

**THE EFFECTIVENESS OF MYOFASCIAL TRIGGER  
POINT THERAPY IN THE TREATMENT OF  
EPISODIC TENSION-TYPE HEADACHE IN  
ADULTS: A COMPARISON OF 3 MANUAL  
INTERVENTIONS APPLIED TO THE POSTERIOR  
CERVICAL MUSCULATURE**

**BY**

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Master's Degree in Technology: Chiropractic in the faculty of health at the Durban  
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**I, Ashna Prithipal, do hereby declare that this  
dissertation is representative of my own work.**

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## **Abstract**

Headaches are one of the most common clinical problems in medicine (Edwards et al. 1995). It is estimated that one in three people suffer from headaches at some stage in their life (Kim et al. 1995). It is an extremely common complaint in the industrialized world (Nilsson, 1997) and has a significant impact on employee absenteeism, productivity and quality of life (Schwartz et al. 1997). In the United States more than 15 000 tons of Aspirin is consumed annually for the relief of headaches, and the cost of evaluation and treatment of headache patients consumes millions of dollars a year (Bemat and Vincent, 1993).

Tension - type headache is the commonest form of headaches (Edwards et al. 1995). It is a highly prevalent condition experienced annually by 30 - 70% of the population, and as a chief complaint, it constitutes 5 - 8% of Chiropractic patients (Vernon and McDermaid, 1998). It is divided into an Episodic and Chronic form (IHS, 1991:29), with Episodic Tension-type headache being far more prevalent than Chronic Tension-type headache (Schwartz et al. 1998). Episodic Tension-type headache is further subdivided according to the presence or absence of a muscular factor. According to the International Headache Society (1991:29) for decades a dispute has prevailed concerning the importance of muscle contraction in the pathogenesis of the headache, but conclusive studies are still lacking (IHS, 1991:29). Based on the IHS (1991:29) classification that tension-type headache is associated with a muscular component, the purpose of this study was to investigate the effect of specific myofascial trigger point therapy in the clinical presentation of Episodic Tension-type headache.

The study was a randomized, controlled study conducted at the Durban Institute of Technology Chiropractic Clinic. Sixty patients were accepted onto the study, and were randomly divided into three groups - A, B and C. Each groups consisted of 20 patients. All groups received 5 treatments over a two-week period.

Group A received spinal manipulative therapy to the cervical spine, group B received a combination of spinal manipulative therapy to the cervical spine and interferential current to the posterior cervical musculature, and group C received interferential current to the posterior cervical musculature.

Subjective measurements included the Numerical Pain Rating scale 101 (NRS 101) and the Headache Diary. Objective measurements included the Myofascial Diagnostic Scale and Algometer readings. All questionnaires except the Headache Diary were completed prior to treatment, at treatments one, three and five. The Headache Diary was taken home by the patients and returned to the researcher at the end of the study.

Intergroup comparisons of subjective and objective data were made using the Kruskal - Wallis H-test coupled with the Dunn procedure. Intragroup comparisons of subjective and objective data were made using the Friedman's T-test coupled with the Dunn procedure. The level of significance was set at  $\alpha = 0.05$  and p-values were used for decision making.

Inter-group statistical analysis showed significant differences between all treatments for NRS 101 scores, Myofascial Diagnostic scale scores, Algometer readings and Headache characteristics. Intra-group statistical analysis showed no significant differences between groups for NRS 101 scores and Algometer readings.

Mean NRS 101 scores reduced by as much as 61.69% by the end of the study. Mean Myofascial Diagnostic Scale scores reduced by as much as 56.21%. Headache frequency decreased by as much as 58.81%, headache intensity by 73% and headache duration by 71.2%. Trigger point sensitivity improved by as much as 56.83% and the greatest reduction in the number of active trigger points was 71%.

The results obtained from this study indicate that tender pericranial muscles may contribute significantly to the tension-type headache, if not equally as much as cervical spine dysfunction. It also supports the IHS (1991:29) hypothesis that the pathogenesis of tension-type headache may be multi-factorial. In conclusion, these results demonstrate that specific myofascial trigger point therapy applied to active posterior cervical myofascial trigger points is slightly more beneficial than Spinal manipulative therapy alone, or Interferential current therapy alone, in the management of Adult Episodic tension-type headache.



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## DEFINITIONS

1. Adjustment - The Chiropractic Adjustment is a specific form of direct articular manipulation using either long or short leverage techniques with specific contacts, and is characterised by a dynamic thrust of controlled velocity, amplitude and direction (Gatterman, 1990:405).
2. Biomechanics - Application of mechanical laws to living structures. The study and knowledge of biological function from an application of mechanical principles (Gatterman, 1990:406)
3. Chiropractic - It is a discipline of the scientific healing arts concerned with the pathogenesis, diagnosis, therapeutics and prophylaxis of functional disturbances, pathomechanical states, pain syndromes and neurophysiological effects related to the statistics and dynamics of the locomotor system, especially of the spine and pelvis (Gatterman, 1990:406).
4. Episodic tension-type headache - Recurrent episodes of headache lasting from minutes to days the pain is typically pressing in quality, of mild to moderate intensity, bilateral in location, and does not worsen with routine physical activity. Nausea is absent, but photophobia or phonophobia may be present (IHS, 1991:29)
5. Fixation - The state whereby articulation has become temporarily immobilised in a position that it may normally occupy during any phase of physiological movement. The immobilisation of an articulation in a position of movement when the joint is at rest, or in a position of rest when a joint is in movement (Gatterman, 1990:408).
6. Interferential current - A form of electrical treatment in which two currents of differing medium frequencies are used to induce analgesia, elicit muscle contraction, modify the activity of the autonomic nervous system, promote healing, and reduce edema (Goats, 1990:87).
7. Manipulation - Passive manoeuvre in which specifically directed manual forces are applied to vertebral and extravertebral articulations of the body, with the object of restoring mobility to restricted areas (Gatterman, 1990:410).

8. Manual Therapy - Therapeutic application of manual force. Spinal manual therapy broadly defined includes all procedures in which the hands are used to mobilise, adjust, manipulate, apply traction, massage, stimulate or otherwise influence the spine and paraspinal tissues with the aim of influencing the patient's health (Gatterman, 1990:410).
9. Motion Palpation - Palpatory diagnosis of passive and active segmental joint range of motion (Gatterman, 1990:412).
10. Myofascial Trigger Point - A hyper-irritable locus within a taut band of skeletal muscle that may be located in the muscular tissue and/or its fascia (Travell and Simons, 1983:13).
11. Objective Findings - Findings obtained from the Myofascial Diagnostic scale and Algometer.
11. Subjective findings - Findings obtained from the NRS 101 and Headache diaries.



## **CHAPTER ONE**

### **1.1 INTRODUCTION**

Tension-type headache is the most prevalent type of headache affecting a large percentage of the population worldwide (Edwards et al. 1991:851). In a Malaysian study Episodic Tension-type headache accounted for 94.4% of the total headache population (Alders et al. 1996). An epidemiological study of the German population showed that 38.3% of the population suffered from Episodic tension-type headache (Gobel et al. 1994). A study by Bove and Nilsson (1998) calculated the one-year prevalence of tension-type headache in Denmark to be more than 38%. In Hong Kong 25.9% of the population met the criteria for Episodic Tension-type headache (Wong et al. 1995) while a survey of 5891 Saudi Arabians showed that 39% of them suffered from Episodic Tension-type headache (Abdul-Jabbar et al. 1996).

According to Bernat and Vincent (1993) more than 40% of people who seek medical attention for headaches are diagnosed as having tension-type headache. Schwartz et al. (1997) state that although tension-type headache is less likely to cause actual lost workdays, it accounts for a significant proportion of reduced work effectiveness, which has a greater cost implication in the workplace.

Although the exact etiology of episodic tension-type headache remains unknown, its pathogenesis is believed by most to be multifactorial, and includes muscular factors, vascular factors, psychological factors (e.g. stress, anxiety and depression) as well as cervical spine dysfunction (IHS, 1991:20). According to the International Headache Society (1991) for decades a dispute has prevailed concerning the importance of muscle contraction in the pathogenesis of the headache, but conclusive studies are still lacking. The Classification Committee of the IHS believes that the diagnostic subdivision of Episodic Tension-type headache according to the presence or absence of a muscular component will stimulate research in this field.

Studies measuring pericranial muscular activity have found a close association between tenderness of the neck and shoulder muscles with the tension-type headache (Kim et al. 1995:357; Sandrini et al. 1994:451, and Murphy and Lehrer, 1990:23). Active myofascial trigger points have been identified in these muscles (De Busser, 2001; Muller, 1999 and Jansen, 1998), but studies investigating the outcome

of specific myofascial trigger point therapy in these headache subjects is largely lacking.

Muller (1999) found a total of 97.5% of tension-type headache subjects in his study had at least one trigger point in one of the four muscles tested, as opposed to 82% of asymptomatic controls. His study revealed that most of the trigger points occurred in the posterior cervical and suboccipital muscles, leading to the conclusion that tension-type headache may be associated with these muscles. Jansen (1998) found that the posterior cervical muscles had the highest number of active trigger points in tension-type headache subjects in her study, when compared to the trapezius, sternocleidomastoid and suboccipital muscles. In total 61.7% of subjects had an active posterior cervical muscle trigger point one, 62.7% had an active posterior cervical muscle trigger point two and 66.6% had an active posterior cervical muscle trigger point three.

Interferential current therapy is an accepted method of treating myofascial trigger points (Gatterman, 1990:353, Hogenkamp *et al.* 1987 and Christie, 1995). It utilizes two medium-frequency alternating currents that differ in frequency by 0 - 100 Hz, causing either analgesia, muscle contraction, reduction of bruising/swelling or healing in the tissues it stimulates (Goats, 1990). In this study, interferential current was used for its analgesic properties on myofascial pain.

According to Gatterman (1990:210) effective functioning of the neck muscles depends on the alignment of the cervical spine. Gatterman (1995) is also of the opinion that cervical spine dysfunction makes a significant contribution to the cause of a number of headache types. Vernon *et al.* (1992) support this and state that altered function of the cervical spine components including skeletal, arthrokinetic and myofascial structures may contribute to the tension-type headache. Gatterman (1990:250) believes that manipulation in combination with other manual therapies is the preferred chiropractic treatment of Episodic Tension-type headache. The use of chiropractic cervical manipulation has been shown in many studies to provide both an immediate and long-term benefit to patients suffering from tension-type headache (Mootz *et al.* 1994, Vernon *et al.* 1992, Vernon 1995, Boline *et al.* 1995).

However, Bove and Nilsson (1998) conducted a randomized trial of seventy-five adult episodic tension-type headache sufferers comparing soft tissue therapy of the trapezius muscle and spinal manipulation (treatment group) with soft tissue therapy and placebo laser (control group). Results indicated that both groups showed a

reduction in daily headache hours and analgesic intake, leading to the conclusion that as an isolated intervention, spinal manipulative therapy does not seem to have an effect on Episodic tension-type headache. It also indicates that soft tissue therapy alone is beneficial in the treatment of Episodic tension-type headache.

Based on the classification of Episodic tension-type headache by the International Headache Society (1991:29) and the belief that its pathogenesis may be multi-factorial (IHS, 1991:20), it may be possible that Episodic tension-type headache unassociated with a muscular component responds favourably to spinal manipulative therapy alone, while Episodic tension-type headache associated with a muscular component does not respond to spinal manipulative therapy alone.

