muscle and directed towards the shoulder.

Trigger point 5 is in the middle trapezius and lies adjacent to the medial border of the scapula at the level of the base of the spine of the scapula. It refers a burning pain medially between the trigger point and the spinous process of the 7th cervical vertebra and the 1st thoracic vertebra.

Trigger point 6 is located over the acromion process and refers an aching pain to that acromion process and to the top of the adjacent shoulder.

Trigger point 7 is found in an area midway between the acromion and the spinous processes of the 7th cervical vertebra and the 1st thoracic vertebra. It gives a shivery sensation and gooseflesh (pilomotor erection) on the lateral aspect of the homolateral arm. Trigger points 5, 6 and 7 are needled with the

patient lying on the opposite side. The needle is angled nearly parallel to the skin and directed towards the shoulder.

Trigger points in the trapezius are activated by skeletal variations (such as a short leg or small hemipelvis); sustained elevation of the shoulders (carrying objects); trauma (whiplash) or misfitting clothing. Associated trigger points may be found in the homolateral supraspinatus and contralateral trapezius muscles. (Travell and Simons 1983: 183-200, Gatterman 1990:307-309 and Rubin 1981)

2.10.2 LEVATOR SCAPULAE

The levator scapulae is one of the most commonly involved shoulder-girdle muscles. Trigger points in this muscle give the patient a stiff neck with markedly limited rotation. It is attached superiorly to the transverse processes of the 1st cervical vertebra to the 4th cervical vertebra, and to the superior angle of the scapula inferiorly. It elevates the scapula and rotates the glenoid fossa downward, as well as assisting in extension and rotation (to the same side) of the neck.

There are two trigger points in the levator scapulae. One is located slightly inferior to the angle of the neck while the other is located supero-medial to the superior angle of the scapula. Both trigger points refer pain to their essential reference zone at the angle of the neck, with a spillover zone

along the medial border of the scapula and posterior shoulder. Neck rotation is limited due to pain on movement, and if the Trigger points are active enough they refer severe pain at rest.

The trigger points are activated by sustained elevation of the shoulders or cramped positioning, especially when the muscle is fatigued and exposed to cold. Patient examination reveals restriction of neck rotation.

Both trigger points are needled with the patient lying on the opposite side and the head supported on a pillow. For the upper trigger point, needle is directed upwards and forwards towards the transverse processes of the cervical vertebrae. For the lower trigger point the scapula brought anteriorly by "rounding" the shoulders and the needled is directed upwards at a shallow angle towards the neck. (Travell and Simons 1983: 334-342, Sola and Williams 1956 and Gatterman 1990:306-307)

2.10.3 RHOMBOIDIUS MAJOR AND MINOR

Pain in the rhomboids is usually due to trigger points in the pectoralis muscles which shorten and pull the shoulders forward, thus overloading the weaker rhomboids. The rhomboids are interscapular muscles and are attached to the spinous processes of the 7th cervical vertebra to the 5th thoracic vertebra medially and to the medial border of the scapula laterally. Its

actions are to retract the scapula and rotate it, turning the glenoid fossa down.

One trigger point is found in the rhomboid minor and two are found in the rhomboid major. They are all located along the medial border of the scapula. Pain referred from these Trigger points is concentrated along the medial border of the scapula, between the scapula and the paraspinal muscles. Pain may also extend to the supraspinatus part of the scapula. It has a similar pain pattern to that of the levator scapulae but has no neck rotation restrictions.

The trigger points are usually activated by poor posture and latent trigger points in the pectoralis muscles.

All the trigger points are needled with the patient sitting. The palpating hand fixes the trigger point against the chest wall and the needle is inserted almost parallel to the skin. The needle is directed towards a rib to avoid penetrating an intercostal space. (Travell and Simons 1983: 425-430)

2.10.4 SUPRASPINATUS

The supraspinatus muscle is attached to the supraspinous fossa medially and to the greater tubercle of the head of the humerus

laterally. Its major actions are to abduct the arm and to pull the head of the humerus into the glenoid fossa.

Active trigger points can be located in the belly of the muscle, one towards the medial aspect and the other towards the lateral aspect. Its pain referral is felt as a deep ache around the shoulder, concentrating in the mid-deltoid region. Often this ache extends down the arm and forearm, focusing over the lateral epicondyle of the elbow. This distinguishes it from the referred pain of the infraspinatus muscle. Symptoms are pain that is aggravated by forceful abduction of the arm at the shoulder. The pain may disrupt the sleep of the patient.

Trigger points are aggravated by carrying heavy objects with the arms hanging down, or lifting the arms above shoulder height. Associated Trigger points can often be found in the infraspinatus and upper trapezius muscles.

With the patient lying on the opposite side the needle is inserted into the trigger point and directed into the supraspinous fossa of the scapula. (Travell and Simons 1983: 368-376 and Gatterman 1990: 315-317)

2.10.5 INFRASPINATUS

The infraspinatus is located inferior to the supraspinatus. It attaches to the infrapinuous fossa medially and to the greater

tuberosity of the humerus laterally. Actions of this muscle include external rotation of the arm at the shoulder and stabilization of the head of the humerus in the glenoid cavity during movement.

The two trigger points are located in the belly of the muscle just inferior to the spine of the scapula. In rare cases a trigger point may be found in the inferior part of the muscle above the inferior angle of the scapula. The main trigger points refer pain to the anterior deltoid region and deep in the shoulder joint. It may also project down the anterolateral aspect of the arm and forearm. It may include the radial half of the hand. The inferiorly located trigger point may refer pain over the adjacent rhomboid muscles. Symptoms include referred pain when sleeping on either side as well as inability to reach behind the back. The patient may also find it difficult or painful when brushing his hair or teeth.

Activation of these trigger points results from muscle overload while reaching backward or upward. The patient cannot effectively achieve external or internal rotation at the shoulder. Associated trigger points are found in the supraspinatus, teres minor, and pectoralis major muscles.

For needling, the patient lies on the opposite side with the involved arm resting on a pillow. The trigger point is pinned between the fingers of the palpating hand and the needle is

directed into the infraspinous fossa. (Travell and Simons 1983: 377-386, Gatterman 1990: 315-317 and Sola and Williams 1956)

2.10.6 TERES MAJOR

The teres major attaches laterally to the lesser tubercle of the humerus and medially to the dorsum of the scapula near the inferior angle. It assists in adduction, internal rotation and extension of the arm from the flexed position, but only when these movements are resisted.

Trigger points are found in two locations: one medially over the posterior aspect of the scapula, and the other more lateral in the posterior axillary fold. Both Trigger points refer pain to the posterior deltoid region, shoulder joint posteriorly and the dorsal forearm. There is pain when reaching forward and up, with a little restriction of motion. These trigger points may be activated when driving a car that is difficult to steer.

The medial trigger point is needled in the same way as the infraspinatus trigger points. The lateral trigger point is injected with the patient supine and the shoulder abducted to 90 degrees. The trigger point is located in the axillary fold and held in a pincer grip between the fingers of the palpating hand. The needle is directed posteriorly. (Travell and Simons 1983: 403-409)

2.10.7 TERES MINOR

The teres minor functions as a "little brother" to the infraspinatus. It is attached to the dorsal surface of the scapula near its axillary border (medially) and to the greater tubercle of the humerus (laterally). Its actions are the same as the infraspinatus.

The trigger point is found in the belly of the muscle postero-inferior to the shoulder joint. It refers a sharply localized pain to the lower posterior deltoid region. It is similar to the pain produced by bursitis of the shoulder. The trigger point is activated by reaching out and behind the shoulder.

The needling technique is the same used for the infraspinatus muscle. (Travell and Simons 1983: 387-392 and Gatterman 1990: 315-317)

2.10.8 PECTORALIS MAJOR

The pectoralis major has four divisions. All attach laterally to the greater tubercle of the humerus. Medially the clavicular fibres attach to the clavicle, the sternal fibres to the sternum, the costal fibres to the cartilages of the second to the seventh ribs, and the abdominal fibres to the aponeurosis of the abdominal muscles. Its actions include internal rotation and

adduction of the arm as well as movement of the arm across the chest.

Trigger points are located in each of the divisions. Those in the clavicular division refer pain over the anterior deltoid muscle and over the pectoralis and clavicular regions. Trigger points in the medial sternal section refer pain to the sternum without crossing the midline. Those in the lateral sternal division refer intense pain to the anterior chest and down the inner aspect of the arm, accenting the medial epicondyle. The pain may extend into the hand, including the last two and a half digits. The costal and abdominal sections develop Trigger points in two regions. Those located along the lateral margin of the muscle cause breast pain and tenderness with nipple hypersensitivity and intolerance to clothing. More medial Trigger points (between the fifth and sixth ribs) are associated with cardiac arrhythmias and are only found on the right side.

The trigger points are activated by stress overload on the muscle or by referred phenomena associated with a myocardial infarction. The muscles are usually shortened by the presence of trigger points (latent or active), giving a rounded shoulder posture.

Trigger points in the clavicular portion of the muscle are held between the fingers of the palpating hand and the needle is aimed cephalad at an angle almost parallel to the skin, thus avoiding penetrating the intercostal space. The sternal trigger points are

needled in a direction upwards towards the coracoid process, thus keeping the needle away from the thoracic cage. The costal trigger points are needled after the muscle has been lifted away from the underlying structures by the thumb and forefinger of the palpating hand. Needle penetration may be perpendicular to the skin in this case. (Travell and Simons 1983: 576-597)

2.11 SUMMARY

From the literature reviewed, there is overwhelming evidence to support the effectiveness of invasive needling, with or without substance injection, as a treatment for myofascial trigger points. To date there appears to be no study comparing the treatment effects of dry needle and saline injections, although it has been shown that saline injections are more effective than anaesthetic injections. The most effective of dry needle and saline injection will therefore be the invasive treatment of choice in treatment of trigger points.

The aim of this study is to determine the effects of dry needle and saline injection techniques in the treatment of myofascial trigger points in order to determine a more effective approach in the elimination of trigger points as associated with myofascial pain and dysfunction syndrome.

CHAPTER THREE

MATERIALS AND METHODS

3. MATERIALS AND METHODS

This study was designed to be a randomised uncontrolled study where the objectives were to assess each of the two treatment groups (dry needling and saline injection) for intra-group improvement. Once this had been achieved, an inter-group statistical analysis could determine which of the two treatments, if any, is more effective. The more effective of the two could then be considered to be the leading invasive needling technique for the treatment of myofascial pain and dysfunction syndrome.

Patients were obtained for this study by means of convenience sampling, whereby any patient presenting to the Technikon Natal Chiropractic Day Clinic with neck, upper back or shoulder pains was screened briefly to assess whether he/she should be considered for the study. If, in the opinion of the researcher, the patient was likely to comply with the criteria necessary for acceptance into the study, then the patient underwent further examination by the researcher.

In order to ensure the integrity of the research it was stated beforehand precisely what standards the data must meet before the research commenced. Only once the subjects had fulfilled the following criteria were they admitted into the study. Each subject had to be diagnosed by the researcher as having active myofascial trigger points, as associated with myofascial pain and dysfunction syndrome, in one or more of the following muscles:

trapezius; levator scapulae; rhomboidius major and minor; infraspinatus; supraspinatus; teres major and minor and pectoralis major. Only patients between the ages of 16 and 65 years would be considered. Any patients taking medication for their condition, or those that suffered from systemic diseases would not be considered eligible for the study.

The criteria used for the diagnosis of myofascial pain and dysfunction syndrome was that specified by Travell and Simons (1983: 18-19):

- either a history of rapid onset during or shortly following acute overload stress, or a history of gradual onset with chronic overload of the affected muscle
- a pattern of pain referred from the trigger point that is characteristic for that muscle in which it is located
- weakness of the affected muscle with associated restriction in its 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 produced by needling or snapping palpation of the trigger point
- reproduction of the characteristic pain patterns by needling or palpating the trigger point
- elimination of the clinical presentation by specific trigger point therapy.

To be considered for this study, the patient's condition had to comply with all eight of the specified diagnostic criteria.

The patients screened (including those rejected for not fitting the criteria of the study) were of a diverse enough nature, with regard to sex, race, income group and area of residence, to be considered representative of the population of the greater Durban area.

The sample size was set at thirty patients which were divided into two groups of fifteen by random assignment. The method of random assignment of patients to experimental groups was done as follows. Fifteen labels were inscribed with the letter S (representing the saline injection group) and fifteen were inscribed with the letter D (representing the dry needle group). The identical labels were then folded to prevent the letters being seen, and placed in a box. The box was then agitated to mix the labels. Each label was drawn out of the hat in the sequence of counting from one to thirty. The letter of the label was recorded next to the number counted as the label was drawn (appendix A). Each label was discarded after being drawn to ensure that each number from one to thirty had only one label assigned to it.

There was no patient blindness regarding treatment type as each patient was told what group they were in as soon as they were integrated into the study.

The methodology followed was similar in execution to that used by Jones (1994) and Christie (1995). The procedure for the study was as follows. Each patient that passed the initial screening was scheduled for a two hour long consultation where an in-depth case history (appendix B) was taken and a physical examination (appendix C) and regional cervical spine examination (appendix D) were done. Once this was completed and the patient's condition had satisfied the diagnostic criteria the patient was scheduled for a maximum of five treatments [Sola (1981) advocates that 2 to 5 treatments should be adequate for most cases] and an assessment consultation. All of these were to be completed within a three week period, with two treatments performed per week. This is in accordance with Mance et al. who specified that trigger point injection should be administered every second, third or fourth day, according to the complaints of the patient. A follow up consultation was scheduled one month after completion of the last treatment.

Once located, the trigger points were drawn onto a pain drawing (appendix E) representation of the patient. This ensured that at the next consultation the exact location of the trigger points

could be seen, which would make the re-location of each one easier and more accurate.

The treatment administered to the first group was dry needling of the active trigger points. The type of needle used was a number 8 (30mm long, 30-gauge) stainless steel acupuncture needle, the same used by MacDonald et al. (1983). The patient either sat or lay in the prone position, with the area to be treated being sufficiently exposed. Once the trigger point had been accurately located and the overlying skin swabbed with alcohol, the needle was inserted into the trigger point. At this point the pain was often recreated in its referral pattern by the action of the needle. The needle was manoeuvred in such a manner as to pierce the trigger point and then withdrawn to a point such that the tip remained inserted in the skin but the trigger point was free of the needle. The angle of penetration was changed and the needle re-inserted into the trigger point. This procedure was repeated so that a fan shape of repeated penetration was achieved, assuring maximum coverage of the area of the trigger point. This technique was consistent with that advocated by Sola (1981) and Travell and Simons (1983: 84-85) and it served to deactivate the trigger points. Each trigger point located within the specified muscles was treated at each consultation (patients had trigger point numbers varying between 2 and 10). A new needle was used for each treatment.

The second group was treated in exactly the same manner, with exactly the same procedures being used. The only difference here was that a bored hypodermic needle was used instead of a pointed acupuncture needle, and during the needling of the trigger point a small amount of saline solution was injected into the trigger point with each penetration. Each trigger point received a total of approximately 1cc of saline solution per treatment, which is consistent with the amounts (0.5 - 2cc) specified by Sola (1981). The needle used was a 23 gauge, one and a half inch long hypodermic needle. The reason that this size needle was used is that it is the size advocated by Travell and Simons (1983: 81), and the smaller diameter hypodermic needles available do not have an adequate enough length to effectively penetrate the deeper trigger points. The saline solution used was sodium chloride 0.9% (0.045g/5ml) produced by Sabax in 5ml ampoules.

Stretch exercises (appendix M), specific for each muscle group treated, were taught to the patients of both groups at the end of the first treatment. The patient was instructed to hold each muscle treated in a stretched position for 10 seconds, and to repeat each stretch 5 times during each of the three daily sessions. The patient was expected to keep up this programme of daily stretches during the entire treatment and follow-up period.

The data was obtained in the following way:

Using the communication method, primary data was obtained directly from the patients by written communications. In this case the collection instrument was a Numerical Rating Scale (appendix F), a McGill Pain Questionnaire (appendix G) and a Pain Disability Index (appendix H). These all recorded the patient's response to pain in a subjective manner.

With the observation method of primary data collection, a mechanical device called an algometer was used to record the response of the patients in an objective manner.

The secondary data used was journal articles, published reports and books containing information relevant to the research being conducted. It also included the case history, physical examination and regional cervical spine examination forms which are used in the Technikon Natal Chiropractic Day Clinic.

The events that occurred at each consultation were as follows:

a) The initial consultation

The case history and physical examination were completed.

b) Treatment consultations

The McGill Pain Questionnaire, Pain Disability Index, Numerical Rating Scale and pain drawings were completed, and the algometer readings taken. This was followed by treatment of the patient.

c) The assessment consultation

The McGill Pain Questionnaire, Pain Disability Index, Numerical Rating Scale and pain drawings were completed, and the algometer readings taken.

d) The follow-up consultation

The McGill Pain Questionnaire, Pain Disability Index, Numerical Rating Scale and pain drawings were completed, and the algometer readings taken.

To ensure that the data satisfied all the pre-set criteria, all pain questionnaires had to be fully completed under the supervision of the researcher, all algometer readings had to be taken by the researcher only and all treatments had to be conducted by the researcher or the qualified clinician staff on duty at the Technikon Natal Chiropractic Day Clinic. If the data, at any time, did not satisfy these criteria, the patient, along with the results, was dismissed from the study.

The **Numerical Rating Scale** used in this study was based on the 11-point box scale discussed by Jensen et al. (1984). It was

chosen because of its ease in application when providing subjective information on the levels of pain as felt by the patient, as well as its established validity and reliability (Jensen et al. 1984). It was used to monitor the progress of the patient, as a decrease of pain intensity as felt by the patient is indicative of an improvement in his condition. Scores on this scale range from 1, for no pain, to 10, which represents unbearable pain.

The **McGill Pain Questionnaire** used in this study was the short-form McGill Pain Questionnaire, which is advocated by Turk and Melzack (1992: 164) for research settings where time to obtain information from patients is limited, yet more information than merely the intensity of pain is required. It is a subjective questionnaire that pertains specifically to the sensory dimension of pain experience and to the affective dimension. Its use along with confirmation of its reliability, validity and consistency are provided by Turk and Melzack (1992: 152-164). The answers are ranked on an intensity scale that can be analysed statistically once all the questionnaires are completed. This questionnaire is divided into two sections. Questions 1 to 11 represent the sensory dimension of pain experience and questions 12 to 15 represent the affective dimension. Each question can score a maximum of 3 for the most severe symptoms in that particular category, and a minimum of 0 for no symptoms in that particular category. The sum of all the completed sections was calculated and given as a percentage of

the highest possible score. If all the sections were completed the highest possible score was 45, and would decrease by 3 for each section not completed.

The **Pain Disability Index** provided subjective information as to the extent to which the patients pain influenced their normal daily activities. The index used in this study was constructed by the researcher from the Neck Disability Index (Vernon and Mior 1991) and the Oswestry Low Back Disability Index (Fairbank et al. 1980). The reason for this reconstruction was due to the fact that the Oswestry Low Back Disability Index (appendix I) deals with the lumbar region and the Neck Disability Index (appendix J) deals with the cervical region, yet the main area of the body dealt with in this study was the lower neck, shoulder and mid-dorsal regions. When Vernon and Mior (1991) searched for a revised Oswestry Index for assessment of disabilities related to other regions of the spine they were unsuccessful in locating one. Thus they created the Neck Disability Index from the Oswestry Low Back Disability Index to cover the disabilities pertaining to the cervical spine. In the same manner the Pain Disability Index was created by the researcher where the questions most pertinent to this area of study were selected from each of the recognised indices and a new 15 question index was formed. The aim of this index was to evaluate that area of the body most affected by the Myofascial Pain Syndrome.

As each of the recognised indices has proven test-retest reliability, internal consistency and validity (Vernon and Mior 1991, and Fairbank et al. 1980) the results of the new index were compared to those achieved by the Numerical Rating Scale and the McGill Pain Questionnaire using Pearson's r correlation. This method was the same used by Vernon and Mior (1991) to prove the Neck Disability Index reliable and valid. The table of results (appendix K) indicates that as the study progressed so the validity and reliability of the new index increased. With a larger sample size the likelihood of greater reliability and validity could be established.

Answers to this questionnaire were scored and statistically analysed to ascertain the effectiveness of the treatment. Resumption of previously ceased normal daily activities scored highly on this questionnaire, as they indicated that the treatment was effective. For each section the highest possible score is 5 and the lowest 0. The top statement scored 0 if marked and the score progressively increased by 1 for each statement marked below, up to the maximum 5 if the last statement was marked. The sum of all the completed sections was calculated and given as a percentage of the highest possible score. If all the sections were completed the highest possible score was 75, and would decrease by 5 for each section not completed.

"The most important requirement of a measure is that it be valid, reliable, consistent, and above all useful." (Turk et al. 1992).

Of the three questionnaires used, only the newly constructed Pain Disability Index has no published proof of the above statement. The reason why multiple subjective questionnaires were used, as for Mendelson et al. (1983) and Graff-Radford et al. (1987), is that they all provided slightly different aspects of pain information, yet all worked towards the same goal of providing a reliable and valid source of subjective information for this study. These self-administered questionnaires avoids any interviewer bias and helps ensure the uniformity of presentation (Fairbank et al. 1980).

The statistics used to evaluate the captured data of subproblem two (the Numerical Rating Scale, McGill Pain Questionnaire and Pain Disability Index) was Wilcoxon's paired signed rank test at the 5% level of significance, for intra-group analysis. The tests were done using the computer software programme STATGRAPHICS PLUS VERSION 6 supplied by MANUGISTICS INC. The processed data was then presented in table form for easy interpretation.

An **algometer** may be defined as an apparatus for determining sensitivity to pain caused by pressure. The algometer used in this study was the model "FDK 20 force dial" made by Wagner Instruments and supplied by Activator methods Inc. (appendix L).

The procedure of taking a pressure reading was as follows: the algometer was set to zero and then pressed precisely over the active trigger point up to the pressure threshold (minimum

pressure causing pain or discomfort) of that patient. The reading, obtained in kilograms per square centimetre, indicated the sensitivity of the Trigger points to pain. A reading was taken on each active trigger point in the specified muscles and the sum of the readings from each trigger point were divided by the number of trigger point readings taken. Thus a single, average reading was provided for that patient at that particular consultation.

The more active the trigger point the more sensitive it is to pressure, thus a post-treatment decrease of trigger point sensitivity to pain indicated that the treatment was proving effective. This increase in pain threshold should correlate with a decrease in the signs and symptoms experienced by the patient.

According to Fischer (1987) the reliability of the assessment of pain by the algometer has been documented and the reproducibility of results collected by those trained in pressure threshold measurement is sufficient for practical clinical use, thus "Changes in pressure threshold, obtained under standard clinical conditions, can therefore be regarded as reliable data." The statistics used to evaluate this data (subproblem one) was Wilcoxon's paired signed rank test for intra-group analysis. The tests were done using the computer software programme STATGRAPHICS PLUS VERSION 6 supplied by MANUGISTICS INC. The

processed data was presented in table form for easy interpretation.

In the above cases the Wilcoxon's paired signed rank test was used because it is a powerful test (less restrictive, yet very near equivalence in sensitivity to the T test) for non-parametric data with small sample sizes, ideal for the data in this study (Daniel 1978: 31-36). Furthermore, the assumption of normally distributed data is also not of importance when applying this test.

The null hypothesis for the above data is that within each group there is no improvement of the patients with regard to objective and subjective clinical features. The alternative hypothesis is that within each group there is significant improvement of the patients with regard to objective and subjective clinical features. (Steyn et al. 1994: 415-421).

Once the objective results of subproblem one and the subjective results of subproblem two were processed, the results of subproblem three, namely finding out which of the two treatment types was more effective, could be determined. This was achieved using the Mann-Whitney U test at the 5% level of significance. This test was chosen for its application to an inter-group statistical analysis as well as being held in high regard with regards to power-efficiency. (Daniel 1978: 82-86). Furthermore,

the assumption of normally distributed data is not of importance when applying this test.

The null hypothesis for subproblem three is that there will be no significant difference in the effects of dry needling as compared to that of saline injection in the treatment of active trigger points. The alternate hypothesis is that saline injection will produce significantly better results than dry needling in the treatment of active trigger points (Steyn et al. 1994: 415-421).

CHAPTER FOUR

RESULTS

4. RESULTS

4.1 DEMOGRAPHICAL DATA

Table 4.1 Demographical data

	DRY NEEDLE	SALINE	TOTAL
AGE DISTRIBUTION			
Age Range	8-65	19-51	18-65
Average Age	35,4	31,4	33,4
GENDER DISTRIBUTION			
Females	12	13	25
Males	3	2	5
RACIAL DISTRIBUTION			
White	8	13	21
Black	3	1	4
Indian	4	1	5

4.2 RESULTS

To ensure that the data satisfied all the pre-set criteria, all pain questionnaires had to be fully completed under the supervision of the researcher, all algometer readings had to be taken by the researcher only and all treatments had to be conducted by the researcher or the qualified clinician staff on duty at the Technikon Natal Chiropractic Day Clinic. If the data, at any time, did not satisfy these criteria, the patient, along with the results, was dismissed from the study.

Of the 33 patients found eligible for inclusion into this study, 3 were non-compliant and the remaining 30 completed the research programme.

The remainder of this chapter covers the results obtained from the statistical analysis of the data collected from the following measurement criteria:

- Algometer readings

- Numerical Rating Scale
- McGill Pain Questionnaire
- Pain Disability Index

The results obtained from the statistical analysis are tabulated to display the mean for each group as well as the exceedence probability value (p-value), which is compared to the level of significance set at 0.05 for all the tests.

4.2.1 SUBPROBLEM ONE

The objective response of the patient to the treatment was recorded using the algometer. The following results were obtained:

Table 4.2 The mean values and results of the Wilcoxon's paired signed rank test for the algometer readings of the two groups during the period between the initial consultation (IC) and the assessment consultation (AC).

	IC	AC	P-VALUE
DRY NEEDLE	2,13	3,41	0,000545875
SALINE INJECTION	2,24	3,62	0,0002950495

The null hypothesis is rejected for both groups which indicates that at the 5% level of significance a statistically significant change took place during the treatment period.

Table 4.3 The mean values and results of the Wilcoxon's paired signed rank test for the algometer readings of the two groups during the period between the assessment consultation (AC) and the follow-up consultation (FC).

	AC	FC	P-VALUE
DRY NEEDLE	3,41	4,13	0,01780025
SALINE INJECTION	3,62	3,81	0,062021

The null hypothesis is rejected for the dry needle group which indicates that at the 5% level of significance a statistically significant change took place during the follow-up period.

The null hypothesis is accepted for the saline group which indicates that at the 5% level of significance no statistically significant change took place during the follow-up period.

4.2.2 SUBPROBLEM TWO

The subjective response of the patient to the treatment was recorded using the Numerical Rating Scale, McGill Pain Questionnaire and Pain Disability Index. The following results were obtained:

Table 4.4 The mean values and the results of Wilcoxon's paired signed rank test for the Numerical Rating Scale readings of the two groups during the period between the initial consultation (IC) and the assessment consultation (AC).