Prior studies on tension-type headaches have shown that active trigger points are closely associated with the headache (Muller, 1999 and Jansen, 1998). There have \* been no studies involving any specific type of trigger point therapy to determine what effect treatment of trigger points will have on the headache. This study sets out to determine the effect of Interferential Current therapy compared to spinal manipulative therapy in the treatment of Episodic tension-type headache in adults.

## **1.2 AIM/PURPOSE OF THE STUDY**

An investigation into the effectiveness of Myofascial Trigger Point Therapy in the treatment of Episodic Tension-type Headache in Adults: A comparison of 3 Manual Interventions applied to the Posterior Cervical Musculature.

## **1.3 OBJECTIVES OF THE STUDY**

### **1.3.1 Objective One**

The first Objective is to determine the relative effectiveness of spinal manipulative therapy of the cervical spine, compared to a combination of spinal manipulative therapy of the cervical spine and interferential current therapy of the posterior cervical musculature, in terms of subjective clinical findings in the treatment of Episodic tension-type headache in adults.

### 1.3.2 Objective Two

The second objective is to determine the relative effectiveness of spinal manipulative therapy of the cervical spine compared to interferential current therapy of the posterior cervical musculature, in terms of subjective clinical findings in the treatment of Episodic tension-type headache in adults.

### 1.3.3 Objective Three

The third objective is to determine the relative effectiveness of interferential current therapy to the posterior cervical musculature compared to a combination of spinal manipulative therapy of the cervical spine and interferential current to the posterior cervical musculature, in terms of subjective clinical findings in the treatment of Episodic tension-type headache in adults.

### 1.3.4 Objective Four

The fourth objective is to determine the relative effectiveness of spinal manipulative therapy of the cervical spine compared to a combination of spinal manipulative therapy of the cervical spine and interferential current therapy to the posterior cervical musculature, in terms of objective clinical findings in the treatment of Episodic tension-type headache in adults.

### 1.3.5 Objective Five

The fifth objective is to determine the relative effectiveness of spinal manipulative therapy of the cervical spine compared to interferential current therapy to the posterior cervical musculature, in terms of objective clinical findings in the treatment of Episodic tension-type headache in adults.

### 1.3.6 Objective Six

The sixth objective is to determine the relative effectiveness of spinal manipulative therapy of the cervical spine compared to a combination of spinal manipulative therapy of the cervical spine and interferential current therapy to the posterior cervical musculature, in terms of objective clinical findings in the treatment of Episodic tension-type headache in adults.

## CHAPTER TWO

### 2.1 LITERATURE REVIEW

#### 2.1.1 DEFINITION AND CLASSIFICATION OF EPISODIC TENSION-TYPE HEADACHE

In 1988 the International Headache Society introduced new diagnostic criteria for headaches and craniofacial pain. Since headaches can only be diagnosed by subjective information received from the patient, it is essential that the criteria for diagnosing the headaches be consistent and reproducible (Leone et al. 1994).

Leone et al. (1994) assessed the reliability of the diagnostic criteria set aside by the International Headache Society for the different headache disorders. The clinical records of 100 consecutive outpatients were evaluated by two neurologists who transferred data about the headache and associated phenomena to a form reflecting the IHS criteria. The results indicated that the IHS diagnostic criteria are satisfactorily applicable to high quality medical records, with inter-observer concordance of kappa values = 0.81 for Episodic tension-type headache.

The IHS (1991:29) defines Episodic tension-type headache as recurrent episodes of headache lasting from minutes to days. The pain is typically pressing or tightening in quality, of a mild or moderate intensity, bilateral in location and does not worsen with routine physical activity. Nausea is absent, but photophobia or phonophobia may be present. Bates (1995:62) describes Episodic tension-type headache as usually being bilateral, but may be generalised or localised to the back of the head and upper neck, or to the fronto-temporal area.

The IHS (1991:29) Operational Diagnostic criteria for Episodic tension-type headache is as follows:

A. At least 10 previous headache episodes fulfilling criteria B - D listed below.

Number of days with such headache < 180/year (< 15/month)

B. Headache lasting from 30 minutes to 7 days



C. At least two of the following pain characteristics:

1. Pressing/tightening quality
2. Mild or moderate intensity (may inhibit, but does not prohibit activities)
3. Bilateral location
4. ~~No aggravation by walking stairs or similar routine physical activity~~

D. Both of the following:

1. No nausea or vomiting (anorexia may occur)
2. Photophobia and phonophobia are absent, or one but not the other is present

E. At least one of the following:

1. History, physical and neurological examinations do not suggest one of the following:
  - a. Trauma
  - b. Vascular disorders
  - c. Non-vascular intracranial disorders
  - d. Substances or their withdrawal e.g. drug abuse
  - e. Non-cephalic infection
  - f. Metabolic disorders
  - g. Disorders of the cranium, neck, eyes, nose, sinuses, teeth, mouth or other facial or cranial structures.
2. History and/or physical and/or neurological examinations do suggest such a disorder, but it is ruled out by appropriate investigations.

The International Headache Society (1991:30) further proposes two subtypes of Episodic tension-type headache. The first subtype is Episodic tension-type headache "associated with disorder of pericranial muscles" and the second subtype is episodic tension-type headache "unassociated with disorder of pericranial muscles."

No specification for "pericranial" is given by the IHS (1991:29).

- a) Episodic tension-type headache associated with a disorder of the pericranial muscles

Previously termed "muscle contraction headache," it is defined as episodic tension-type headache with increased levels of tenderness and/or EMG activity of the

pericranial muscles. The diagnostic criteria for this subtype fulfils all of the criteria listed above for Episodic tension-type headache, with the addition of the following two findings:

1. increased tenderness of pericranial muscles-demonstrated by manual palpation or pressure algometer.
2. increased EMG level of pericranial muscles at rest or during physiological tests.

b) Episodic tension-type headache unassociated with a disorder of pericranial muscles

Previously termed "Idiopathic headache, essential headache and psychogenic headache," it is defined as episodic tension-type headache with normal levels of tenderness and/or EMG of pericranial muscles. The diagnostic criteria for this subtype of headache fulfils all of the criteria listed above for Episodic tension-type headache with the addition of the following finding:

1. No increased tenderness of the pericranial muscles. If studied, EMG of pericranial muscles shows normal levels of activity.

## **2.2 EPIDEMIOLOGY**

### **2.2.1 INCIDENCE AND PREVALENCE**

Headaches are perhaps the most distressing of all human complaints and, in its most severe form, can vitiate (impair) life (Abduljabbar *et al.* 1996).

According to Martin (1993:22) tension-type headaches affect 66% to 83% of the population in developed countries. Jensen *et al.* (1998) state that 14% of adults report tension-type headaches once or more per week and 3% are affected on a daily basis.

An epidemiological study of headache distribution among 4061 Germans revealed that 38.3% suffer from tension-type headache. Sixty-seven percent of these fulfilled

the criteria for Episodic tension-type headache and reported headaches 1 – 2 times per month (Gobel et al. 1994).

A door-to-door community survey of 5891 Saudi Arabians indicated that the lifetime prevalence of all headache types in Saudi Arabia was 8%, of which 39% was Tension-type headache (Abduljabbar et al. 1996). A community based headache survey by Wang et al. (1997) of the Kinmen Chinese population indicated that the one-year prevalence of tension-type headache was 35%, of which 67% represented Episodic tension-type headaches. In both communities the diagnosis of tension-type headache was made using structured headache questionnaires and clinical evaluation based on the IHS (1998) criteria for tension-type headache.

In Denmark, Rasmussen et al. (1991) calculated the lifetime prevalence of headaches to be 96%. The overall lifetime prevalence of tension-type headache was 69% among males and 88% among females. Twenty-three percent of all tension-type headache sufferers fulfilled the criteria for Episodic tension-type headache and reported headache episodes between 8 – 14 days per year, while 36% reported headaches several times a month. Jensen (1999) carried out a similar study in Denmark and found that the lifetime prevalence of tension-type headache in the general population was 78%, with Episodic tension-type headache accounting for approximately 90% of the total tension-type headache population.

Srikiatkhachorn et al. (1997) examined 220 patients of the Chulalongkorn Headache Clinic and found that the prevalence of tension-type headache was 36.7%.

Edmeads et al. (1993) found similar findings in a Canadian study, where 5.8 million (29.5%) Canadians were found to suffer from tension-type headache. The frequency of headache occurrence was approximately 21 episodes per patient per year.

### 2.2.2 AGE AND GENDER

Tension-type headaches can occur at any age (Weisberg et al. 1989) but symptoms usually begin before the age of 20 in 40% of patients (Bernat and Vincent, 1993).

In Saudi Arabia the age of onset of tension-type headache ranged from childhood to 77 years of age and peaked in the fourth decade (Abduljabbar et al. 1996).

Rasmussen (1993) found that 49% of males and 58% of females in his study reported the onset of their headaches to be in the second decennium (between ages

10-20) while approximately 25% each of males and females reported onset of the headache to be in the third decennium (between ages 21-30).

According to Weisberg et al. (1989) and Rasmussen et al. (1991), women are more commonly afflicted than males. The prevalence rate of tension-type headache among females in Saudi Arabia was 4.3% compared to 3.6% of males (Abduljabbar et al. 1996). Among the Chinese population of Kinmen, tension-type headache occurred in 20% of males and 46% of females (Wang et al. 1997). Rasmussen et al. (1991) found a male: female ratio of 4:5 for tension-type headache in Copenhagen, while Jensen (1999) found a male: female ratio of 3:4 for tension-type headache.

Rasmussen (1993) also states that women outnumber men in the occurrence of tension-type headache, but this female preponderance remains unexplained (Rasmussen, 1992). Rasmussen (1995) also found that more females sought medical care for their headaches, compared to males, and this may contribute to the female preponderance (Linnet et al. 1989). Females were also found to be more sensitive to mechanical pressure than males, and revealed more tenderness from pericranial muscles, which could also explain the higher ratio for Episodic tension-type headaches among females (Jensen, 1999). Rasmussen (1993) believes that female hormones may act as underlying, constitutional predisposing factors of the headache, and thus also contribute to the female preponderance of episodic tension-type headache.

### 2.2.3 CLINICAL FEATURES OF TENSION-TYPE HEADACHE

As defined by the IHS (1991:29) episodic tension-type headache occurs less than fifteen times per month, or one hundred and eighty times per year. The duration of the headache may vary from thirty minutes to days. The pain is typically of a pressing or tightening quality of mild to moderate intensity that does not worsen with routine physical activity e.g. climbing stairs. The pain is most often occiputonuchal in location, but may be felt in other areas of the cranium as well. Nausea is absent, but photophobia or phonophobia may be present.

Bates (1995:62) describes Episodic tension-type headache as usually being bilateral, but may be generalised or localised to the back of the head and upper neck, or to the fronto-temporal area.

Bernat and Vincent (1993) state that episodic tension-type headache is bilateral in 90% of individuals, and is usually described as band-like, dull, pressing and sometimes throbbing. It may wax and wane throughout the day but in classic cases it reaches maximum intensity toward the evening, and may sometimes awaken patients from sleep. The pain is predominantly occiputonuchal in location, and is sometimes described as piercing, occasionally radiating to the vertex of the head (frequently described as a nail being driven into the skull). Photophobia may accompany tension-type headaches. According to Diamond (1987) tinnitus, vertigo and lacrimation may also be associated with a headache episode.