	IC	AC	P-VALUE
DRY NEEDLE	6,00	2,40	0,0002950495
SALINE INJECTION	5,50	2,00	0,0004387455

The null hypothesis is rejected for both groups which indicates that at the 5% level of significance a statistically significant change took place during the treatment period.

Table 4.5 The mean values and the results of Wilcoxon's paired signed rank test for the Numerical Rating Scale readings of the two groups during the period between the assessment consultation (AC) and the follow-up consultation (FC).

	AC	FC	P-VALUE
DRY NEEDLE	2,40	2,10	0,220603
SALINE INJECTION	2,00	2,40	0,091715

The null hypothesis is accepted for both groups which indicates that at the 5% level of significance no statistically significant change took place during the follow-up period.

Table 4.6 The mean values and results of the Wilcoxon's paired signed rank test for the McGill Pain Questionnaire readings of the two groups during the period between the initial consultation (IC) and the assessment consultation (AC).

	IC	AC	P-VALUE
DRY NEEDLE	17,63	6,22	0,0004387455
SALINE INJECTION	25,92	5,03	0,0004387455

The null hypothesis is rejected for both groups which indicates that at the 5% level of significance a statistically significant change took place during the treatment period.

Table 4.7 The mean values and results of the Wilcoxon's paired signed rank test for the McGill Pain Questionnaire readings of the two groups during the period between the assessment consultation (AC) and the follow-up consultation (FC).

	AC	FC	P-VALUE
DRY NEEDLE	6,22	5,04	0,86535
SALINE INJECTION	5,03	7,85	0,1313085

The null hypothesis is accepted for both groups which indicates that at the 5% level of significance no statistically significant change took place during the follow-up period.

Table 4.8 The mean values and results of the Wilcoxon's paired signed rank test for the Pain Disability Index readings of the two groups during the period between the initial consultation (IC) and the assessment consultation (AC).

	IC	AC	P-VALUE
DRY NEEDLE	22,06	10,47	0,0002950495
SALINE INJECTION	20,24	7,04	0,0002950495

The null hypothesis is rejected for both groups which indicates that at the 5% level of significance a statistically significant change took place during the treatment period.

Table 4.9 The mean values and results of the Wilcoxon's paired signed rank test for the Pain Disability Index readings of the two groups during the period between the assessment consultation (AC) and the follow-up consultation (FC).

	AC	FC	P-VALUE
DRY NEEDLE	10,47	9,91	0,0539865
SALINE INJECTION	7,04	6,69	0,266846

The null hypothesis is accepted for both groups which indicates that at the 5% level of significance no statistically significant change took place during the follow-up period.

4.2.3 SUBPROBLEM THREE

The results of the above subproblems has now been combined in order to determine whether the saline injection group performed significantly better than the dry needle group. The following results were obtained:

Table 4.10 The mean values and results of the Mann-Whitney U test comparing the algometer readings of both groups [dry needle (DN) and saline (S)], firstly at the initial consultation and then at the assessment consultation.

	DN	S	P-VALUE
INITIAL CONSULTATION	2,13	2,24	0,191839
ASSESSMENT CONSULTATION	3,41	3,62	0.450483

The null hypothesis is accepted for both groups which indicates that at the 5% level of significance there is no statistically significant difference between the two groups.

Table 4.11 The mean values and results of the Mann-Whitney U test comparing the algometer readings of both groups [dry needle (DN) and saline (S)], firstly at the assessment consultation and then at the follow-up consultation.

	DN	S	P-VALUE
ASSESSMENT CONSULTATION	3,41	3,62	0,450483
FOLLOW-UP CONSULTATION	4,13	3,81	0,369981

The null hypothesis is accepted for both groups which indicates that at the 5% level of significance there is no statistically significant difference between the two groups.

Table 4.12 The mean values and results of the Mann-Whitney U test comparing the Numerical Rating Scale readings of both groups [dry needle (DN) and saline (S)], firstly at the initial consultation and then at the assessment consultation.

	DN	S	P-VALUE
INITIAL CONSULTATION	6,00	5,50	0,243081
ASSESSMENT CONSULTATION	2,40	2,00	0,0967105

The null hypothesis is accepted for both groups which indicates that at the 5% level of significance there is no statistically significant difference between the two groups.

Table 4.13 The mean values and results of the Mann-Whitney U test comparing the Numerical Rating Scale readings of both groups [dry needle (DN) and saline (S)], firstly at the assessment consultation and then at the follow-up consultation.

	DN	S	P-VALUE
ASSESSMENT CONSULTATION	2,40	2,00	0,0967105
FOLLOW-UP CONSULTATION	2,10	2,40	0,1252835

The null hypothesis is accepted for both groups which indicates that at the 5% level of significance there is no statistically significant difference between the two groups.

Table 4.14 The mean values and results of the Mann-Whitney U test comparing the McGill Pain Questionnaire readings of both groups [dry needle (DN) and saline (S)], firstly at the initial consultation and then at the assessment consultation.

	DN	S	P-VALUE
INITIAL CONSULTATION	17.63	25,92	0,1223215
ASSESSMENT CONSULTATION	6,22	5,03	0,372792

The null hypothesis is accepted for both groups which indicates that at the 5% level of significance there is no statistically significant difference between the two groups.

Table 4.15 The mean values and results of the Mann-Whitney U test comparing the McGill Pain Questionnaire readings of both groups [dry needle (DN) and saline (S)], firstly at the assessment consultation and then at the follow-up consultation.

	DN	S	P-VALUE
ASSESSMENT CONSULTATION	6,22	5,03	0,372792
FOLLOW-UP CONSULTATION	5,04	7,85	0,163326

The null hypothesis is accepted for both groups which indicates that at the 5% level of significance there is no statistically significant difference between the two groups.

Table 4.16 The mean values and results of the Mann-Whitney U test comparing the Pain Disability Index readings of both groups [dry needle (DN) and saline (S)], firstly at the initial consultation and then at the assessment consultation.

	DN	S	P-VALUE
INITIAL CONSULTATION	22,06	20,24	0,483436
ASSESSMENT CONSULTATION	10,47	7,04	0,1621795

The null hypothesis is accepted for both groups which indicates that at the 5% level of significance there is no statistically significant difference between the two groups.

Table 4.17 The mean values and results of the Mann-Whitney U test comparing the Pain Disability Index readings of both groups [dry needle (DN) and saline (S)], firstly at the assessment consultation and then at the follow-up consultation.

	DN	S	P-VALUE
ASSESSMENT CONSULTATION	10,47	7,04	0,1621795
FOLLOW-UP CONSULTATION	9,91	6,69	0,50

The null hypothesis is accepted for both groups which indicates that at the 5% level of significance there is no statistically significant difference between the two groups.

CHAPTER FIVE

DISCUSSION

5. DISCUSSION

This chapter covers the discussion of the results from the algometer readings, Numerical Rating Scale, McGill Pain Questionnaire and the Pain Disability Index, all presented in the previous chapter.

Wilcoxon's paired signed rank test for the **algometer** readings during the treatment period (table 4.2) resulted in the rejection of the null hypothesis ($p < 0.05$ for all statistical tests) for both groups, indicating that a statistically significant change occurred during the period.

Wilcoxon's paired signed rank test for the **algometer** readings during the follow-up period (table 4.3) resulted in the rejection of the null hypothesis for the dry needle group, indicating a statistically significant change, and acceptance of the null hypothesis for the saline group, indicating no statistically significant change during the period.

Thus, with regards to the objective symptoms (the levels of pain felt over the trigger point site) displayed by the patient, there was significant improvement over the treatment period for both groups, which was maintained over the follow-up period by the saline group, and further improved upon by the dry needle group. This supports hypothesis one, which states that both groups will

show significant improvement in the objective presentation of the patient.

The preservation of the improvement in the patient's pain during the follow-up period indicates that the long term effects of each treatment group were positive, but the fact that marked improvement did not occur in the follow-up period, as it did in the treatment period, may be due to a variety of factors. Patient non-compliance with the stretching programme (that they were instructed to continue with during this period), or continued exposure to the original or to new precipitating factors are just two of the possibilities.

The results from the above objective findings were compared using the Mann-Whitney U test and it was found that there was no difference between the two groups before treatment started (table 4.10). Each group showed significant improvement over the treatment period, but this was by similar amounts so one group did not out-perform the other (table 4.10). This trend continued into the follow-up period, where although the dry needle group showed further significant improvement and the saline group maintained its levels of improvement, there was still no significant difference between the two groups (table 4.11). This does not support hypothesis three which states that the saline group will prove to produce better results when compared to the dry needle group.

Wilcoxon's paired signed rank test for the **Numerical Rating Scale** readings during the treatment period (table 4.4) resulted in the rejection of the null hypothesis for both groups, indicating that a statistically significant change occurred during the period. This change was in the form of reduction of the mean scores over the specified time, indicating that the patients perceived a decrease in pain intensity as the treatment took effect.

Wilcoxon's paired signed rank test for the **Numerical Rating Scale** readings during the follow-up period (table 4.5) resulted in the acceptance of the null hypothesis for both groups, indicating that no statistically significant change occurred during the period. Thus the patients maintained the perceived improvement in their condition over the follow-up period but did not improve further.

Wilcoxon's paired signed rank test for the **McGill Pain Questionnaire** readings during the treatment period (table 4.6) resulted in the rejection of the null hypothesis for both groups, indicating that a statistically significant change occurred during the period. This change was in the form of reduction of the mean scores over the specified time, indicating that the patients perceived a decrease in the different aspects pertaining to pain as the treatment took effect.

Wilcoxon's paired signed rank test for the **McGill Pain Questionnaire** readings during the follow-up period (table 4.7) resulted in the acceptance of the null hypothesis for both groups, indicating that no statistically significant change occurred during the period. Thus the patients maintained the perceived improvement in their condition over the follow-up period but did not improve further.

Wilcoxon's paired signed rank test for the **Pain Disability Index** readings during the treatment period (table 4.8) resulted in the rejection of the null hypothesis for both groups, indicating that a statistically significant change occurred during the period. This change was in the form of reduction of the mean scores over the specified time, indicating that the patients perceived a reduction in pain and showed improvement in myofascial-related disability as the treatment took effect.

Wilcoxon's paired signed rank test for the **Pain Disability Index** readings during the follow-up period (table 4.9) resulted in the acceptance of the null hypothesis for both groups, indicating that no statistically significant change occurred during the period. Thus the patients maintained the improvement in their condition over the follow-up period but did not improve further.

All three subjective tests show the same results, with significant improvement over the treatment period with regards to the patients' perception of their problem, and this improvement

being maintained over the follow-up period. This consistency shown by the three subjective tests helps prove the reliability of the new Pain Disability Index and thus reinforces the validity of the results. These subjective results support hypothesis two, which states that both groups will show significant improvement in the subjective presentation of the patient.

This support of subproblems one and two is in accordance with Travell and Simons (1983:76, 77), Sola (1981), Baldry (1989: 37), Lewit (1978), Murphy (1989) and Rubin (1981), who all profess the effectiveness of invasive needling of trigger points, with or without substance injection.

As for the objective findings, The preservation of the improvement in the patient's pain during the follow-up period indicates that the long term effects of each treatment group were positive, but the fact that marked improvement did not occur in the follow-up period, as it did in the treatment period, may be due to a variety of factors. Patient non-compliance with the stretching programme (that they were instructed to continue with during this period), or continued exposure to the original or to new precipitating factors are just two of the possibilities.

The results from the above subjective findings were compared using the Mann-Whitney U test and it was found that there was no difference between the two groups at the pre-treatment stage

(tables 4.12, 4.14, 4.16). Each group showed significant improvement over the treatment period, but this was by similar amounts so one group did not out-perform the other (tables 4.12, 4.14, 4.16). This trend continued into the follow-up period where, although there was no further improvement, there was still no difference between the two groups (tables 4.13, 4.15, 4.17). This does not support hypothesis three which states that the saline group will produce better results when compared to the dry needle group.

When considering all of the results obtained, the general tendency of accepting hypothesis one and two and rejecting hypothesis three is evident throughout. What gives strength to this tendency is the fact that it is statistically supported by each of the four categories of measurement. This study showed that both treatment types are very effective in the treatment of Myofascial Pain and Dysfunction Syndrome, but the ultimate aim of this study, to prove saline injection to be more effective than dry needle, was not achieved.

The fact that both groups responded significantly to the treatments supports the work of several authors who advocate the use of invasive needling (with or without saline injection) of active trigger points. Lewit (1979), Garvey et al. (1989) and Baldry (1989: 36,37) stress that it is the effect of the needle that is of importance in trigger point therapy and not the injection of any substance. After studying the results of the

would probably be desirable. It is difficult for the results of this study to be compared to those from studies performed by Lewit (1979), Sola et al. (1955) and Lewit and Simons (1984) study this was the view taken by the author as the added aspect of saline injection did not appear to influence the results significantly. It is assumed that the common denominator in both groups - the mechanical effect of the needle - is responsible for the results achieved, as the results are the same for both groups.

The hypothesis that saline injection would be better was made because it was the saline solution that would supposedly give that particular group the added dimension to work on top of the effects achieved by the needle. A possible explanation as to why it didn't show any extra improvement is as follows: hypodermic needles have a cutting edge that, according to Baldry (1989: 37), cause microtrauma and damage to tiny blood vessels in the area of injection. This undesirable effect in the treatment of trigger points may result in any benefits caused by the injection of saline to be negated due to the bleeding and inflammatory process re-activating the trigger points.

To redesign this study I would take into consideration the sample size first of all. Statistically speaking, the sample size of 15 patients per group was far too small. An absolute minimum of 30 patients per group is needed for the sample to be assumed to have a normal distribution. Numbers

where respective sample sizes of 241 patients, 200 patients and 244 patients were used.

The use of the three subjective questionnaire was justified as each covered a different aspect of pain, yet were consistent with their results. The change I would make here would be to further validate the Pain Disability Index. With published proof of validity, reliability and a Pearson's r correlation in excess of 0.60 [the figure considered significant by Vernon and Mior (1991)] it could be considered to be on a par with the Oswestry Low Back Disability Index and the Neck Disability Index, and thus be used as a standard questionnaire when dealing with myofascial pain of the mid-dorsal, shoulder and lower neck region.

To remove the difference of trauma caused by the hypodermic needle in one group as compared to none or far less trauma in the other group, I would either standardise both groups and use hypodermic needles on both (injecting only one group with saline) or I would have three groups, one with the dry needle and the other two with hypodermic needles (also injecting only one group with saline).

With regard to the maintenance programme, I would make the patients perform the stretches under my supervision after each treatment, and I would schedule consultations twice a week during the follow-up period to observe the stretch exercises being performed. This would serve to remove patient non-compliance with

the instructions of the researcher. Nearly every piece of literature dealing with Myofascial Pain stresses the importance of stretching the effected muscles, while Lewit and Simons (1984) demonstrated that long term relief was elicited in 63% of Myofascial patients using only stretching techniques. Thus it should be an objective of the researcher to ensure that all patients comply with their stretching programme to ensure the best results.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6. CONCLUSIONS AND RECOMMENDATIONS

The facts pertaining to this study are that although each of the two groups showed significant improvement over the treatment period, allowing us to accept hypothesis one and two, neither performed significantly better than the other, forcing a rejection of hypothesis three. Thus one cannot recommend which of the two, dry needling or saline injection, is the treatment of choice for Myofascial Pain and Dysfunction Syndrome on the basis of the results of the study. Instead one should consider other aspects that set them apart when deciding which of the two is the treatment of choice.

These aspects which are now discussed are based on the personal experiences of the researcher, encountered when performing the study.

The time factor is always important to professionals in private practice. Keeping this in mind it is recommended that dry needling be used as there is no need to fill/refill syringes and the accupuncture needle is far more manoeuvrable than the more bulky syringe and hypodermic needle, making the treatment quicker and easier.

When patients (who had completed the study) were asked which of the two treatments they would prefer if they had a choice, they almost unanimously chose the dry needle, citing less likelihood

of pain as the reason. Having experienced both forms of treatment personally, I would recommend the dry needle as it is less painful.

As the researcher performing the treatments, I would recommend the dry needle technique as the needle is smaller and more manoeuvrable and the patients tend to relax more, making the needling process quicker and easier.

The cost factor is also always important to patient and practitioner alike. The acupuncture needles are a lot cheaper than the hypodermic needle, syringe and saline ampoules needed for saline injections.

Using analysis of performance, I cannot recommend which of the two treatments is the one of choice, but I can recommend which of the two appears to have the most advantages when it comes to use in a practice setting, and that would be the dry needle technique.

REFERENCES

REFERENCES

- Baldry, P. E. 1989. Acupuncture, Trigger Points and Musculoskeletal Pain. UK, Churchill Livingstone. 295 p.
- Bennett, R. M. 1986. Current Issues Concerning the Management of Fibrositis/Fibromyalgia Syndrome. The American Journal of Medicine. 81 (3A): 15-18.
- Christie, K. R. 1995. Study into the Treatment of Active Myofascial Trigger Points using Interferential Current as an Alternative to Dry Needling Agitation. Masters Diploma Dissertation, Technikon Natal, Durban.
- Daniel, W. W. 1978. Applied Nonparametric Statistics. U.S.A., Houghton Mifflin.
- Fairbank, J. C. T., Couper, J., Davies, J. B. and O'Brien, J. P. 1980. The Oswestry Low Back Pain Disability Index. Physiotherapy, 66(8): 271-273.
- Fischer, A. A. 1986. Pressure Threshold Meter: Its Use for Quantification of Tender Spots. Archives of Physical and Rehabilitative Medicine, 67: 836-838.

- Fischer, A. A. 1987. Pressure Threshold Measurement for Diagnosis of Myofascial Pain and Evaluation of Treatment Results. Clinical Journal of Pain, 2(4): 207-214.
- Frost, F. A., Jessen, B. and Siggaard-Andersen, J. 1980. A Controlled Double-Blind Comparison of Mepivacaine Injection for Myofascial Pain. Lancet, 1: 499-501.
- Garvey, T. A., Marks, M. R. and Wiesel, S. W. 1989. A Prospective, Randomized, Double-Blind Evaluation of Trigger-Point Injection Therapy for Low-Back Pain. Spine, 14(9): 962-964.
- Gatterman, M. I. 1990. Chiropractic Management of Spine Related Disorders. USA, Williams and Wilkens. 437 p.
- Gelb, H. 1980. Profile of a Chronic Pain Sufferer. Killing Pain Without Prescription. Harper and Row. p 1-17.
- Goldenberg, D. L. 1987. Fibromyalgia Syndrome, An Emerging but Contraversial Condition. JAMA. 257 (20): 2782-2786.
- Good, M. G. 1950. The Role of Skeletal Muscles in the Pathogenesis of Disease. Acta Medica Scandinavica. 138 (4): 285-292.

- Good, M. G. 1951. Objective Diagnosis and Curability of Non-Articular Rheumatism. The British Journal of Physical Medicine. 14 (1): 1-7.
- Graff-Radford, S. B., Reeves, J. L. and Jaeger, B. 1987. Management of Chronic Head and Neck Pain: Effectiveness of Altering Factors Perpetuating Myofascial Pain. Headache, 27: 186-190.
- Haldeman, S. 1992. Principles and Practice of Chiropractic. 2nd edition. USA, Appleton and Lange. 641 p
- Jensen, M. P., Karoly, P. and Braver, S. 1986. The Measurement of Clinical Pain Intensity: a Comparison of Six Methods. Pain, 27: 117-126.
- Jones, A. D. 1994. The Effectiveness of Myofascial Trigger Point Therapy on Myofascial Pain Syndrome Trigger Points. Masters Diploma Dissertation, Technikon Natal, Durban.
- Lewit, K. 1979. The Needle Effect in the Relief of Myofascial Pain. Pain, 6: 83-90.
- Lewit, K and Simons, D. G. 1984. Myofascial Pain Relief by Post-isometric Relaxation. Archives of Physical Rehabilitative Medicine, 65: 452-456.

Levine, J. D., Gormley, J. and Fields, H. L. 1976. Observations on the Analgesic effects of Needle Puncture (Accupuncture). Pain, 2: 149-159.

Macdonald, A. J. R., Macrae, K. D., Master, I. and Rubin, A. P. 1983. Superficial Accupuncture in the Relief of Chronic Low Back Pain. Annals of the Royal College of Surgeons of England, 65: 44-46.

Mance, D., McConnel, B., Ryan, P. A., Silverman, M. and Master, G. 1986. Myofascial Pain Syndrome. Journal of the American Podiatric Medical Association, 76(6): 328-331.

Martin, A. J. 1952. Nature and Treatment of Fibrositis. Archives of Physical Medicine, 33: 409-413.

Melzack, R. 1981. Myofascial Trigger Points: Relation to Accupuncture and Mechanisms of Pain. Archives of Physical and Rehabilitative Medicine, 62: 114-117.

Melzack, R., Stillwell, D. M. and Fox, E. J. 1977. Trigger Points and Accupuncture Points for Pain: Correlations and Implications. Pain, 3: 3-23.

- Mendelson, G., Selwood, T. S., Kranz, H., Loh, T. S., Lidson, M. A. and Scott, D. S. 1983. Accupuncture Treatment of Chronic Back Pain. The American Journal of Medicine, 74: 49-55.
- Murphy, G. J. 1989. Myofascial Trigger Points. JCO, 23(9): 627-631.
- Payne, T. C., Leavitt, F., Garron, D. C. Katz, R. S., Golden, H. E., Glickman, P. B. and Vanderplate, C. 1982. Fibrositis and Psychological Disturbance. Arthritis and Rheumatism. 25 (2): 213-217.
- Rubin, D. 1981. Myofascial Trigger Point Syndromes: An Approach to Management. Archives of Physical and Rehabilitative Medicine, 62: 107-110.
- Sandman, K. B. 1981. Myofascial Pain Syndromes: Their Mechanism, Diagnosis and Treatment. Journal of Manipulative and Physiological Therapeutics, 4(3): 135-140.
- Sandman, K. B. and Backstrom, C. J. 1984. Psychophysiological Factors in Myofascial Pain. Journal of Manipulative and Physiological Therapeutics, 7(4): 237-242.
- Simons, D. G. 1975. Muscle Pain Syndromes - Part I. American Journal of Physical Medicine, 54: 289-311.

- Simons, D. G. 1976. Muscle Pain Syndromes - Part II. American Journal of Physical Medicine, 55: 15-42.
- Sola, A. E. 1981. Myofascial Trigger Point Therapy. Resident and Staff Physician, 38-45.
- Sola, A. E., Rondenberger, M. L. and Gettys B. B. 1955.
Incidence of Hypersensitive Areas in Posterior Shoulder Muscles. American Journal of Physical Medicine, 34: 585-590.
- Sola, A. E. and Williams, R. L. 1956. Myofascial Pain Syndromes. Neurology, 6: 91-95.
- Steyn, A. G. W., Smit, C. F., Du Toit, S. H. C. and Strasheim, C. 1994. Modern Statistics in Practice. Pretoria, South Africa, J. L. van Schaik Publshers.
- Telling, W. H. M. 1935. The Clinical Importance of Fibrositis in General Practice. British Medical Journal. 689-692.
- Travell, J. G. and Simons, D. J. 1983. Myofascial Pain and Dysfunction: The Trigger Point Manual. Volume 1. USA, Williams and Wilkens. 713 p.

Turk, D. C. and Melzack, R. 1992. Handbook of Pain Assessment.
New York, USA, The Guilford Press.

Vernon, H. and Mior, S. 1991. The Neck Disability Index: A Study
of Reliability and Validity. Journal of Manipulative and
Physiological Therapeutics, 14 (7): 409-415.

Wolfe, F. 1986. Development of criteria for the Diagnosis of
Fibrositis. The American Journal of Medicine. 81 (3A):
99-104.

Yunus, M. B., Kaylan-Raman, U. P. and Kaylan-Raman, K. 1988.
Primary Fibromyalgia Syndrome and Myofascial Pain Syndrome:
Clinical Features and Muscle pathology. Archives of Physical
and Rehabilitative Medicine. 69: 451-454.

Yunus, M. B., Masi, A. T., Calabro, J. J., Miller, K. A. and
Feigenbaum, S. L. 1981. Primary Fibromyalgia (Fibrositis):
Clinical Study of 50 Patients with Matched Normal Controls.
Seminars in Arthritis and Rheumatism. 11 (1): 151-171.

APPENDICES

=====			
PATIENT	TREATMENT	PATIENT	TREATMENT
NUMBER	GROUP	NUMBER	GROUP
=====			
1	DRY NEEDLE	16	DRY NEEDLE
2	DRY NEEDLE	17	DRY NEEDLE
3	DRY NEEDLE	18	SALINE INJECTION
4	SALINE INJECTION	19	SALINE INJECTION
5	DRY NEEDLE	20	SALINE INJECTION
6	DRY NEEDLE	21	SALINE INJECTION
7	DRY NEEDLE	22	DRY NEEDLE
8	SALINE INJECTION	23	SALINE INJECTION
9	SALINE INJECTION	24	SALINE INJECTION
10	DRY NEEDLE	25	DRY NEEDLE
11	SALINE INJECTION	26	SALINE INJECTION
12	SALINE INJECTION	27	DRY NEEDLE
13	DRY NEEDLE	28	SALINE INJECTION
14	SALINE INJECTION	29	DRY NEEDLE
15	DRY NEEDLE	30	SALINE INJECTION
=====			

TECHNIKON NATAL CHIROPRACTIC DAY CLINICCASE HISTORY

Patient: _____ Date: _____

File #: _____

X-ray #: _____

Age: _____ Sex: _____ Occupation: _____

Intern: _____ Signature: _____

FOR CLINICIAN'S USE ONLY

Initial visit clinician: _____

Signature: _____

Case History:

Examination:

Previous: TN
OtherCurrent: TN
Other

X-ray Studies:

Previous: TN
OtherCurrent: TN
Other

Clinical path. lab.:

Previous: TN
OtherCurrent: TN
Other

Case status:

PTT: Conditional: Signed off: Final sign out:

Recommendations:

Intern's Case History

1. Source of history:
2. Chief complaint: (patient's own words)

3. Present illness:

Location

Onset

Duration

Frequency

Pain (character)

Progression

Aggravating factors

Relieving factors

Associated S & S

Previous occurrences

Past treatment and outcome

4. Other complaints:

5. Past history:

General health status

Childhood illness

Adult illness

Psychiatric illness

Accidents/injuries

Surgery

Hospitalizations

6. Current health status and life-style:

Allergies

Immunizations

Screening tests

Environmental hazards
(home, school, work)Safety measures
(seat belts, condoms)

Exercise and leisure

Sleep patterns

Diet

Current medication

Tobacco

Alcohol

Social drugs

7. Family history:

Immediate family:

Age

Health

Cause of death

DM

Heart disease

TB

HBP

Stroke

Kidney disease

CA

Arthritis

Anemia

Migraines

Thyroid disease

Epilepsy

Mental illness

Alcoholism

Drug addiction

Other

8. Psychosocial history:

Home situation

Daily life

Important experiences

Religious beliefs

9. Review of systems:

General

Skin

Head

Eyes

Ears

Nose/sinuses

Mouth/throat

Neck

Breasts

Respiratory

Cardiac

Gastro-intestinal

Urinary

Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

Psychiatric.