#### 2.2.4 SEVERITY

According to the International Headache Society (1991:29) pain is typically mild to moderate in intensity. In Germany, 68% of Episodic tension-type headache sufferers reported the intensity of their pain to be moderate, while 10% reported severe pain and 22% reported mild pain. A study by Rasmussen (1991) found that with tension-type headache the pain was severe in 1% of cases, moderate in 58% and mild in 41% of cases. Linet et al. (1989) found that the mean intensity of headache pain in subjects in Maryland, scored on a scale from 1 to 10, increased from 4.7 to 5.1 for females. No corresponding scores were available for male subjects. In total, 25.6% of males and 32.5% of females described their mean headache intensity as 6 or greater, and 3.2% of males and 5.4% of females reported an intensity between 9-10.

#### 2.2. 5. ASSESSMENT OF DISABILITY

According to Micieli et al. (1995), headaches are a "social" phenomenon of considerable dimension whose impact is felt not only in exorbitant economic costs, but also as a reduction of indices measuring health concepts. Schwartz et al. (1997) states that headaches have a significant impact on employee absenteeism, productivity and quality of life. Although tension headaches are less likely to cause actual lost workdays, it accounts for a significant proportion of headache-associated decreased work effectiveness, which has greater cost implications (Schwartz et al. 1997).

## 2.2.6 PRECIPITANTS AND PROVOKING FACTORS

Precipitants, also called trigger factors and promoters, are factors which alone or in combination with other exogenous or endogenous-exposures, induce headache attacks in susceptible individuals (Rasmussen, 1995).

Rasmussen (1993) investigated the effects of various precipitating factors on migraine and tension-type headaches. One or more precipitants were found in 64% of the migraine group and in 88% of the tension-type group. In both headache disorders the most conspicuous precipitating factors were found to be stress and tension. In the tension-type headache group this was followed closely by smoking, alcohol and weather changes, menstruation, certain foods and sexual activity.

### a. Stress and Mental tension

Sixty-three percent of males and 77% of females in the tension-type headache group listed stress and mental tension as the main precipitating factor of their headaches. Within this group, females stated stress as a precipitating factor more frequently than men, although the difference was not statistically significant ( $p = 0.06$ ) (Rasmussen, 1993).

### b. Smoking and Alcohol consumption

Thirty-four percent of males and 38% of females suffering from tension-type headaches indicated that smoking aggravated their headaches, while 25% of males and 28% of females found alcohol consumption to be a precipitant of their headaches (Rasmussen, 1993).



c. Food

Only 5% of males and 11% of females with tension-type headache reported aggravation of the headache by foodstuff (Rasmussen, 1993). No indication is given as to the types of foodstuff that may aggravate the headache.

d. Climatic changes

Climatic changes affected 26% of males and 28% of females with tension-type headaches (Rasmussen, 1993)

e. Menstruation and Pregnancy

Thirty-nine percent of women suffering from tension-type headaches with onset before the age of 51, reported that their menstrual cycles affected the headaches. 71% stated that their headaches were most prevalent 1-2 days before their cycle, and 29% during their cycles. Forty-five percent of women indicated that more than 50% of their headache attacks were menstrual related. Among females with tension-type headache, 67% stated unchanged headaches during pregnancy, 27% disappearance or improvement and in 5% the headache worsened. Compared to tension-type headache, migraine headaches more frequently disappeared or improved during pregnancy ( $p = 0.01$ ) (Rasmussen, 1993).

f. Sexual Activity

Tension-type headache was aggravated by sexual activity in 2% of males and 3% of females (Rasmussen, 1993).

#### g. Physical activity

Tension-type headache was found to be significantly more prevalent in men who had exclusively sedentary activity. The level of activity for the study was divided into four categories viz. sedentary, moderate activity, active and heavy work/competitive sport.

33% each of males and females in the "sedentary" category reported aggravation of their headaches by activity.

14% of males and 28% of females in both the "moderate activity" and "active" categories reported that their headaches were made worse by activity.

23% of males and 40% of females in the "heavy work/competitive sport" category indicated that activity worsened their headaches (Rasmussen, 1993).

No explanation for the association between physical activity and tension-type headache was provided by the author.

#### h. Sleep Pattern

Rasmussen (1995) found that irregular sleep patterns were positively associated with tension-type headaches. Among the subjects with tension-type headaches, 24% of males ( $p \leq 0.05$ ) and 41% of females ( $p \leq 0.01$ ) experienced sleeping problems. Within this group males with tension-type headache awoke earlier in the morning and were unable to fall asleep again more frequently than males without headache ( $p \leq 0.01$ ).

Lack of refreshment, as a result of inadequate sleep, was associated more with females ( $p \leq 0.01$ ) than males in the tension-type headache group.

Among tension-type headache sufferers the usual onset of attacks occurred in 1% at night, 11% in the morning, 49% during the day, 6% in the evening, and 33% varied in onset (Rasmussen, 1995).

The literature did not reveal any information specifically on episodic tension-type headache. No explanation for the association between tension-type headache and sleep patterns was provided by the author.

## 2.3 PATHOGENESIS OF EPISODIC TENSION-TYPE HEADACHE

Although the exact etiology of Episodic tension-type headaches remain unknown, its pathogenesis is believed by most to be multifactorial, and includes muscular factors, vascular factors, psychological factors (stress, anxiety and depression) as well as cervical spine dysfunction (IHS, 1991:20). According to the International Headache Society (1991) for decades a dispute has prevailed concerning the importance of muscle contraction in the pathogenesis of the headache, but conclusive studies are still lacking. The Classification Committee of the IHS believes that the diagnostic subdivision according to the presence and absence of a muscular component will stimulate research in this regard.

### 2.4.1 Vascular factors

Barre and Lieou, as cited by Vernon et al. (1992) were the first to implicate vascular factors as a possible cause of headaches, and stated that irritation of the cervical sympathetic system was linked to circulatory disturbances, primarily as a disturbance of vasomotor tone in the distribution of the vertebral artery, thus causing headaches. No indication is given by Vernon et al. (1992) as to how Barre (1926) and Lieou (1928) arrived at this conclusion.

Bogduk, as cited by Vernon et al. (1992) held a similar belief, and noted that mechanical irritation of the vertebral artery, vertebral nerve and ascending sympathetic chain can initiate an "autonomic barrage" that is sufficient to create a cerebral vasospasm. He believed that subluxation of the cervical facet joints may compromise these structures, and that the mechanical derangement of the cervical facet and craniocervical synovial joints ultimately leads to the headache.

Bernat and Vincent (1993) state that headaches may originate from various sources within the cranium, as a result of malfunction, displacement or encroachment of pain-sensitive structures. These pain-sensitive structures are mostly vascular and include the proximal portions of the cerebral arteries, the large veins and the venous sinuses. In addition, the meninges, upper cervical nerve roots and the scalp and neck muscles may also be involved in the origin of the headache.

According to Kunkel (1991:597) early studies done on tension-type headache (Myers and McCall, 1983; Tunis and Wolff, 1954) demonstrated decreased blood flow with subsequent muscle ischemia in chronically contracted muscles. It was believed that the ischemia of muscle leads to acidosis and other metabolic changes that will cause pain. However, whether ischemia caused by chronically contracted muscles plays a significant role in the pain of tension-type headache is still uncertain.

#### 2.4.2 Psychological Factors

Among the psychological factors most commonly associated with tension-type headaches, stress and tension are reported to be the most frequent perpetuating factors of the headaches (Jensen, 1999; Rasmussen, 1995; Srikiatkachorn, 1996 and Rasmussen, 1992). According to Bernat and Vincent (1993) in 85% of patients, depression may be the cause of the headache. Kunkel (1991) states that the majority of the patients with tension-type headaches show elevated depression scores on Minnesota Multiphasic Personality Inventory (MMPI) testing and believes that depression is quite prevalent in patients with tension-type headaches.

Sternbach et al. (1980) measured MMPI patterns in three common headache disorders, and found that tension-type headache patients were more depressed than Vascular headache patients ( $p < 0.05$ ). Subjects in the tension-type headache group also showed greater elevations on scales reflecting resentment and hostility, and paranoia. Female tension-type headache subjects showed a greater propensity to deny problems in their lives, and to focus on physical symptoms, which could possibly contribute to the tension-type headaches.

Hatch et al. (1991) administered a battery of psychometric tests to a group of 47 Episodic tension-type headache subjects and 47 headache-free controls. Tests administered were the MMPI, Cook Medley Hostility scale, Anger Expression scale, State-Trait Personality Inventory, Beck Depression Inventory and the Depression Adjective Check lists. The results indicated that compared to control subjects, Episodic tension-type headache subjects showed higher levels of anxiety, depression, anger and hostility. They were more prone to feelings of resentment, mistrust, suspicion and antagonism in their interpersonal relations. In addition, Episodic tension-type headache subjects showed greater levels of suppressed anger than control subjects.

The literature review failed to find reference to psychological studies discussing the pathogenic mechanism of psychological factors in episodic tension-type headache.

### 2.4.3 Muscular factors

Although the exact etiology of episodic tension-type headache remains unknown, the IHS (1991:30) believes that involuntary tightening of muscles induced mentally or physically is an important pathogenic mechanism of the headache. For decades a dispute has prevailed concerning the importance of muscle contraction in the clinical presentation of episodic tension-type headaches, and the IHS now believes that subdividing Episodic tension-type headaches according to the presence or absence of a muscular component will stimulate further research in this regard to provide us with more insight into the role that muscular factors play in tension-type headaches.

Jensen and Rasmussen (1995) state that 66% of episodic tension-type headaches have an associated muscular component, defined as increased tenderness recorded by either manual palpation, pressure algometry and /or increased EMG levels. However they agree that more studies are needed in this area for clarification of the pathogenic importance of muscular disorders in episodic tension-type headaches.

Studies measuring pericranial muscular activity in tension-type headache subjects have found a close association between tenderness of the neck and shoulder muscles and the headache (Kim et al. 1995; Sandrini et al. 1994 and Murphy and Lehrer et al. 1990). Active myofascial trigger points have also been identified in these muscles (De Busser, 2001 and Muller, 1999) and will be discussed later in the section.

#### 2.4.3.1 Myofascial Trigger Points

##### 2.4.3.1.1 Definition

A myofascial trigger point is a hyperirritable locus within a taut band of skeletal muscle that may be located in the muscular tissue and/or its fascia. If compressed,

the spot is painful and can evoke the characteristic referred pain and autonomic phenomena. Trigger points are classified as being either active or latent. Only active trigger points cause the patient pain. Latent trigger points may also cause limitation of movement with an associated weakness of the involved muscle/s (Travell and Simons, 1983:13).

#### 2.4.3.1.2 Prevalence

Trigger points can develop in individuals of any age, in either sex, irrespective of the degree of activity of the individual. However, sedentary middle-aged women appear more prone to developing myofascial trigger points (Travell and Simons, 1983:14). No explanation for this association is given by the author.

Muller (1999) found that 97.5% of tension-type headache subjects as opposed to 82% of asymptomatic controls in his study had at least one trigger point in the muscles tested. His study revealed that most of the trigger points occurred in the posterior cervical and suboccipital muscles, leading to the conclusion that episodic tension-type headache may be associated with these muscles. Jansen (1998) also found that the posterior cervical muscles had the highest number of active trigger points compared to the trapezius, sternocleidomastoid and suboccipital muscles among tension-type headache subjects in her study. In total, 61.7% of subjects had an active posterior cervical muscle trigger point one, 62.7% had an active trigger point two, and 66.6% had an active trigger point three.

Jensen and Rasmussen (1995) found that 66% of episodic tension-type headache subjects had increased tenderness of the anterior temporal muscles when a combination of manual palpation, pressure algometry and EMG activity of the muscle was recorded.

Hyung - Suk et al. (1995) recorded the pressure pain thresholds (PPT) of 13 pairs of muscles of the head and neck region of 31 tension-type headache sufferers and 32 control subjects, and found that the PPT of the patient group were lower than those of the control group ( $p < 0.01$ ) for the superior and middle sternocleidomastoid, as well as the trapezius muscles. He concluded that the PPT of the head and neck region should be considered in the diagnosis of ETTH, and that increased pain



sensitivity of the head, and especially the neck region, may be included in the pathogenic mechanism of tension-type headache.

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#### 2.4.3.1.3 Clinical characteristics of Myofascial Trigger Points

Myofascial pain produced by active trigger points is referred in specific patterns characteristic of each muscle. The pain is rarely located at the site of the trigger point but is instead projected to a distant reference zone. The patient may complain of a pain that is dull and aching, and often deeply located. The intensity of the pain may vary from a low-grade discomfort to a severe and incapacitating torture that may be present at rest, or only on motion (Travell and Simons, 1983:14).

In addition to pain, active trigger points also produce autonomic phenomena in their pain reference zones. Localised vasoconstriction, sweating, lacrimation, coryza, salivation and pilomotor activity may occur. The patient may also experience proprioceptive disturbances as a result of active trigger point activity e.g. imbalance, dizziness, tinnitus and distorted perceptions of weights lifted in the hands (Travell and Simons, 1983:15).

#### 2.4.3.1.4 Development of Myofascial Trigger Points

The previous section discussed the association between active myofascial trigger points and episodic tension-type headaches.

The pain associated with myofascial trigger points is aggravated or perpetuated by factors that affect or stress the muscle containing the trigger point (Graff-Radford et al. 1987). Active trigger points may develop directly by acute overload stress of a muscle, overwork fatigue of a muscle, direct trauma or exposure of a muscle to cold. Indirectly, trigger points may be activated if they lie in the pain reference zone of other trigger points, by diseased viscera, arthritic joints or emotional stress. Sudden unaccustomed shortening of a muscle, or one that is left in the shortened position for a prolonged period of time is also sufficient to initiate development of an active trigger point, or to activate a latent trigger point (Travell and Simons, 1983:14).

Other physical stressors that may contribute to the development of trigger points include poor posture or body mechanics, skeletal asymmetry or disproportion, dental malocclusion and the use of non-ergonomically designed furniture. A sedentary lifestyle and prolonged television viewing is also associated with myofascial head and neck pain. ~~Nutritional, metabolic and endocrine inadequacies~~ may also contribute to myofascial trigger point development. Psychological perpetuating factors include depression, operant pain and mental stress. Other perpetuating factors include cold damp weather, poor sleep and fatigue (Graff-Radford et al. 1987).

#### 2.4.3.2 Biomechanical Considerations of the Cervical Spine Muscles

According to Jordan and Ostergaard (1996) the strength levels of neck muscles are approximately twice that of the trunk musculature with respect to workloads. Besides protection of the cervical spine and its vital structures, the musculature of the cervical spine can also withstand considerable mechanical stress such as that incurred with flexion of the neck and elevation of the shoulders, both common in daily living.

Because of the anterior displacement of the center of gravity of the cervical spine, muscular effort is required to maintain erect posture. A small percentage (2-3%) of extensor muscle capacity is required to maintain erect posture. Fifteen degrees of cervical spine flexion, which is extremely common at work stations, increases the muscular loads of the posterior muscles to levels greater than 20% of maximal voluntary contraction levels. As a result, intramuscular pressure in the posterior musculature may even exceed the blood pressure, resulting in muscular fatigue and pain (Jordan and Ostergaard, 1996) which may predispose the muscle to the development of myofascial trigger points (Graff-Radford et al. 1987).

According to the International Headache Society (1991: 30) the presence of pericranial muscular disorder in tension-type headache should be evaluated using one of the following methods: EMG, pressure algometry or manual palpation. Various studies measuring pericranial muscular activity of the head and neck muscles of tension-type headache subjects compared to control subjects have showed a positive association between muscle tenderness and the headache (Kim et al. 1995; Mennell, 1989; Graff-Radford, 1987; Jensen et al. 1998; Jensen and Rasmussen, 1995; Sandrini et al. 1994; Hubbard et al. 1993; Lacroix and Corbett, 1990).

Kim et al. (1995) assessed the pain pressure thresholds of the head and neck region of 31 female episodic tension-type headache subjects and 32 control subjects to determine if tender muscles contributed to episodic tension-type headaches. The results indicated that the pressure pain thresholds, recorded using an algometer, ~~were significantly lower in episodic tension-type headache sufferers than in the~~ control subjects at three cervical sites ( $p < 0.01$ ). Kim et al. (1995) concluded that decreased pressure pain thresholds of pericranial muscles in the neck is related to episodic tension-type headache, and that increased pain sensitivity of the head, and especially the neck region, may be included in the pathogenic mechanism in episodic tension-type headache.

Jensen et al. (1998) investigated the importance of muscular factors in tension-type headaches by examining the pain perception in tension-type headaches associated with and without a muscular component, and healthy headache-free control subjects. Pericranial myofascial tenderness was evaluated by manual palpation of nine unspecified pairs of muscles, and the total tenderness score was recorded. Subjects with a total tenderness score above 9 were classified as having an associated muscular component, and subjects with a total tenderness score of 9 and below were classified as not having an associated muscular component to the headaches. The results indicated the episodic tension-type headache associated with a disorder of pericranial muscles had significantly higher total tenderness scores at 15.3 compared to 4.3 in those without such an association ( $p < 0.0001$ ), indicating a positive association between the tender muscles and the headache.

Sandrini et al. (1994) evaluated 15 episodic tension-type headache individuals using pressure algometry, EMG and manual palpation applied to the frontalis and trapezius muscles bilaterally. Tenderness, as a result of manual palpation, was assessed according to a 4 - point scale: 0 = no pain, 1 = report of tenderness without visible reaction, 2 = report of painful tenderness and visible reaction, 3 = report of severe pain and marked reaction. The results showed that pressure pain thresholds were significantly reduced in episodic tension-type headache patients as compared to controls ( $p < 0.05$ ). The mean values obtained with manual palpation of the trapezius muscles bilaterally showed that the trapezius muscles were significantly more tender in episodic and chronic tension-type headaches, than in headache-free control subjects ( $p < 0.05$  and  $p < 0.005$  respectively), further supporting the association of muscle tenderness with tension-type headaches.

Jensen and Rasmussen (1995) carried out a similar study in a random sample population of 735 adult tension-type headache sufferers, comparing EMG, pressure algometry and manual palpation to evaluate the diagnostic criteria for muscular disorders in tension-type headache. The results indicated that 66% of episodic tension-type headache sufferers had an associated muscular component of the upper and middle sternocleidomastoid, and trapezius muscles, when assessed by all three methods.

Hubbard and Berkoff (1993) assessed myofascial trigger point activity with needle EMG in tension-type headache, fibromyalgia and normal subjects with no history of headache or pain. A comparison of the three groups showed that the mean EMG amplitudes for the tension-type headache group was significantly higher than for the headache-free control group (46.21 vs. 7.53 respectively). In addition, mean EMG amplitudes for active trigger points within the tension-type headache group were significantly higher than mean EMG amplitudes for adjacent non-tender muscles (46.21 vs. 6.28 respectively). No p-values were available. This study confirms that tension-type headaches are associated with a higher incidence of active myofascial trigger points than headache-free groups.

Jansen (1998) found that in comparison to the trapezius, suboccipitals and sternocleidomastoid muscles, the posterior cervical muscles had the highest incidence of active trigger points in Episodic tension-type headaches. In total, 61.7% of subjects has an active posterior cervical muscle trigger point one, 62.7% had an active posterior cervical muscle trigger point two while 66.6% had an active posterior cervical muscle trigger point three.

Muller (1999) compared the prevalence of cervical spine dysfunction among tension-type headache subjects compared to non-headache subjects and found that 97.5% of the headache group had at least one trigger point in one of the four muscles tested, as opposed to 82% of asymptomatic controls. His study revealed that 79% of the headache group had active Posterior Cervical trigger points, and concluded that tension-type headache may be associated with these trigger points ( $p < 0.000001$ ).

### 2.4.3.3 The Posterior Cervical Musculature

The muscles at the back of the neck lie in four layers of increasing depth. The first layer constitutes the trapezius muscle, the second layer constitutes the splenius capitis and cervicis, the third layer constitutes the semispinalis capitis, semispinalis cervicis and longissimus capitis, and the fourth layer constitutes the multifidus, rotatores and the small suboccipital muscles (Travell and Simons, 1983:305).

The semispinalis capitis, semispinalis cervicis and the multifidi collectively form the Posterior Cervical muscles, which extends from the occiput to the level of the 6<sup>th</sup> or 7<sup>th</sup> thoracic vertebrae. The semispinalis capitis muscle overlies the semispinalis cervicis, both of which attach inferiorly to the transverse processes of the first six or seven thoracic vertebrae. The semispinalis capitis also attaches to the transverse processes of the third to sixth cervical vertebrae, and often has a tendinous inscription that runs across the muscle opposite the sixth cervical vertebra.

Superiorly the semispinalis capitis muscle attaches to the occiput between the superior and inferior nuchal lines. The semispinalis cervicis attaches to the spinous processes of the second to fifth cervical vertebrae.

The cervical multifidi are short muscles that traverse two to four vertebrae. Superiorly they attach to the transverse processes of the second to fifth cervical vertebrae. Inferiorly they attach to the articular processes of the last four cervical vertebrae (C4 – C7) (Travell and Simons, 1983:307).

The semispinalis capitis is innervated by branches of the posterior primary divisions of the first four of five cervical nerves. The semispinalis cervicis and other deeper lying muscles are innervated by the posterior primary divisions of the third to sixth cervical nerves (Travell and Simons, 1983:309).

According to Travell and Simons (1983:309) the semispinalis capitis extends the neck and inclines it to the same side. The semispinalis cervicis extends the neck, rotates it to the opposite side and produces lateral flexion of the spine. The multifidi muscles contribute to extension of the spine, lateral flexion of the spine to the same side and rotation of the spine to the opposite side.

The posterior cervical muscles contain three trigger points (TP's). Trigger point one (TP1) is located above the base of the neck at the C4 - C5 level and refers pain to the suboccipital region, and sometimes down the neck to the upper vertebral border

of the scapula. TP2 lies 2 – 4cm below the occiput and refers pain over the occiput toward the vertex. TP3 is located lightly below the occipital ridge and refers pain forward like a band that half encircles the head and reaches it's maximum intensity in the temple and forehead over the eye (Travell and Simons, 1983:306). Some overlap therefore exists between the referral-pain-pattern of the posterior cervical muscles as described by Travell and Simons (1983:306) and that of Episodic tension-type headache as described by Bates (1995:62) and the IHS (1991:29).

#### 2.4.4 Cervical Spine Dysfunction in Episodic tension-type headache

Gatterman (1995:11) defines the term "subluxation" as a "motion segment in which alignment, movement, integrity and/or physiological function are altered although contact between joint surfaces remains intact." A "fixation" is defined as "the state whereby articulation has become temporarily immobilized in a position that it may normally occupy during any phase of physiological movement, or immobilization of an articulation in a position of movement when the joint is at rest, or in a position of rest when the joint is in movement" (Gatterman, 1990:408).

Gatterman (1990:210) states that the effective functioning of the neck muscles depends on the alignment of the cervical spine. Vernon *et al.* (1992) supports this and states that altered function of the cervical spine components including skeletal, arthrokinetic and myofascial structures may contribute to the tension-type headache.