RECEIVED DATA SUPPLEMENTARY RAY CLINICPHYSICAL EXAMINATION

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

Patient: _____ File # _____

Last name

First name

Clinician: _____ Signature: _____

Intern: _____ Signature: _____

Date: _____

Height: _____ Weight: _____ Temp: _____

Rate: Heart: _____ Pulse: _____ Respiration: _____

Blood pressure: Arm: L / R /

Legs: L / R /

General appearance:

STANDING EXAMINATION.

Minor's sign

skin changes

Posture

crest

Adam's

"Ranges of motion:

T/L spine: Flexion: 90 Fingers to floor

Extension: 50

R.lat.flex.: 30 Fingers down leg

L.lat.flex.: 30 Fingers down leg

Rot.to R.: 35

Rot.to L.: 35

Flex.

L.Rot.

R.Rot.

L.lat
flex.R.lat.
flex.

Ext.

/ = pain-free limitation; // = painful limitation.

Romberg's sign.

Pronator drift.

Trandelenburg's sign.

Gait.

rhythm

balance

pendulousness

on toes

on heels

tandem

Half squat.

Scapular winging.

Muscle tone.

Spasticity/Rigidity.

Shoulder:

skin

symetry

ROM - glenohumeral

scapulo-thoracic

acromioclavicular

elbow

wrist

Chest measurement

inspiration

expiration

Visual acuity

Breast examination:**Inspection:**

skin

size

contour

nipples

arms overhead

hands against hips

leaning forward.

Palpation:

axillary lymph nodes.

SEATED EXAMINATION.**Spinal posture****Head**

scalp

skull

face

skin

Eyes

conjunctiva

sclera

eyebrows

eyelids

lacrimal gland

nasolacrimal duct

alignment

corneal reflex

ocular movement

L
III IV VI

R
III IV VI

visual fields

accommodation

iris

pupils

red reflex

optic disc

vessels
 general background
 macula
 vitreous
 lens

Ears:

auricle
 ear canal
 drum
 auditory acuity
 Weber test
 Rinne test

Nose:

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

Mouth and pharynx:

lips
 buccal mucosa
 gums and tooth
 roof
 tongue
 inspection
 movement
 taste
 palpation
 pharynx
 inspection
 CXI

-Neck:

posture
 size
 swelling
 scars
 discoloration
 hair line

ROM:

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

Flex.

L.Ret.

R.Ret.

L.Lat.
 flex.

R.lat.
 flex.

Ext.

lymph nodes
 trachea
 thyroid
 carotid arteries (thrills, bruit)
 C V
 C VII
 C VIII (systolic)
 C IX
 C XI
 TMJ --

Inspection

ROM

deviation

Palpation

crepitus

tenderness

Neurological:

Dermatomes

C5

C6

C7

C8

T1

Tendon reflexes

biceps

triceps

brachioradialis

Muscle strength

C5

C6

C7

C8

T1

Coordination:

point-to-point

dysdiadochokinesia

Thorax:

Chest:

Inspection:

skin

shape

respiratory distress

rhythm (respiratory)

depth "

effort "

intercostal/supracloavicular retractions

Palpation:

tenderness

masses

respiratory expansion

tactile fremitus

Percussion:

lungs (posterior)

diaphragmatic excursion

kidney punch

Auscultation:

breath sounds

vesicular

bronchial

adventitious sounds

crackles (rales)

wheezes (rhonchi)

voice sounds

broncophony

whispered pectoriloquy

egophony

Cardiovascular:

auscultation (aortic murmurs)

Allen's test

SUPINE EXAMINATION

JVP

FMI

auscultation heart (L.lat. recumbent)

respiratory crackles

percussion chest (anterior)

breast palpation

The abdomen:

Inspection:

skin

umbilicus

contour

peristalsis

pulsations

hernias (umbilical/incisional)

Auscultation:

bowel sounds

bruit

Percussion:

general

liver

spleen

Palpation:

superficial reflexes

cough

light

rebound tenderness

deep

liver

spleen

kidneys

aorta

intra-/retro-abdominal wall mass

shifting dullness

fluid wave

Acute abdomen:

where pain began and now

cough

tenderness

guarding/rigidity

rebound tenderness

Rovsing's sign

psoas sign

obturator sign

cutaneous hyperaesthesia

rectal exam

Murphy's sign.

Male genitals and hernias.

Inspection:

skin
 prepuce
 glans
 testes
 pits/lico
 scrotum
 inguinal/femoral bulges

Palpation:

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

Auscultation:

scrotal map.

Peripheral vasculature:

Inspection:

skin
 nail beds
 pigmentation
 hair loss

Palpation:

pulses - radial, brachial, femoral, popliteal, post.tibial,
 dorsalis pedis
 lymph nodes - epitrochlear, femoral (horizontal & vertical)
 temperature (foot & legs)
 Manual compression test
 Retrograde filling (Trandolaburg) test
 Arterial insufficiency test

Musculoskeletal:

ROM

hip

flex. 90/120
 ext. 15
 abd. 45
 add. 30
 int rot 40
 ext rot 45

knee

flex. 130
 ext. 0/15

ankle

plantar flex 45
 dorsiflex 20
 inversion 20
 eversion 20

leg length

Neurological:**dermatomes**

L1

L2

L3

L4

L5

S1

muscle strength

hip flexion

knee extension

ankle dorsiflexion

plantar flexion

tendon reflexes

patellar

Achilles

plantar reflex

Rectal examination:**Inspection**

haemorrhoidal & perianal areas

Palpation

sphincter tone

tenderness

induration

nodules

prostate

seminal vesicles

Mental status**Appearance and behaviour:**

level of consciousness

posture and motor behaviour

dress, grooming, personal hygiene

facial expression

affect

Speech and language:

quantity

rate

volume

fluency

aphasia (pr)

Mood

Thought processes (logical, relevant, organised)

Memory and attention:

orientation (time, place, person)

remote memory

recent memory

new learning ability

Higher cognitive functions:

information and vocabulary (general & specialised knowledge)

abstract thinking.

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

PATIENT: _____

FILE # : _____ DATE: _____

INTERN/RESIDENT: _____

SUPERVISING CLINICIAN : _____

OBSERVATION :.

Posture
 Swellings
 Scars
 Discoloration
 Hair Line
 Bony and soft tissue contours

Shoulder position:

Left =

Right =

Muscle spasm

Facial expression

RANGE OF MOTION:

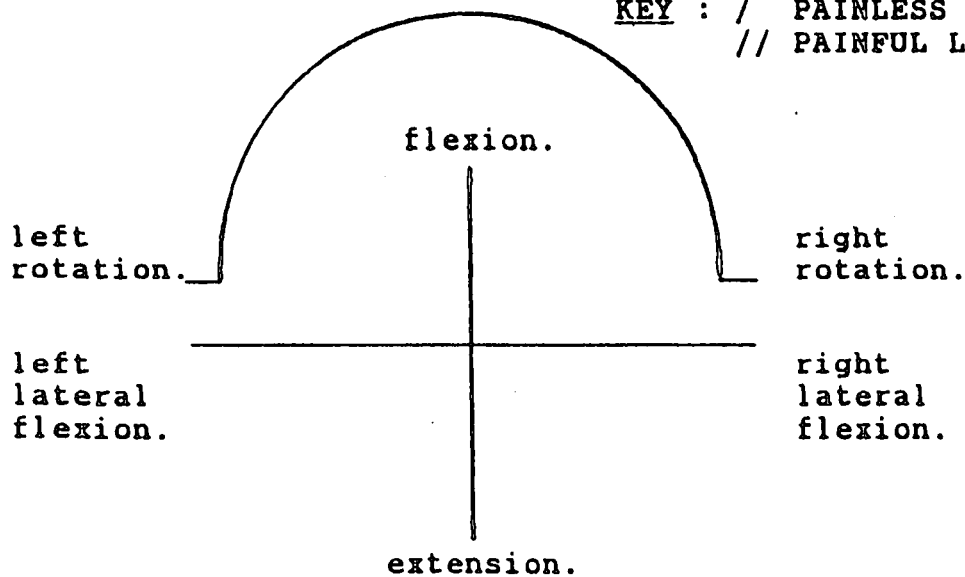
Flexion = 45 degrees.

Extension = 70 degrees.

L/R Rotation = 70 degrees.

L/R Lateral flexion = 45 degrees.

KEY : / PAINLESS LIMITATION.
 // PAINFUL LIMITATION.



PALPATION : lymph nodes.
 trachea.
 thyroid gland.

ORTHOPAEDIC EXAMINATION :

Tenderness

Active MF Trigger Points :

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

Doorbell Sign

Kemp's Test

Cervical Distraction

Halstead's Test

Hyperabduction Test (Wright's)

Shoulder abduction Test

Dizziness rotation Test

Brachial Plexus Tension

Cervical Compression

Lateral Compression

Adson's Test

Costoclavicular Test

Eden's (traction) Test

Shoulder depression Test.

Lhermitte's Sign

O'Donoghue Manoeuvre

Remarks : _____

NEUROLOGICAL EXAMINATION :

DERMATOMES: Left Right. MYOTOMES: Left Right. REFLEXES: Left Right.

C2		C1		C5	
C3		C2		C6	
C4		C3		C7	
C5		C4			
C6		C5			
C7		C6			
C8		C7			
T1		C8			
		T1			

VASCULAR :

LEFT.

RIGHT.

BLOOD PRESSURE.

CAROTIDS.

SUBCLAVIAN ARTERIES.

WALLENBERG'S TEST.

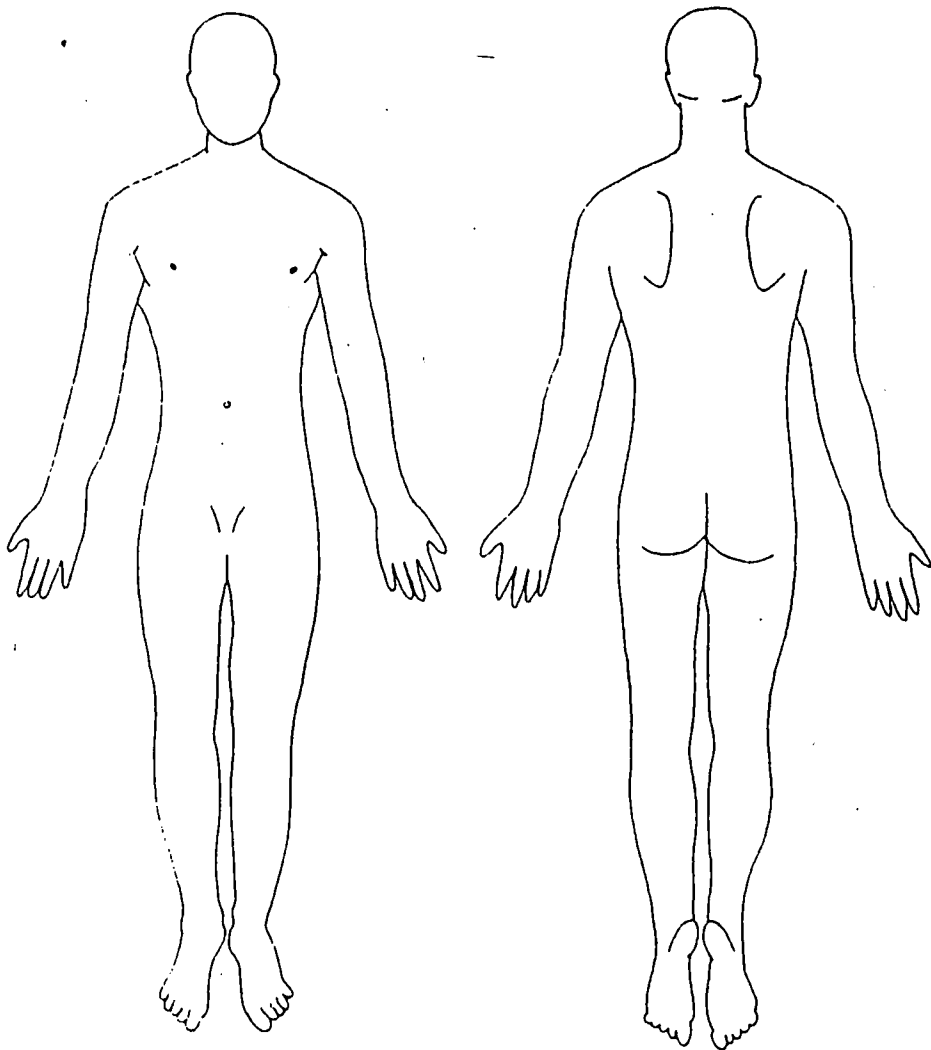
COMMENTS:

MOTION PALPATION :

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

PATIENT NAME : -----

FILE # : ----- DATE : -----

**PAIN DRAWINGS**

PATIENT NAME : -----

FILE # : ----- DATE : -----

NO PAIN

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

UNBEARABLE PAIN

NUMERICAL RATING SCALE

PATIENT NAME : -----

FILE # : ----- DATE : -----

	NONE	MILD	MODERATE	SEVERE
1 THROBBING	0) _____	1) _____	2) _____	3) _____
2 SHOOTING	0) _____	1) _____	2) _____	3) _____
3 STABBING	0) _____	1) _____	2) _____	3) _____
4 SHARP	0) _____	1) _____	2) _____	3) _____
5 CRAMPING	0) _____	1) _____	2) _____	3) _____
6 GNAWING	0) _____	1) _____	2) _____	3) _____
7 HOT-BURNING	0) _____	1) _____	2) _____	3) _____
8 ACHING	0) _____	1) _____	2) _____	3) _____
9 HEAVY	0) _____	1) _____	2) _____	3) _____
10 TENDER	0) _____	1) _____	2) _____	3) _____
11 SPLITTING	0) _____	1) _____	2) _____	3) _____
12 TIRING-EXHAUSTING	0) _____	1) _____	2) _____	3) _____
13 SICKENING	0) _____	1) _____	2) _____	3) _____
14 FEARFUL	0) _____	1) _____	2) _____	3) _____
15 PUNISHING-CRUEL	0) _____	1) _____	2) _____	3) _____