Muller (1999) found that 97.5% of subjects in his experiment group had at least one cervical spine fixation. Penter (1994) found that over 90% of episodic tension-type headache subjects in his experiment and control groups had cervical spine fixations, most frequently at C2 – C3 levels. Jansen (1998) found that 93.9% of the experiment group and 94.1% of the control group in her study had fixated cervical spine segments, indicating that cervical spine fixations are very prevalent in tension-type headache subjects.

Kidson (2001) found that the most commonly fixated cervical level in his experiment and control groups was C7, followed in descending order by C1, C0, C3, C6, C2, C5 and C4. Thomson (1999) found the most commonly fixated level in her study to be C2, followed by C1 and C3. Fixations at C0 and C3 were also noted, with very few fixations at C5, C6 and C7. De Busser (2001) indicated that C1 was the most

frequently fixated spinal level in her study, followed by C2, and then C4 in group A and C3 in group B. This indicates that upper cervical spine fixations are more commonly associated with episodic tension-type headaches.

Bogduk (1992) states that joint dysfunction affecting the upper cervical synovial joints may play a role in the source of headache. He states that the pathological nature of the joint dysfunction is unknown, but the role of these joints in headache is strongly implicated by the presence of abnormal palpatory and motion findings, as well as the relief of the headache upon anesthetization, by injection, of the responsible joint/s. No further explanation was provided by the author on how cervical synovial joint dysfunction causes headaches.

## 2.5 THERAPEUTIC INTERVENTIONS

### 2.5.1 CHIROPRACTIC

Vernon (1982) conducted a prospective study of thirty-three tension-type headache sufferers. Following nine manipulations the average headache frequency dropped from 13 to 3 per month, the average severity decreased from 3.5 out of a score of 5, to 2.5, and the duration of headaches decreased by 10 hours from 12 to 2 hours ( $p < 0.005$  for duration,  $p < .01$  for intensity and frequency).

Mootz et al. (1994) treated eleven chronic and episodic tension-type headache sufferers with spinal manipulative therapy, myofascial trigger point therapy and moist heat packs for eight weeks (sixteen interventions). Myofascial trigger point therapy was in the form of ischemic compression to tight cervical and thoracic musculature, and was considered preparatory to adjusting in order to relax the muscles and assist the patient to relax during manipulation. The mean pre-treatment to post-treatment headache frequency changed from 6.4 episodes per two-week period to 3.1, a statistically significant change ( $p < 0.01$ ). These findings indicate that spinal manipulative therapy in combination with trigger point therapy is beneficial in the treatment of Episodic tension-type headache.

Bove and Nilsson (1998) conducted a randomized trial of seventy-five adult episodic tension-type headache sufferers comparing soft tissue therapy of the trapezius

muscle and spinal manipulation (treatment group), with soft tissue therapy and placebo laser (control group). Both groups showed a reduction in daily headache hours and analgesic intake ( $p = 0.66$  and  $p = 0.87$  respectively) leading to the conclusion that as an isolated intervention, spinal manipulative therapy does not seem to have an effect in the treatment of episodic tension-type headache with a muscular component. The results also indicate that soft tissue therapy by itself is beneficial in the short-term treatment of episodic tension-type headache.

Similar findings have been documented by Penter (1994) and De Busser (2001). Penter (1994) compared soft tissue therapy (10 minutes of massage) and spinal manipulative therapy of the cervical and upper thoracic spines, to spinal manipulative therapy only of the same regions, and found that both groups responded equally well to the interventions. He concluded that soft tissue therapy could be an effective short-term treatment for episodic tension-type headaches.

De Busser (2001) performed that same study in children and adolescents with episodic tension-type headaches and concluded that spinal manipulation of the cervical and upper thoracic musculature was not found to be more effective than soft tissue therapy alone in the management of episodic tension-type headaches, indicating that soft tissue therapy by itself is beneficial in the treatment of episodic tension-type headache.

It may be possible, based on the classification of episodic tension-type headache by the IHS (1991:29) and the belief that its pathogenesis may be multi-factorial, that Episodic tension-type headache unassociated with a muscular component responds favourably to spinal manipulative therapy alone, while Episodic tension-type headache associated with a muscular component does not respond to spinal manipulative therapy alone.

#### 2.5.1.1 Indications for Spinal Manipulative Therapy

Gatterman (1990:51) states that the primary indication for manipulation is a joint fixation, or blockage, which is defined as a reversible mechanical derangement of the facet joint, causing limitation in normal movement. The term "adjustment" is used to describe a chiropractic manipulation, and consists of a short-lever, specific, high-velocity, low-amplitude, controlled forceful thrust aimed at individual articulations



(Gatterman, 1995:12).

Schafer and Faye (1990:40) cite the following as indications for spinal manipulative therapy:

- Increasing spinal mobility
- Freeing entrapped or stretched nerves
- Returning intervertebral discs and foramina to their normal boundaries
- Extend shortened tendons and ligaments
- Break adhesions

#### 2.5.1.2 Contra-indications to Spinal Manipulative Therapy

Gatterman (1990) cites the following as contra-indications to Spinal Manipulative Therapy:

- Tumors (lung, thyroid, breast, bone...)
- Aneurysm
- Vertebro-basilar artery insufficiency (VBAI's)
- Atherosclerosis of the major blood vessels
- Bone infections (Tuberculosis, Osteomyelitis)
- Traumatic injuries (fractures, severe sprains or strains, instability or hypermobility, unstable spondylolisthesis)
- Arthritis (Rheumatoid, Ankylosing Spondylitis, Psoriatic Arthritis, severe Osteoporosis, Uncoarthritis)
- Metabolic disorders (Osteoporosis, Osteomalacia, clotting disorders)
- Neurologic complications (Disc lesions with advancing neurological deficits, space occupying lesions)

#### 2.5.2 INTERFERENTIAL CURRENT THERAPY

Gatterman (1990:250) states that manipulation combined with other manual therapies is the preferred chiropractic treatment of episodic tension-type headache.

Among the electrotherapies available for the treatment of myofascial trigger points, Interferential Current is an accepted method of treating myofascial trigger points (Gatterman, 1990:353)

The development of Interferential Current therapy in the early 1950's overcame many of the difficulties experienced previously with transcutaneous electrical stimulation. Previously used direct and low-frequency alternating currents encountered high electrical resistance in the outer layers of the skin, making treatment of the deep structures painful. Alternating currents of medium or high frequency met little resistance and penetrated the tissues easily but oscillated too rapidly to stimulate the tissues directly. Interferential Current utilizes two alternating currents of slightly differing medium frequencies that creates a resultant "beat frequency" where they coincide, allowing maximum current to pass into the tissues whilst reducing unwanted stimulation of cutaneous nerves to a minimum (Goats, 1990). The two alternating currents differ in frequency by 0 – 100 Hz, causing either analgesia, muscle contraction, reduction of bruising/swelling or healing in the tissues it stimulates. Analgesia is produced in the 90 – 100 Hz range. At this frequency type C pain fibers are stimulated which produce a longer lasting analgesia than the larger type A sensory fibers (Gatterman 1990:353 and Goats, 1990).

Hogenkamp *et al.* (1987: 18) states that Interferential current enables stimulation of selectively myelinated afferent (thick) nerve fibers resulting in a reduction of pain and improvement of the circulation. Stimulation of the thick nerve fibers has an inhibiting or blocking effect on the activity of thin afferent nerve fibers, and consequently the pain perception is diminished or not felt at all. Hogenkamp *et al.* (1987:18) also states that Interferential current is beneficial in the treatment of pain-points or trigger points, as well as muscular disorders where the purpose of therapy is to tone the muscles, improve the circulation, strengthen or relax the muscles.

Christie (1995) conducted a controlled study on 30 patients with myofascial trigger points of the trapezius, levator scapulae, rhomboid major and minor, supraspinatus and infraspinatus muscles to determine whether Interferential current could be considered a non-invasive alternative to dry needling. Subjects received Interferential current via the pen electrode for 5 treatments over two weeks. Results showed a statistically significant difference in pain measurements ( $p < 0.05$ ) between the both groups, leading to the conclusion that Interferential current pen electrode is an effective and viable alternative treatment to dry needling for active trigger points.

### 2.5.2.1 Indications for Interferential Current Therapy

As stated earlier, Interferential current therapy is indicated where the desired effect of therapy is to induce analgesia, elicit muscle contraction, modify the activity of the autonomic nervous system, promote healing and reduce edema (Goats, 1990:87).

### 2.5.2.2 Contra-indications to Interferential Current Therapy

Contra-indications to Interferential Current therapy as outlined by Goats (1990:87) include:

- Thrombosis
- Pacemaker patients
- Any cardiac conditions
- Bacterial infections
- Malignancy
- In close proximity to an operation
- Fever
- Pregnancy
- Where hemorrhage may be a possibility e.g. following a stroke or an acute injury.

### 2.5.3. PHARMACOLOGICAL TREATMENT

Knowledge about the use of analgesics among headache sufferers is poor, and is based mainly on headache prone populations. It is suspected that 16% of all tension-type headache sufferers have visited a general practitioner, while 4% have visited a specialist, and only 13% have managed without any type of medication for their headaches (Rasmussen, 1995). The most commonly used analgesics were acetylsalicylic acid preparations and paracetamol (Rasmussen, 1995). According to Kim et al. (1995) 30 million pounds of aspirin is consumed annually, most of which is for the relief of headaches.

Pini et al. (1996) states that headaches are frequently associated with the daily use of non-prescription "pain-killer" drugs, and the low efficacy of single preparations also leads physicians to prescribe combination analgesic drugs. After a variable period of time the dosage of compounds is gradually increased until drug dependence and analgesic-induced headache results. Schneider et al. (1993) support this and state that by this stage regular intake of analgesics and ergotamines becomes a way of life, and the patient's original headache is not cured, but worsened.

Schneider et al. (1993) studied the use and abuse of analgesics among eighty tension-type headache subjects for a period of 21 years. He found that patients took an average of 6.3 different drugs for the relief of the headache, and patients who rated their drugs as "moderately effective" often took greater dosages in the hope that the efficacy of the drugs will increase. Schneider et al. (1993) also found it difficult to explain why drugs with no known lasting effects on tension-type headaches e.g. ergot alkaloids and calcium channel blockers were prescribed 43% and 31% of the time. Furthermore, drugs with a considerable potential for addiction such as minor tranquilisers, barbiturates and narcotic analgesics were prescribed 33%, 23% and 15% of the time respectively. The most often used drugs acetaminophen (81%), propyphenazone (79%) and acetylsalicylic acid (66%) were taken primarily as components of compound tablets, often in combination with caffeine (43%). Since chronic caffeine abuse can lead to anxiety, restlessness, insomnia and autonomic dysfunctions, minor tranquilisers are then brought in to counteract these secondary effects (Schneider et al. 1993).

No method of treatment for tension-type headache can be successful in the presence of analgesic abuse. Drug-addicted patients must first be successfully withdrawn before their tension-type headache can be effectively managed (Pini et al. 1996 and Schneider et al. 1993).

## 2.5.4 MISCELLANEOUS TREATMENTS

### 2.5.4.1 Traction

Donkin (1998) investigated the effect of manual traction combined with spinal manipulative therapy of the cervical spine in tension-type headache subjects and

concluded that manual traction did not enhance the effect of the cervical manipulation, and appears to have limited value in the treatment of tension-type headache ( $p > 0.025$ ).

#### 2.5.4.2 Massage

Gatterman (1190:250) advocates massage as one of the treatment options for tension-type headaches. Penter (1994) demonstrated that massage could be an effective short-term therapy for tension-type headache sufferers. He compared the effects of a ten-minute massage to the trapezius muscles and spinal manipulative therapy of the cervical spine, to massage alone and found that both groups experienced a reduction in headache pain, frequency and duration.

#### 2.5.4.3 Relaxation Techniques

Relaxation techniques are based on learning techniques to reach a psycho-physical state of complete muscular and mental relaxation. This state is characterized by important autonomic modifications such as vasodilation, decreased heart rate, blood pressure and respiratory rates, and other physiological responses (Bondi et al. 1994).

#### 2.5.4.4. Myofascial Trigger Point Therapy

In addition to Interferential current therapy, trigger point injections, spray and stretch, ischemic compression, dry needling, ultrasound, massage, moist/dry heat, drug therapy and biofeedback have also been used in the treatment of myofascial trigger points (Travell and Simons, 1983:86).

## 2.6 CONCLUSION

From the above review of the related literature, it is clearly evident that Episodic tension-type headaches may have more than one causative or contributing factor. It is also evident that muscular factors are closely associated with Episodic tension-type headache. This study aimed to investigate the role that muscular factors play in the clinical presentation of the headache by treating the active myofascial trigger points of the posterior cervical muscles to determine the effect it has on the headache.

## **CHAPTER THREE**

### **3.1 INTRODUCTION**

This chapter will concern itself with the specific method followed in the experimental procedure.

### **3.2 MATERIALS AND METHODS**

#### **3.2.1 The Data**

The Data required for this study consists of both Primary and Secondary Data.

##### **3.2.1.1 The Primary Data**

The primary data was obtained from a standardized case history, physical examination and cervical regional examination according to the Durban Institute of Technology Chiropractic Day Clinic forms (Appendix A, B and C), as well as from subjective measures (NRS 101 and headache diary), an objective measure (myofascial diagnostics scale) and pressure pain thresholds (using an algometer).

##### **3.2.1.2 The Secondary Data**

The secondary data required to document and explain the primary data by means of statistical analysis was obtained from books, journals and periodicals.

### 3.3 STUDY DESIGN AND PROTOCOL

#### 3.3.1 The Study Design

The study was a randomized, controlled trial investigating the effectiveness of three (3) manual interventions applied to the Posterior Cervical musculature in the treatment of Episodic Tension type Headaches in Adults.

#### 3.3.2 Sampling and Allocation of Subjects

The study was limited to patients from the province of KwaZulu-Natal only. Candidates were recruited by means of advertisements placed on various notice boards around campus, by means of e-mails to Durban Institute of Technology staff and a few independent companies, from pamphlets that were distributed to houses in the vicinity of the Durban Institute of Technology and in various newspapers in circulation in the greater Durban area.

All patients who responded to the advertisements were screened by telephonic interview by the researcher, using the following questions:

1. What is your age?
2. How often do you get headaches?
3. How long do the headaches last?
4. How would you describe the headache?
5. Do you often:
  - Feel nauseous or vomit when you have a headache?
  - Have a severe aversion to light or to sound?
6. Do you have any other severe illnesses or disorders?



The purpose of these questions were to ensure that patients fulfilled the criteria for episodic tension-type headaches, before they were called in for an initial consultation.

### 3.3.3 Inclusion and Exclusion Criteria of Subjects

#### 3.3.3.1 Inclusion criteria:

Volunteers between the ages of 18 - 65 who fulfilled the specific diagnostic criteria for Episodic Tension type Headache (ETTH) as outlined by the International Headache Society (IHS, 1991:29) were considered for the study. The IHS criteria for ETTH is as follows:

- A. At least ten previous headache episodes fulfilling criteria B-D listed below.  
Number of days with such a headache fewer than 180 per year (fewer than 15 per month.)
- B. Headache lasting from 30 minutes to 7 days.
- C. At least 2 of the following pain characteristics:
  - 1. pressing/tightening quality
  - 2. mild or moderate intensity (may inhibit, but does not prohibit activities)
  - 3. bilateral location
  - 4. no aggravation by walking stairs or similar routine physical activity
- D. Both of the following
  - 1. No nausea or vomiting (anorexia may occur)
  - 2. Photophobia or phonophobia are absent, or one but not the other is present.
- E. At least one of the following:

1. History and physical or neurological examinations do not suggest one of the following:
  - a. Trauma
  - b. Vascular disorders
  - c. Non-vascular intracranial disorders
  - d. Substances or their withdrawal e.g. drug abuse
  - e. Non-cephalic infection
  - f. Metabolic disorders
  - g. Disorders of the cranium, neck, eyes, nose, sinuses, teeth, mouth or other facial or cranial structures.

3.3.3.2. Exclusion criteria:

1. Patients older than 65 years were excluded from the study because phase 3 degeneration is usually present in their cervical spines (Kirkaldy Willis, 1992:111).
2. Patients with any illnesses that may have caused or aggravated the headache, or that may have affected the muscles, were also excluded from the study.  
Such illnesses or disorders included:
  - a. Any tumors
  - b. Traumatic injuries (fractures, severe sprains and strains)
  - c. Arthritis (rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis)
  - d. Neurological complications (disc lesions with associated neurological deficits)
  - e. Muscle disorders (congenital muscle disorders, muscular dystrophies, inflammatory muscle conditions, muscle infections, myopathies and neurologic disorders resulting from defects at the neuromuscular junction)
  - f. Inflammation due to bacterial action
3. Patients with contra-indications to Spinal Manipulative Therapy (SMT) were also excluded from the study. Such contra-indications (as outlined by Gatterman, 1990:55-62) included:
  - a. Osteomyelitis

- b. Tuberculosis of the spine
- c. Infectious arthritis
- d. Vertebral malignancy
- e. Spondylolisthesis
- f. Severe Osteoporosis

4. Patients with contra-indications to Interferential current therapy were also excluded from the study. Such contra-indications (as outlined by Goats, 1990:87-92) included:

- a. Thrombosis
- b. Pacemaker patients
- c. Patients with any cardiac conditions
- d. Bacterial infections
- e. Malignancy
- f. In proximity to an operation
- g. Fever
- h. Pregnancy
- i. Where hemorrhage may be a possibility e.g. following a stroke or an acute injury

#### 3.3.4 The Procedure

Sixty patients in total were accepted onto the study.

At the initial consultation all patients were required to read and sign a Letter of Information (Appendix A) and an Informed Consent form (Appendix B), which briefly outlined the nature, terms and conditions of the study. Each patient then underwent a complete Case history (Appendix C), Physical Examination (Appendix D) and a Cervical regional Examination (Appendix E).

All patients in groups A, B and C were screened for cervical spine fixations by means of motion palpation of the cervical spine as set forth by Schafer and Faye (1998:98). Motion palpation is a reliable clinical pre-and post-intervention assessment tool (Lakhani, 1999).

All patients were also assessed for active myofascial trigger points of the posterior cervical musculature as described by Travell and Simons (1983:18). The criteria for identifying myofascial trigger points is as follows:

- A history of sudden onset during or shortly following acute overload stress, or a history of gradual onset with chronic overload of the affected muscle.
- Characteristic patterns of pain that are referred from myofascial trigger points, patterns that are specific to individual muscles.
- Weakness and restriction in the stretch range of motion of the affected muscle
- A taut, palpable band in the affected muscle
- Exquisite, focal tenderness to digital pressure (the TP), in the band of taut muscle fibers
- A local twitch response elicited through snapping palpation or needling of the tender spot (the TP).
- The reproduction of the patient's pain complaint by pressure on, or needling of, the tender spot (TP).
- The elimination of symptoms by therapy directed specifically to the affected muscles.

Patients in all three groups were required to complete the Numerical Rating Scale 101. Algometer readings of all active posterior cervical myofascial trigger points were taken by the researcher, and the Myofascial Diagnostic scale was also completed by the researcher. At the end of the first consultation each patient was given a copy of the Headache Diary and explained how to record their headaches for the duration of the study.

#### 3.3.4.1 Randomization of Patients

Sixty (60) pieces of paper in total were used for this purpose, twenty each with A, B or C written on them. All 60 pieces of paper were placed in a plastic money packet. For each patient one (1) piece of paper was drawn and the patient was assigned to the group indicated by that piece of paper. The piece of paper was then discarded.

### 3.3.4.2. Interventions

#### 3.3.4.2.1 Group A.

Patients allocated to group A received Spinal manipulative therapy (SMT) to fixated cervical spine segments, as per motion palpation findings, for a total of five treatments over a two week period. All fixations were adjusted according to the principles of the diversified technique (Szaraz, 1990) at the fixated level and in the direction indicated by motion palpation. The manipulation was administered by the researcher at all visits. If more than one level was fixated then all were manipulated.

Selection of the manipulation technique was based on the direction and level of the fixation, as well as on patient built and comfort. The manipulation was performed in either the supine or seated position.

#### 3.3.4.2.2 Group B

Patients in group B received a combination of SMT to fixated cervical spine segments as per motion palpation findings, and interferential current therapy (IFC) to all active posterior cervical myofascial trigger points bilaterally.

SMT was carried out by the researcher at each visit, as per Group A.

IFC was administered using the Physiodyn M (manufactured by Physiomed - Medizintechnik GmbH, Bayreuther street, 91218 Schnaittach/Numberg, Germany) for the duration of the study.

All patients receiving IFC were thoroughly questioned at their initial consultation for possible contra-indications to IFC therapy. Prior to each treatment session, all patients were fully informed about the nature and duration of the session, and were given an opportunity to ask questions before initiation of treatment.

Duration of each treatment session was 10 minutes, as outlined by Gatterman (1990:354) during which all active myofascial trigger points of the posterior cervical

musculature was treated. Patients were treated in a prone position, or in a seated position if they requested. A pair of electrodes was placed over the Trapezius muscles bilaterally, and the pen electrode over the active trigger point to be treated. With the electrodes in place the machine was switched on and the timer set to a ten (10) minute treatment time. The frequency was slowly increased until the patient acknowledged feeling a mild tingling sensation. Thereafter the intensity of the current was gradually increased until the patient reported that a further increase would cause discomfort (Goats, 1990:88).

The procedure of IFC treatment remained the same for each patient at successive treatments, and for the duration of the study.

#### 3.3.4.2.3 Group C

Patients allocated to group C received only IFC at each visit, for the duration of the study. IFC was administered by the researcher, as explained above for group B.

#### 3.3.5 Study Limitations

Patients were asked to refrain from starting any new type/s of medication while on the study. Those that started new medication for their headaches (e.g. analgesics, NSAIDS, muscle relaxants and tranquilizers) prior to the study required a wash-out period of 3-7 days before being allowed to enter the study (Poul *et al.* 1993). However, patients who took routine medication e.g. Prozac, antidepressants etc. were allowed to continue their medication during the study.

### 3.4 MEASUREMENTS AND OBSERVATIONS

#### 3.4.1 Methods of Measurement

Subjective and Objective measurements for all three groups were recorded prior to the first, third and fifth treatments. At the end of treatment five all headache diaries were collected.

#### 3.4.2 Subjective Measurements

##### 3.4.2.1 Numerical Pain rating Scale 101

The NRS - 101 (Appendix 6) assesses the perceived level of pain intensity of the patient (Jensen et al. 1986) as a numerical value. It consists of two linear scales, each from 0 to 100, with 0 representing no pain, and 100 representing severe pain. On one scale patients are required to indicate the severity of their pain as a numerical value when it is at its worst, and on the other scale when it is at its least.

According to Jensen et al. (1986) the NRS - 101 was found to be the most practical index of measuring clinical pain intensity when compared to five other scales, in a group of 75 chronic pain patients.