McGILL PAIN
QUESTIONNAIRE

PAIN DISABILITY INDEX

PATIENT NAME : -----

FILE # : ----- DATE : -----

1.1 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

1.2 PERSONAL CARE (WASHING, DRESSING, ETC)

- ☐ I can look after myself 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

1.3 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

1.4 WALKING

- ☐ Pain does not prevent me from walking any distance
- ☐ Pain prevents me from walking more than 2 km
- ☐ Pain prevents me from walking more than 1 km
- ☐ Pain prevents me from walking more than 0.5 km
- ☐ I can only walk using a stick or crutches
- ☐ I am in bed most of the time and have to crawl to the toilet

1.5 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

1.6 WORK

- ☐ I 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 cannot do any work at all

1.7 STANDING

- ☐ I can stand as long as I want with no extra pain
- ☐ I can stand as long as I want, but it gives me extra pain
- ☐ Pain prevents me from standing for more than 1 hour
- ☐ Pain prevents me from standing for more than 30 minutes
- ☐ Pain prevents me from standing for more than 10 minutes
- ☐ Pain prevents me from standing at all

1.8 SOCIAL LIFE

- ☐ My social life is normal and gives me no extra pain
- ☐ My social life is normal but increases the degree of pain
- ☐ Pain has no significant effect on my social life apart from limiting my more energetic interests, for example, dancing
- ☐ Pain has restricted my social life and I do not go out as often
- ☐ Pain has restricted my social life to my home
- ☐ I have no social life due to pain

1.9 SLEEPING

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

1.10 TRAVELLING

- ☐ I can travel anywhere without extra pain
- ☐ I can travel anywhere but it gives me extra pain
- ☐ Pain is bad but I manage trips over 2 hours
- ☐ Pain restricts me to trips of less than 1 hour
- ☐ Pain restricts me to trips under 30 minutes
- ☐ Pain prevents me from travelling, except to the doctor or hospital

1.11 RECREATION

- ☐ I am able to engage in all my recreation activities with no pain at all
- ☐ I am able to engage in all my recreation activities with some pain
- ☐ I am able to engage in most, but not all of my usual recreational activities due to pain
- ☐ I am able to engage in few of my recreation activities due to pain
- ☐ I can hardly do any recreation activities due to pain
- ☐ I cannot do any recreation activities at all

1.12 HEADACHES

- ☐ I have no headaches at all
- ☐ I have slight headaches which occur infrequently
- ☐ I have moderate headaches which occur infrequently
- ☐ I have moderate headaches which occur frequently
- ☐ I have severe headaches which occur frequently
- ☐ I have headaches which occur almost all the time

1.13 DRIVING

- ☐ I can drive my car without any neck pain
- ☐ I can drive my car as long as I want with slight pain
- ☐ I can drive my car as long as I want with moderate pain
- ☐ I cannot drive my car as long as I want due to moderate pain
- ☐ I can hardly drive at all due to severe pain
- ☐ I cannot drive my car at all

1.14 SITTING

- ☐ I can sit in any chair as long as I like
- ☐ I can only sit in my favourite chair as long as I like
- ☐ Pain prevents me from sitting more than 1 hour
- ☐ Pain prevents me from sitting more than 30 minutes
- ☐ Pain prevents me from sitting more than 10 minutes
- ☐ Pain prevents me from sitting at all

1.15 SEX LIFE

- ☐ My sex life is normal and causes no pain
- ☐ My sex life is normal but causes some extra pain
- ☐ My sex life is nearly normal but it is very painful
- ☐ My sex life is severely restricted by pain
- ☐ My sex life is nearly absent because of pain
- ☐ Pain prevents any sex life at all

OSWESTRY BACK DISABILITY INDEX

PATIENT NAME: _____ FILE #: _____ DATE: _____

This questionnaire has been designed to give the doctor information as to how your back 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 realise 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 - Walking

- ☐ Pain does not prevent me walking any distance.
- ☐ Pain prevents me walking more than 1 mile (2.2 km).
- ☐ Pain prevents me walking more than 1/2 mile (1.1 km).
- ☐ Pain prevents me walking more than 1/4 mile (0.5 km).
- ☐ I can only walk using a stick or crutches.
- ☐ I am in bed most of the time and have to crawl to the toilet.

Section 5 - Sitting

- ☐ I can sit in any chair as long as I like.
- ☐ I can only sit in my favorite chair as long as I like.
- ☐ Pain prevents me from sitting more than 1 hour.
- ☐ Pain prevents me from sitting more than 1/2 hour.
- ☐ Pain prevents me from sitting more than 10 minutes.
- ☐ Pain prevents me from sitting at all.

Section 6 - Standing

- ☐ I can stand as long as I want without extra pain.
- ☐ I can stand as long as I want, but it gives me extra pain.
- ☐ Pain prevents me from standing for more than one hour.
- ☐ Pain prevents me from standing for more than 30 minutes.
- ☐ Pain prevents me from standing for more than 10 minutes.
- ☐ Pain prevents me from standing at all.

Section 7 - Sex Life

- ☐ My sex life is normal and causes no extra pain.
- ☐ My sex life is normal but causes some extra pain.
- ☐ My sex life is nearly normal but it is very painful.
- ☐ My sex life is severely restricted by pain.
- ☐ My sex life is nearly absent because of pain.
- ☐ Pain prevents any sex life at all.

Section 8 - Social Life

- ☐ My social life is normal and gives me no extra pain.
- ☐ My social life is normal but increases the degree of pain.
- ☐ Pain has no significant effect on my social life apart from limiting my more energetic interests, for example, dancing.
- ☐ Pain has restricted my social life and I do not go out as often.
- ☐ Pain has restricted my social life to my home.
- ☐ I have no social life because of pain.

Section 9 - Sleeping

- ☐ I have no trouble sleeping.
- ☐ I can sleep well only by using pills.
- ☐ Even when I take pills I have less than six hours sleep.
- ☐ Even when I take pills I have less than four hours sleep.
- ☐ Even when I take pills I have less than two hours sleep.
- ☐ Pain prevents me from sleeping at all.

Section 10 - Travelling

- ☐ I can travel anywhere without extra pain.
- ☐ I can travel anywhere but it gives me extra pain.
- ☐ Pain is bad but I manage trips over two hours.
- ☐ Pain restricts me to trips of less than one hour.
- ☐ Pain restricts me to trips under 30 minutes.
- ☐ Pain prevents me from travelling, except to the doctor or hospital.

CMCC NECK DISABILITY INDEX

PATIENT NAME: _____ FILE #: _____ DATE: _____

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

Section 1 - Pain Intensity

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

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

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

Section 3 - Lifting

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

Section 4 - Reading

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

Section 5 - Headaches

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

Section 6 - Concentration

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

Section 7 - Work

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

Section 8 - Driving

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

Section 9 - Sleeping

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

Section 10 - Recreation

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

=====

VALIDITY ANALYSIS

=====

CORRELATION (PEARSON'S r)

CONSULTATION	PAIN DISABILITY INDEX vs NUMERICAL RATING SCALE	
1		0.5847
2		0.6184
3		0.6841
4		0.5707
5		0.4808
6		0.7224
7		0.7748

CONSULTATION	PAIN DISABILITY INDEX vs MCGILL PAIN QUESTIONNAIRE	
1		0.4726
2		0.5404
3		0.6488
4		0.4744
5		0.4805
6		0.5516
7		0.6011

For the above readings, the closer the value is to 1.0, the more near-perfect the correlation of the specified questionnaires, and therefore the greater the validity of the Pain Disability Index.

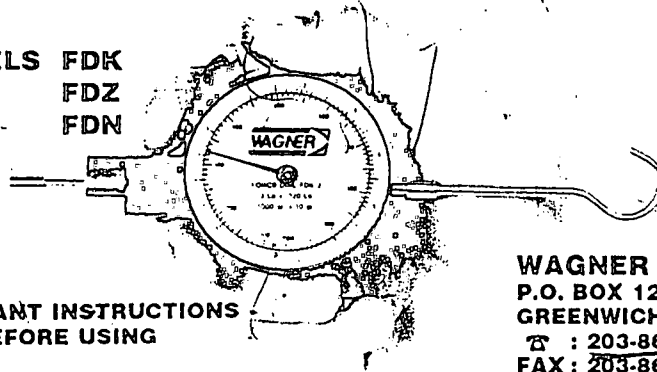
FORCE DIAL **CERTIFICATE OF CALIBRATION**

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

QUALITY CONTROL DIRECTOR

FORCE DIAL™ **PUSH - PULL FORCE GAGE**

**MODELS FDK
FDZ
FDN**



**IMPORTANT INSTRUCTIONS
READ BEFORE USING**

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

Complete list of available FORCE DIALS

FDK

DECIMAL POUND / GRAM GRADUATIONS					OUNCE / GRAM GRADUATIONS				
Model	Capacity/Graduations				Model	Capacity/Graduation			
FDK 025	.25 LB x	.002 LB/	100 G x	1 G	FDK 4	4 OZ x	1/32 OZ/	100 G x	1 G
FDK 050	.50 LB x	.005 LB/	200 G x	2 G	FDK 8	8 OZ x	1/16 OZ/	200 G x	2 G
FDK 1	1 LB x	.010 LB/	500 G x	5 G	FDK 16	16 OZ x	1/8 OZ/	500 G x	5 G
FDK 2	2 LB x	.020 LB/	1000 G x	10 G	FDK 32	32 OZ x	1/4 OZ/	1000 G x	10 G
FDK 5	5 LB x	.050 LB/	2500 G x	25 G	FDK 80	5 LB x	1 OZ/	2500 G x	25 G
FDK 10	10 LB x	.100 LB/	5 KG x	50 G	FDK 160	10 LB x	2 OZ/	5 KG x	50 G
FDK 20	20 LB x	.250 LB/	10 KG x	100 G					
FDK 40	40 LB x	.500 LB/	20 KG x	200 G					
FDK 60	60 LB x	.500 LB/	28 KG x	250 G					

FDN

NEWTON / GRAM GRADUATIONS

Model	Capacity/Graduation	
FDN1	1N x .01N/	100G x 1G
FDN2	2N x .02N/	200G x 2G
FDN5	5N x .05N/	500G x 5G
FDN10	10N x .1N/	1000G x 10G
FDN20	20N x .2N/	2000G x 20G
FDN50	50N x .5N/	5KG x 50G
FDN100	100N x 1N/	10KG x 100G
FDN200	200N x 2N/	20KG x 200G
FDN300	300N x 2.5N/	30KG x 250G

GENERAL

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

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

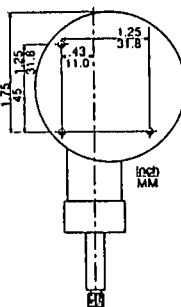
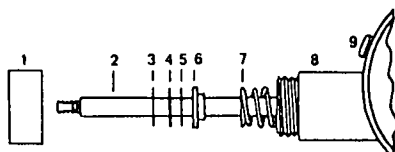
Lubrication of the FORCE DIAL is not recommended.

IMPORTANT

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

MOUNT

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

**PARTS**

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

ACCESSORIES:

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

* Not shown in diagram.

CALIBRATION

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

IMPLEMENT WEIGHT ADJUSTMENT

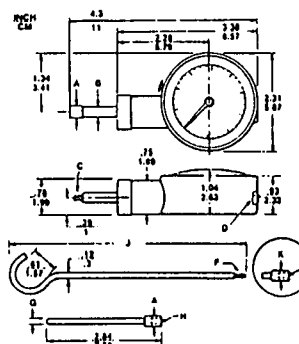
The FORCE DIAL is calibrated for use in the horizontal position. When using low capacity models - thru 2 LB/ 1000 G/ 10 N - in the vertical position, add or deduct the weight of the implements used from your readings, as follows:

WEIGHT OF IMPLEMENTS:

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

ADJUSTMENT:

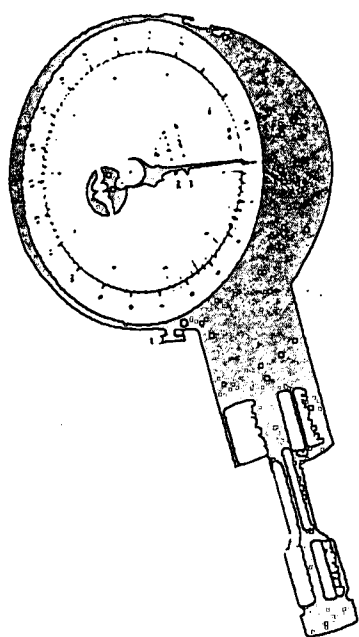
USE	WITH	+/-
Pushing Down	Plunger/Flat Tip	+9 G
Pushing Down	Plunger/Long Rod	+11 G
Pulling Down	Plunger/Flat Tip/Hook	+15 G
Pushing Up	Plunger/Flat Tip	-9 G
Pushing Up	Plunger/Long Rod	-11 G
Pulling Up	Plunger/Flat Tip/Hook	-15 G

DIMENSIONS

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

All dimensions are approximate.

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



Activator Methods, INC.

3714 E INDIAN SCHOOL RD., PHOENIX, AZ 85018
(602) 224-0220

ALGOMETER INSTRUCTIONS

Background:

Pressure pain threshold (PPT) has been used by many authors to quantify palpatory pain findings for myofascial trigger points and pain over bone using an algometer (1-7).

Description:

The pressure algometer consists of a force dial which reads in pounds or kilograms and a 1 cm diameter rubber tipped stylus. Pain threshold is determined by the amount of force/cm² required for a person to first perceive pain.

Procedure:

Prior to recording the pain threshold, discuss the procedure with the patient. Before taking a measurement, you may wish to demonstrate the process to the patient by pressing the algometer into the palm of their hand.

1. Localize any sensitive areas you wish to measure by gentle but firm palpation.
2. Hold the meter in the palm of your hand between your thumb and index finger.
3. Place the rubber tipped stylus over the pre-determined trigger point or area of palpable tenderness you wish to

measure. Make sure the force dial is perpendicular to the skin surface. Stabilize any nodular muscular regions between the middle and index finger of your indifferent hand.

4. Apply steady, gentle pressure at a rate of 1kg/cm²/sec. until the patient first feels pain and responds by saying "now."
5. Remove the stylus and record the value and locations of the tender areas in your notes or on a diagram for follow-up examination.
6. Reset the meter prior to making another reading.

References:

1. Fischer AA. Pressure algometry over normal muscles: Standard values, validity, reproducibility of pressure threshold. *Pain* 1986; 30:115-126.
2. Hsieh J, Hong CZ. Effect of chiropractic manipulation on the pain threshold of myofascial trigger point: a pilot study. Presented at the FCER's 2nd Annual International Conference on Spinal Manipulation, May 11-12, 1990, Washington, D.C.
3. Maloney P, Tepe R, Buerger D, et al. Evaluating the algometer as a diagnostic instrument. Presented at the FCER's 1st

GENERAL INFORMATION

The algometer is most accurate in the range which is 75% from full scale. In the range below 25% of full scale, the gauge will give consistent readings, however, with less accurate results. This inaccuracy is inherent to the design of mechanical gauges. (Note: several studies have demonstrated reliability in a clinical setting.)

The algometer requires no lubrication or other form of service.

The face of the meter has no zero setting because the zero has no significance in the calibration or accuracy of the gauge.

CALIBRATION

Activator Methods certifies that all algometers have been properly calibrated and are accurate to $\pm 1\%$ of full scale. The calibration of the algometer may be checked by attaching the pull hook and suspending test weights at $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and full capacity in the vertical position. The weight of the plunger, flat tip, and pull hook (15 g.) should be subtracted from the test results. If it is determined that calibration is required, the instrument should be returned to the factory.

Annual International Conference on Spinal Manipulation, March 31-April 1, 1989, Washington, D.C.

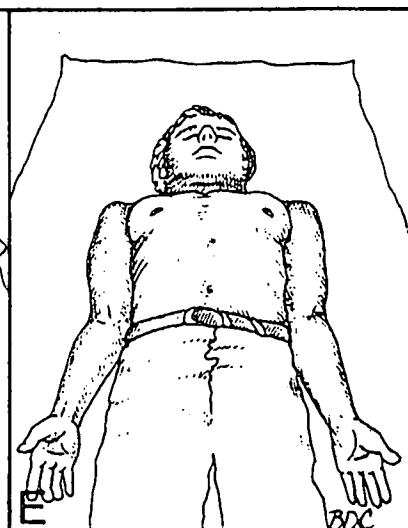
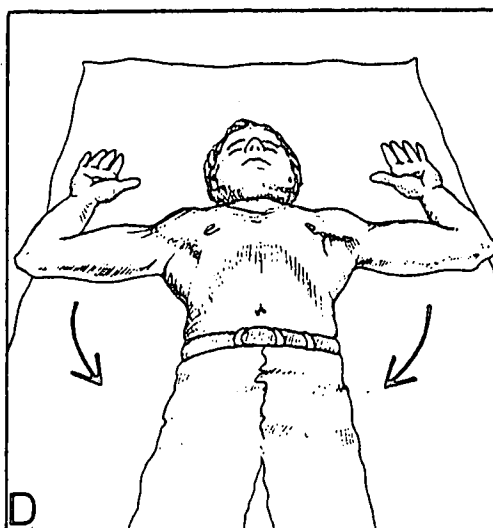
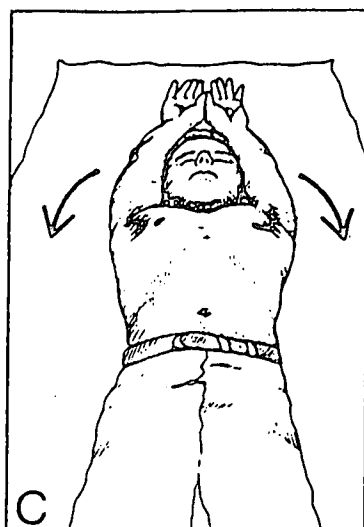
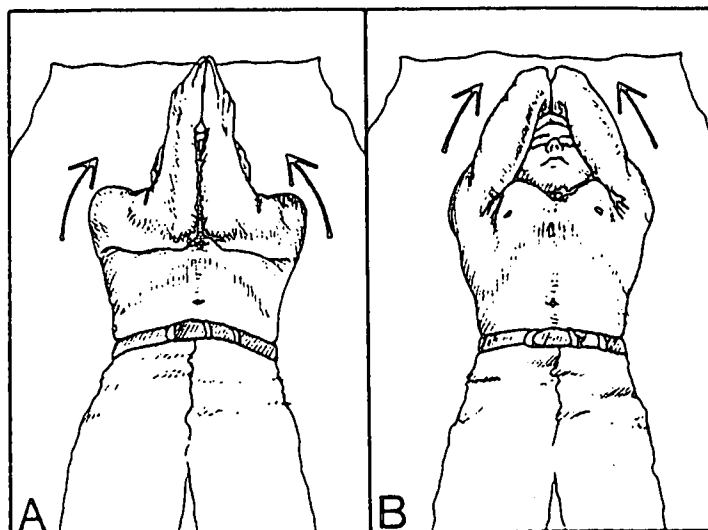
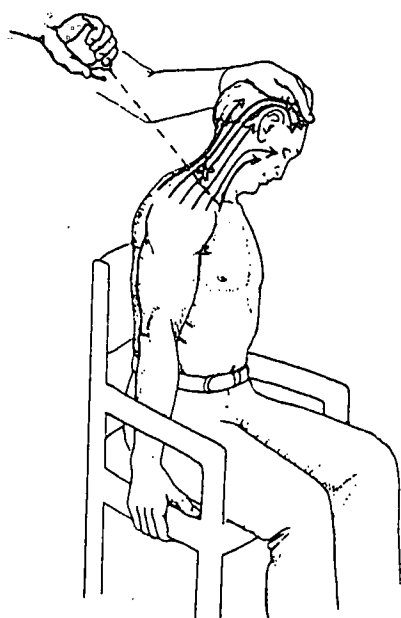
4. Osterbauer PJ, Fuhr AW, DeBoer KF, et al. Preliminary clinical and biomechanical assessment patients with chronic sacroiliac syndrome. Presented at the FCER's 2nd Annual International Conference on Spinal Manipulation, May 11-12, 1990, Washington, D.C.
5. Reeves JL, Jaeger D, Graff-Radiard SA. Reliability of the pressure algometer as a measure of myofascial trigger point sensitivity. *Pain* 1986; 24:313-21.
6. Vernon HT. Pressure pain threshold evaluation of the effect of spinal manipulation on chronic neck pain: a single case study. *J Can Chiropr Assoc* 1988; 32(4):191-4.
7. Vernon HT, Acker P, Burns S., et al. Pressure pain threshold evaluation of the effect of spinal manipulation in the treatment of chronic neck pain: a pilot study. *J. Manipulative & Physiol Ther* 1990; 13(1):13-16.

**THIS INSTRUMENT CARRIES A
ONE YEAR WARRANTY
FROM DATE OF PURCHASE.**

TRAPEZIUS

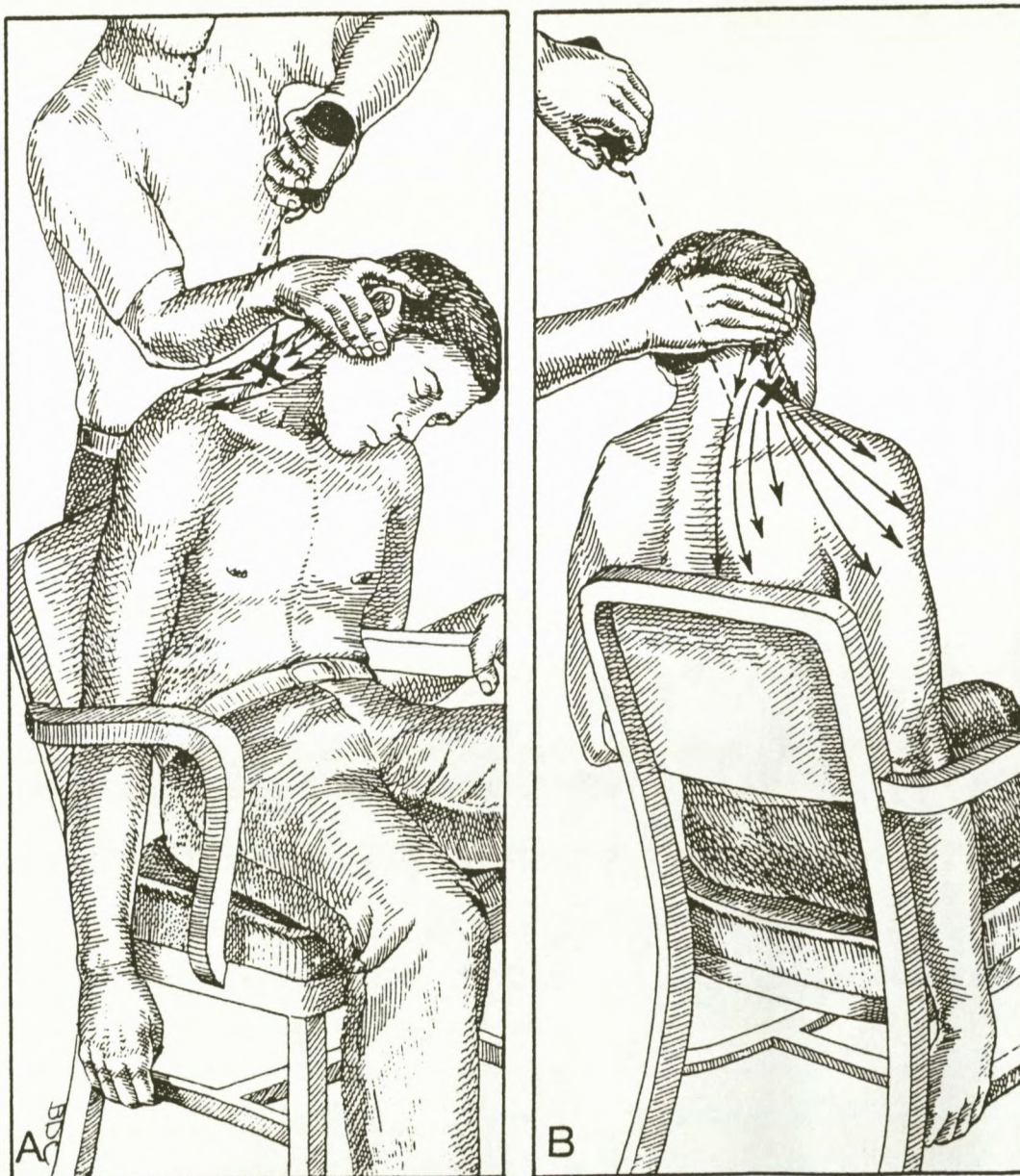
The upper fibres are stretched by turning and laterally flexing the head to the opposite side, and pulling the head antero-laterally.

The middle and lower fibres are stretched by the patient lying supine with his elbows, forearms and palms of his hands together in front of his abdomen. The forearms are raised over the face while the elbows are kept tightly together for as long as possible. The forearms are then dropped past the ears to the floor and the arms are swung down against the sides of the body with the elbows and wrists keeping contact with the floor (the movements progress through pictures A to E).



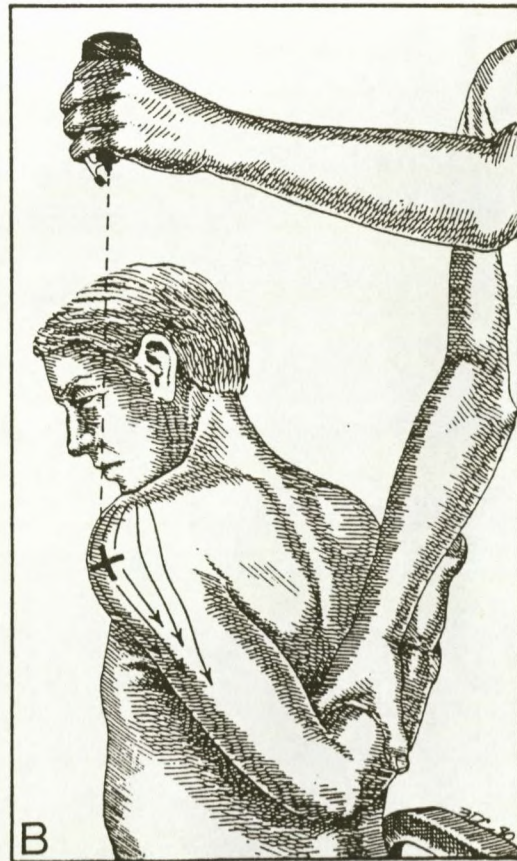
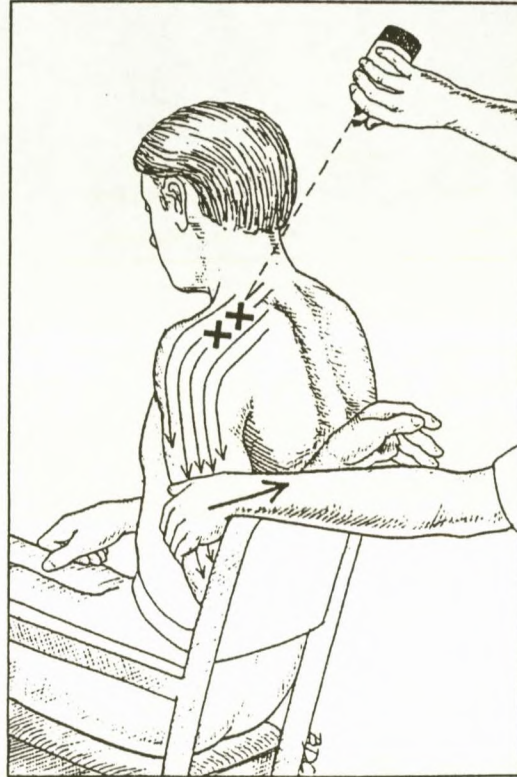
LEVATOR SCAPULAE

The patient sits relaxed in a chair with his pelvis level and his fingers hooked under the chair seat to hold the scapula down. The head is turned about 30 degrees to the opposite side and pulled laterally to stretch the diagonal fibres (figure A) or anteriorly to stretch the vertical fibres (figure B).