##### 3.4.2.2 Headache Diary

The Headache Diary (Andrasik and Burke, 1987:353-356) used in this study was the same that was used by Donkin (1998) in a previous study on tension headaches (Appendix 7). It was validated in a study by Blanchard et al. (1981).

The diary consists of numerous grids, each of which represents one 24-hour period. The x-axis represents time in one - hour intervals, beginning at 6am on one morning

and ending at 6am the following morning. The y-axis represents Pain Intensity on a scale from 0 -100.

Patients were required to record all headaches experienced during the study in the headache diary. A separate grid was used for each day. The intensity of the headache was plotted against the time of onset of the headache, and thereafter at each hour of the headache episode until cessation. If more than one headache episode occurred in a given 24-hour period, all of the headache episodes for that period were recorded on the same grid.

The Headache diaries were collected at the fifth treatment for quantitative analysis of the patients' headache activity.

### 3.4.3 Objective Measurements

#### 3.4.3.1 The Myofascial Diagnostic Scale

The Myofascial Diagnostic Scale (Appendix 8) was developed by Chettiar (2001) to assess the extent to which patients suffer from myofascial pain syndrome. It uses four signs of a myofascial trigger point, as outlined by Travell and Simons (1983:12-16), as indicators of assessment. The four signs are:

1. focal tenderness
2. presence of a local twitch response
3. presence of a palpable taut band
4. referred pain in the zone of reference

The first indicator (focal tenderness) is sub-divided into five grades of Soft Tissue tenderness, with each grade given a score as follows:

- grade 0 - no tenderness = score 0
- grade 1 -tenderness to palpation without grimace or flinch = score 1
- grade 2 - tenderness with grimace and/or flinch to palpation = score 2
- grade 3 - tenderness with withdrawal = score 3
- grade 4 - withdrawal to non-noxious stimuli = score 4



The second and third indicators represented the presence of a palpable taut band and the presence of a local twitch response upon palpation, and were each given a score of 4.

The fourth indicator (referred pain in the zone of reference) was given a score of 5.

A total value of 9 or more was indicative of an active trigger point and was used to standardize the inclusion of patients (Chettiar 2001).

The Myofascial Diagnostic scale was used to assess all patients within the study. It was filled in by the researcher at the beginning of treatments one, three and five. However, the reliability and validity of the Myofascial Diagnostic scale has not yet been established.

#### 3.4.3.2 Algometer

Since its development by Fischer (1986) the Algometer has become a widely used tool in the assessment of Pressure Pain Threshold in myofascial trigger points. Pressure Pain Threshold is the minimum pressure required to induce pain or discomfort (Fischer, 1986). A study by Fischer (1987) investigating pressure threshold measurement for diagnosis and evaluation of treatment results of trigger points concluded that algometry is a useful method for diagnosis of trigger points, and is particularly useful in their clinical management and assessment of results.

The Algometer used in this study was the Force Dial manufactured by Wagner Instruments: P.O. Box 1217, Greenwich CT 06836, USA. The pressure range of the algometer was 11 kilograms.

Algometer readings were recorded for all patients in all three groups (Appendix 9). Readings of only active myofascial trigger points of the posterior cervical musculature were recorded at the beginning of treatments one, three and five. If an active trigger point became latent during the course of the study, no further readings for that trigger point were recorded. If a latent trigger point became active during the course of the study, algometer readings for that trigger point were recorded at the appropriate visit thereafter.

### 3.5 STATISTICAL ANALYSIS

Statistical analysis was carried out using non-parametric tests. Intergroup comparison of subjective and objective data was analysed using the Kruskal-Wallis H-test, coupled with the Dunn Procedure while intragroup comparison of subjective and objective data was analysed using the Friedman's T-test coupled with the Dunn Procedure. Visual analysis was made using bar charts and graphs.

#### 3.5.1 The Decision Rule and the Null Hypothesis

The Null Hypothesis ( $H_0$ ) states that there is no difference between the group receiving spinal manipulative therapy, the group receiving interferential current therapy and the group receiving a combination of spinal manipulative therapy and interferential current therapy. The alternative hypothesis ( $H_1$ ) states that there is a difference between the group receiving spinal manipulative therapy, the group receiving interferential current therapy and the group receiving a combination of spinal manipulative therapy and interferential current therapy.

$H_0$  : there is no difference

$H_1$  : there is a difference

The level of significance was set at  $\alpha = 0.05$ .

For a two-tailed test:

Reject  $H_0$  if  $p < \alpha$

Accept  $H_0$  if  $p > \alpha$

P was the observed significance level.

#### The Dunn Procedure

If the Null hypothesis was rejected for either the Kruskal-Wallis H-test or the Friedman's T-test, the multiple comparison Dunn procedure was applied to the tests to determine which of the medians (means) were significantly different .

### 3.5.2 Treatment of the Data

#### 3.5.2.1 Subjective data

The subjective Data was treated in the following manner:

- Headache diaries that were completed by each patient were screened to ensure that they had been completed appropriately.
- Raw data from the NRS 101 (Jensen, Karoly and Braver, 1986) was converted into a percentage and recorded separately for each group. The average of the headache intensity, frequency and duration was calculated per one week time period and recorded separately for each group.
- The data was analysed using a 95% confidence interval (5% level of significance).

#### 3.5.2.2 Objective Data

The Objective data was treated as follows:

- Myofascial Diagnostic Scale readings were recorded separately for each group.
- Algometer readings were recorded separately for each group.
- The data was analysed using a 95% confidence interval (5% level of significance).

### 3.5.3 Statistical Analysis of the Data

The Durban Institute of Technology statistician was consulted on how to statistically analyse that data obtained from this research study. Due to the sample size ( $n_1 = 20$ ,  $n_2 = 20$  and  $n_3 = 20$ ) non-parametric tests were used for analysis. Data were

transferred to a spreadsheet and statistical analysis was conducted at a 5% level of significance.

#### 3.5.4 Hypothesis Testing

The Null hypothesis for sub-problem one stated that there was no difference in patient condition between the three groups in terms of subjective clinical findings

The alternative hypothesis (H1) for sub-problem one stated that there was a difference in patient condition between the three groups in terms of subjective clinical findings.

The Null hypothesis (Ho) for sub-problem two stated that there was no difference in patient condition between the three groups in terms of objective clinical findings.

The alternative hypothesis (H1) for sub=problem two stated that there was a difference in patient condition between the three groups in terms of objective clinical findings.

## **CHAPTER FOUR**

### **RESULTS**

#### **4.1 INTRODUCTION**

The criteria governing the admissibility of the data will be discussed in this chapter, and data collected from the study will be presented in tabulated form. This will include demographic data, followed by inter-group and intra-group data obtained from the study. Each table of the inter-group data will contain the mean, standard deviation, mean ranks and p-values for the relevant data. Each table of the intra-group data will contain the mean, standard deviation, mean ranks and p-values for the relevant data. Minimum and maximum values for each of the questionnaires used will also be included in the tables. The discussion of this data will be covered in Chapter five.

#### **4.2 CRITERIA GOVERNING THE ADMISSIBILITY OF THE DATA**

Information obtained from the case history, physical examination, cervical regional examination, questionnaires and algometer readings was used as data for this study. The NRS – 101 and the headache diaries were completed by the patients, under the supervision of the researcher. The Myofascial Diagnostic Scale was completed by the researcher, and algometer readings were taken by the researcher at each visit.

The level of significance for all data was set at  $\alpha = 0.05$ . The null hypothesis was rejected if  $p < 0.05$  and accepted if  $p \geq 0.05$ .

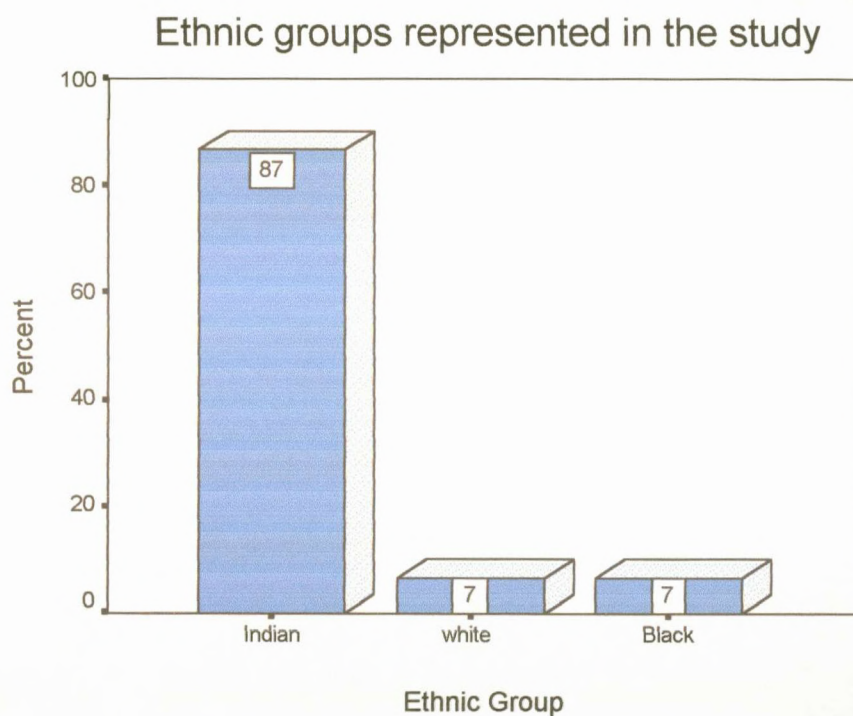
#### 4.3 ABBREVIATIONS USED IN THE TABLES

1. Durn = Duration
2. Fq = Frequency
3. Hr = hour
4. Int = Intensity
5. MFDS = Myofascial Diagnostic Scale
6. Mins = Minutes
7. Mth = Month
8. N = Number
9. NRS 101 = Numerical Rating Scale 101
10. TP = Trigger Point
11. Tx = Treatment
12. Yr = Year

## DEMOGRAPHIC DATA

### 4.4.1 ETHNIC GROUP DISTRIBUTION

Graph 1: Ethnic group distribution within a sample of 60 patients

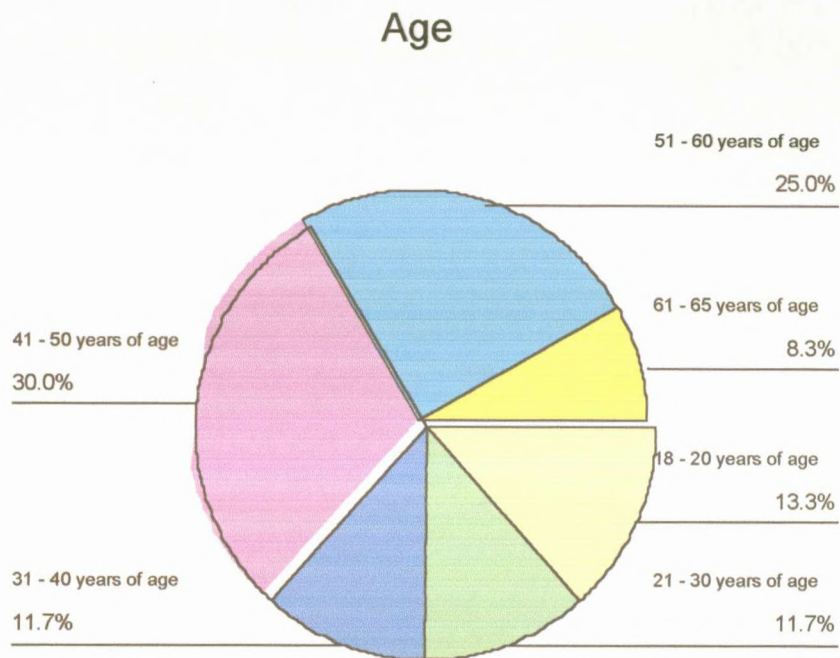


All subjects within the study fell into one of the above three ethnic groups, therefore only these ethnic groups are represented in the above graph.