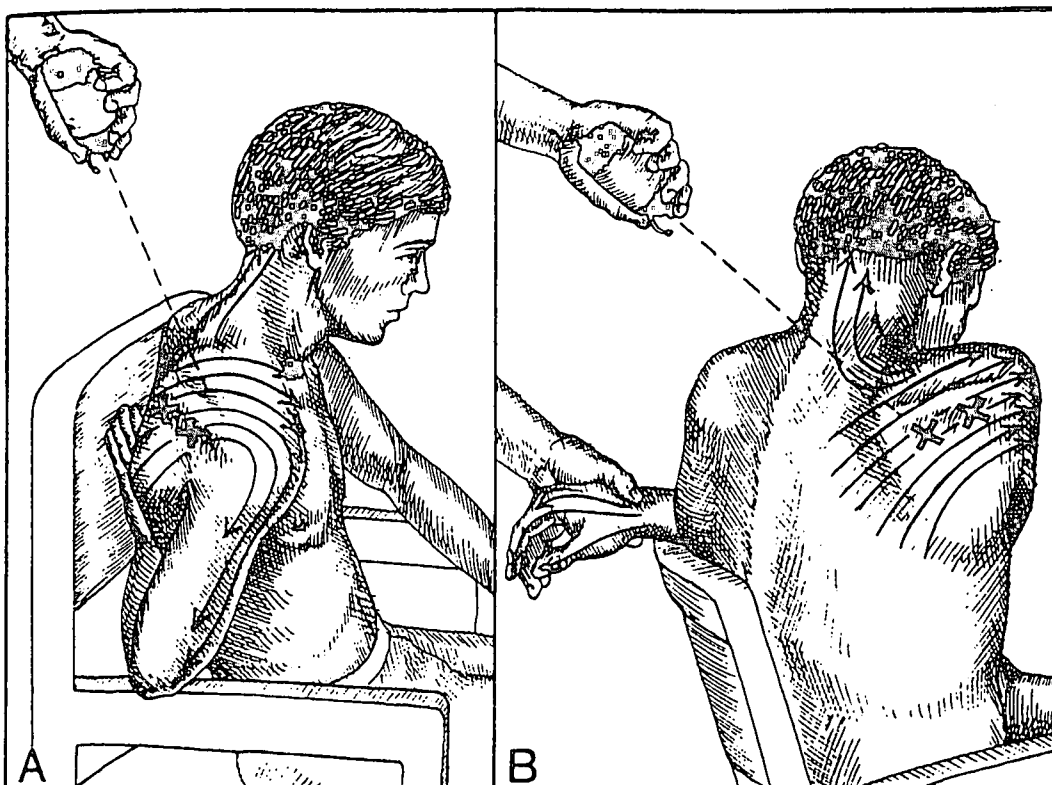
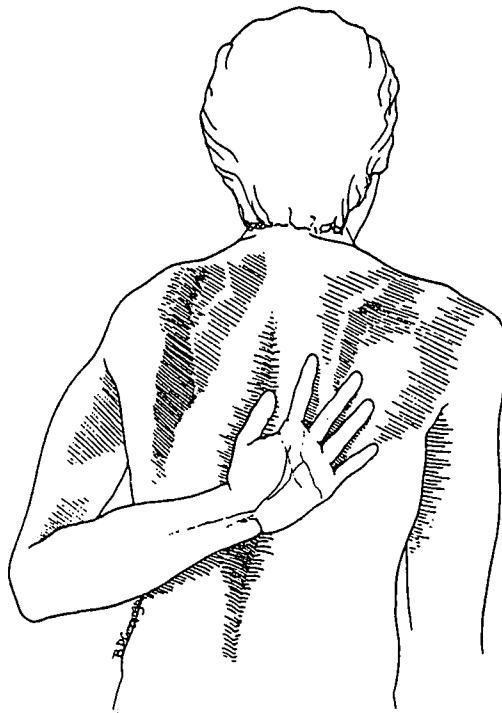
SUPRASPINATUS

The supraspinatus is stretched by placing the forearm behind the back and pulling it with the uninvolved arm into adduction in an upward direction. Another form of stretch is to fully horizontally adduct the involved arm across the chest and with the uninvolved hand pull it further into adduction.



INERASPINATUS

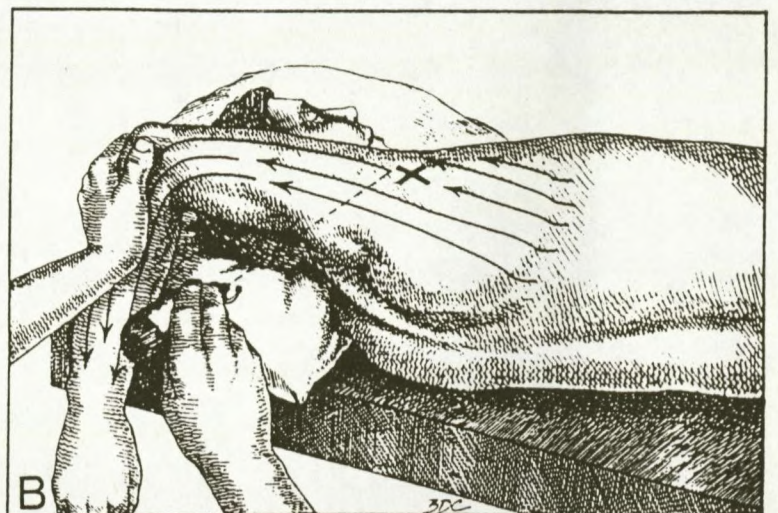
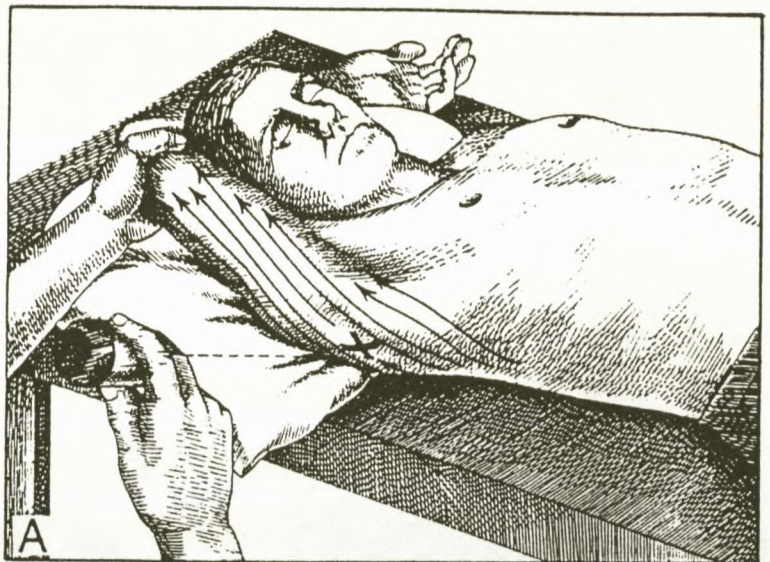
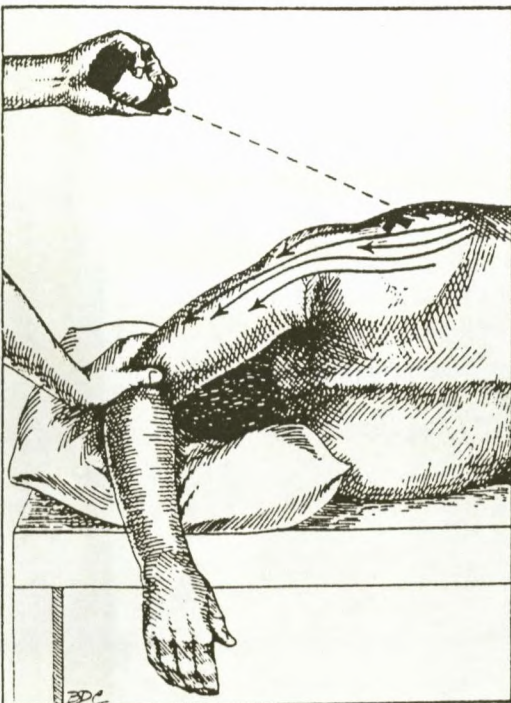
The infraspinatus may be stretched in two different ways with the patient seated. Firstly the affected arm may be brought behind the back in a position of adduction and internal rotation (figure A). For extra stretch the arm may be pulled further into adduction. The second method is to pull the arm across the chest in full horizontal adduction (figure B). A similar technique is to reach across the chest with the involved arm and grasp the far armrest of the chair. Then to produce the stretch the patient leans away and rotates away from the involved side.



TERES MAJOR AND MINOR

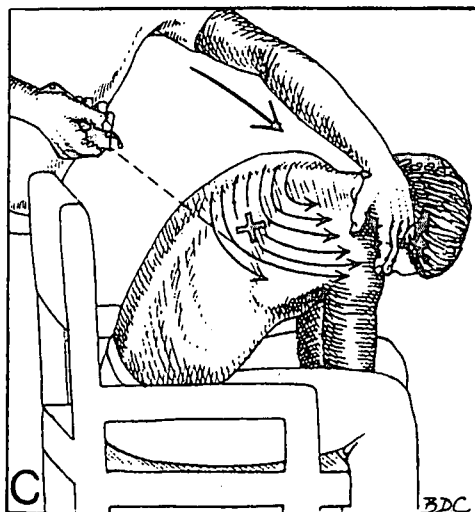
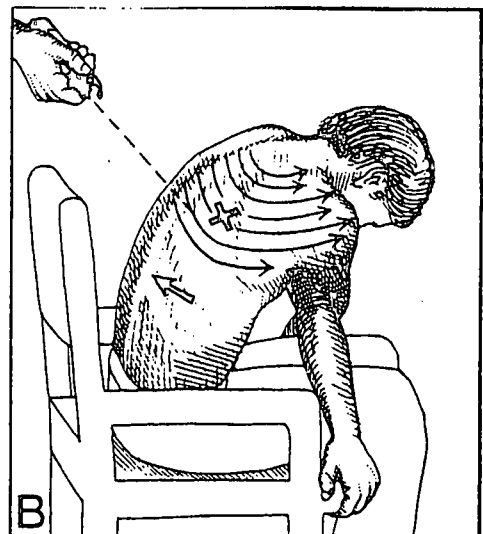
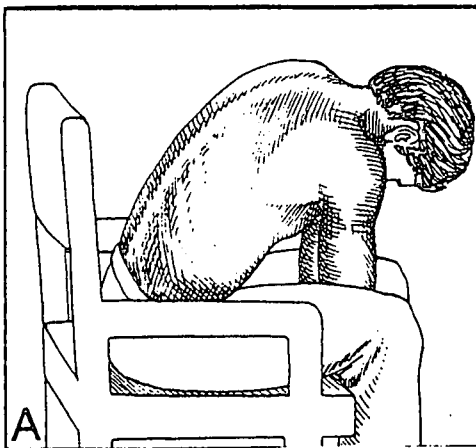
These muscles may be stretched in the seated or lateral recumbent position on the uninvolved side. The involved arm is abducted fully at the shoulder and the elbow bent to bring the hand behind the head. In the seated position the uninvolved hand can grasp the elbow of the involved arm and pull the shoulder further into abduction to increase the stretch.

An alternate stretch is that for the infraspinatus where the involved arm is brought into adduction and internal rotation (arm behind the back).



RHOMBOIDEUS MAJOR AND MINOR

The patient sits in a chair with his thoracic spine flexed and his arms in one of two positions, either hanging between the knees (figure A) or crossed in front of the chest (figure B). With the "arms between the legs" position the patient lets the weight of the arms pull the shoulders forward and laterally. To increase the degree of stretch, force may be applied to the acromian process (figure C) in a forward and downward direction. With the "arms in front of the chest" position the patient pushes his arms down over his legs as far they will go and then pushes his legs apart to further the degree of stretch.



PECTORALIS MAJOR

The in-doorway stretch is used for this muscle. The patient stands in a narrow doorway with his forearms against the doorjams. One foot is placed in front of the other, and the forward knee is bent. The patient holds his head erect, looking straight ahead. With the bending of the forward knee a stretch is placed bilaterally on the pectoralis major muscle.

The hand position is altered to vary the stretch on the different parts of the muscle. A low hand position (figure A) stretches the clavicular section, a middle hand position, with the upper arms horizontal to the ground, stretches the sternal section, and a high hand position stretches the abdominal fibres.