4.4.2 AGE DISTRIBUTION

Graph 2: Age distribution within a sample of 60 patients



4.4.3 GENDER DISTRIBUTION

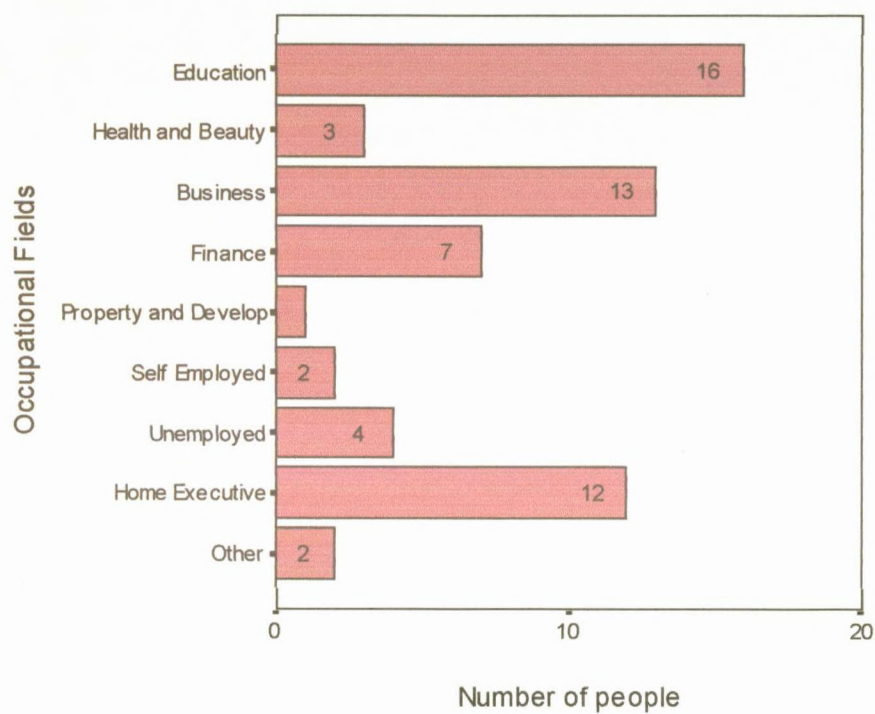
Table 1: Gender Distribution within a sample of 60 patients

	Male	Female	Total
Group A	7	13	20
Group B	9	11	20
GroupC	3	17	20
Percentage	31.66	68.33	100%



#### 4.4.4 OCCUPATIONAL DISTRIBUTION

Graph 3: Occupation Distribution within the study



#### 4.4.5 HEADACHE CHARACTERISTICS

Table 2: Headache Frequency

Frequency	Number of subjects	Percentage
1 - 2x / wk	9	15
2 - 3x / wk	27	45
3 - 4x /wk	12	20
2- 3 x / mth	2	3
3 - 4x /mth	4	6.6
4 - 5x/ mth	1	1.6
5 - 6 x /mth	1	1.6
11 - 12x /mth	2	3.3
12 - 13x /mth	1	1.6
13 - 14x / mth	1	1.6

Table 3: Headache Duration

Duration	Number of subjects	Percentage
30 mins - 1 hr	10	17
1 - 2 hrs	12	20
2 - 4 hrs	15	25
4 - 6 hrs	11	18
10 -12 hrs	1	2
> 12 hrs < 1 day	6	10
> 1 day	1	2
> 2 days	2	3
3 - 4 days	2	3

Table 4: Headache Location

Cranial Location	Number of subjects	Percentage
Occipital	41	68
Temporal	28	47
Frontal	17	28
Orbital	12	20
Vertex	9	15
Parietal	7	12
Other	2	3

Table 5: Headache Description

Description/Quality	Number of subjects	Percentage
Heaviness	39	65
Pressing	15	25
Tightness	14	23
Dull ache	5	8
Squeezing	1	2
Cramping	1	2
Constricting	5	8

Table 6: Cause of the Headache

Cause	Number of subjects	Percentage
Studying	17	28
Divorce/Marital discord	2 / 3	3% / 5%
Retrenchment/loss of job	3	5
MVA/Trauma	2 / 1	3% / 2%
Loss of Family member	2	3
Epidural	1	2
Stress	32	53
No attributable cause	5	8

Table 7: Precipitating and Provoking factors

Precipitant	Number of subjects	Percentage
Stress/Tension	52	87
Noise	36	60
Light	17	28
Head/neck mvt	10	17
Menstruation	7	12
Heat	5	8
Extremes of temperature	4	7
Meat	1	2
Lentils	1	2
Smoking	9	15
Alcohol	3	5
Insufficient sleep	1	2
Hypoglycemia	1	2
Posture	4	7
Perfume odour	2	3
Exercise	1	2
Studying	4	7

Table 8: Associated Signs and Symptoms

Sign/Symptom	Number of subjects	Percentage
Nausea	21	35
Photophobia	7	12
Phonophobia	7	12
Vertigo	3	5
Increased appetite	3	5
Reduced appetite	15	25
Blurring of vision	6	10
Clamminess of hands	2	3
Excessive perspiration	1	2

Table 9: Relief of Headache

Intervention	Number of subjects	Percentage
Medication	54	90
Sleep	24	40
Massage	25	42
Relaxation	2	3
Hot shower	21	35
Exercise	2	3
Reflexology	1	2
Ischemic compression	1	2
Ayurvedic medication	1	2

Table 10: Distribution of Active Myofascial Trigger points

Trigger Point	Number of subjects	Percentage	Trigger point	Number of subjects	Percentage
Left TP 1	11	18	Right TP 1	8	13
Left TP 2	25	42	Right TP 2	21	35
Left TP 3	48	80	Right TP 3	43	72

Table 11: Most commonly fixated Spinal levels

Cervical Spinal segment	Number of subjects	Percentage
C2	42	70
C3	33	55
C4	34	57
C5	16	27
C6	14	23
C7	6	10

## 4.5 RESULTS OF DATA ANALYSIS

### 4.5.1 INTRA - GROUP COMPARISONS

#### 4.5.1.1 SUBJECTIVE MEASURES

Table 12: Numerical Pain Rating Scale (NRS 101)

#### 12.1 Descriptive Statistics for NRS 101 - Groups A, B, C

	group	Mean	Minimum	Maximum
Numerical Rating Sclae scores at treatment 1	1	73.85	30	100
	2	80.25	50	100
	3	81.25	25	100
Numerical Rating Scale scores at treatment 3	1	35.50	0	80
	2	51.40	0	90
	3	52.05	0	90
Numerical Rating Scale scores at treatment 5	1	23.55	0	60
	2	16.40	0	80
	3	24.65	0	60

12.2 Mean Ranks for NRS 101 -Groups A, B, C

group		Mean Rank
1	Numerical Rating Sclae scores at treatment 1	2.97
	Numerical Rating Scale scores at treatment 3	1.83
	Numerical Rating Scale scores at treatment 5	1.20
2	Numerical Rating Sclae scores at treatment 1	2.83
	Numerical Rating Scale scores at treatment 3	2.03
	Numerical Rating Scale scores at treatment 5	1.15
3	Numerical Rating Sclae scores at treatment 1	2.95
	Numerical Rating Scale scores at treatment 3	1.92
	Numerical Rating Scale scores at treatment 5	1.13

Table 13: Headache Frequency - Group A

13.1 Descriptive Statistics for headache frequency - group A

	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache Intensity	6.4500	1.7313	3.00	10.00
Headache Intensity during treatment	1.9075	1.3814	.00	4.35



### 13.2 Mean Ranks for headache frequency - group A

		N	Mean Rank
Headache Intensity during treatment - Pre-treatment Headache Intensity	Negative Ranks	20 <sup>a</sup>	10.50
	Positive Ranks	0 <sup>b</sup>	.00
	Ties	0 <sup>c</sup>	
	Total	20	

- a. Headache Intensity during treatment < Pre-treatment Headache Intensity
- b. Headache Intensity during treatment > Pre-treatment Headache Intensity
- c. Pre-treatment Headache Intensity = Headache Intensity during treatment

Table 14: Headache Intensity -Group A

### 14.1 Descriptive Statistics for headache intensity - group A

	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache Intensity	6.4500	1.7313	3.00	10.00
Headache Intensity during treatment	1.9075	1.3814	.00	4.35

### 14.2 Mean Ranks for headache intensity - group A

		N	Mean Rank
Headache Intensity during treatment - Pre-treatment Headache Intensity	Negative Ranks	20 <sup>a</sup>	10.50
	Positive Ranks	0 <sup>b</sup>	.00
	Ties	0 <sup>c</sup>	
	Total	20	

- a. Headache Intensity during treatment < Pre-treatment Headache Intensity
- b. Headache Intensity during treatment > Pre-treatment Headache Intensity
- c. Pre-treatment Headache Intensity = Headache Intensity during treatment

Table 15: Headache Duration - Group A

15.1 Descriptive statistics for headache duration - group A

	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache Duration	6.5250	5.1337	.50	24.00
Headache Duration during Treatment	1.9265	1.6246	.00	4.58

15.2 Mean Ranks for headache duration - group A

		N	Mean Rank
Headache Duration during Treatment - Pre-treatment Headache Duration	Negative Ranks	19 <sup>a</sup>	10.58
	Positive Ranks	1 <sup>b</sup>	9.00
	Ties	0 <sup>c</sup>	
	Total	20	

- a. Headache Duration during Treatment < Pre-treatment Headache Duration
- b. Headache Duration during Treatment > Pre-treatment Headache Duration
- c. Pre-treatment Headache Duration = Headache Duration during Treatment

Table 16: Headache Frequency - Group B

16.1 Descriptive statistics for headache frequency - group B

	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache Frequency	2.7500	.7164	1.00	4.00
Headache Frequency during treatment	1.7250	1.2822	.00	4.50

## 16.2 Mean Ranks for headache frequency - group B

		N	Mean Rank
Headache Frequency during treatment - Pre-treatment Headache Frequency	Negative Ranks	16 <sup>a</sup>	9.59
	Positive Ranks	2 <sup>b</sup>	8.75
	Ties	2 <sup>c</sup>	
	Total	20	

- a. Headache Frequency during treatment < Pre-treatment Headache Frequency
- b. Headache Frequency during treatment > Pre-treatment Headache Frequency
- c. Pre-treatment Headache Frequency = Headache Frequency during treatment

Table 17: Headache Intensity -Group B

## 17.1 Descriptive statistics for headache intensity - group B

	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache Intensity	7.2000	1.9084	3.00	10.00
Headache Intensity during Treatment	2.2165	1.2999	.00	5.00

## 17.2 Mean Ranks for headache intensity - group B

		N	Mean Rank
Headache Intensity during Treatment - Pre-treatment Headache Intensity	Negative Ranks	20 <sup>a</sup>	10.50
	Positive Ranks	0 <sup>b</sup>	.00
	Ties	0 <sup>c</sup>	
	Total	20	

- a. Headache Intensity during Treatment < Pre-treatment Headache Intensity
- b. Headache Intensity during Treatment > Pre-treatment Headache Intensity
- c. Pre-treatment Headache Intensity = Headache Intensity during Treatment

Table 18: Headache Duration - Group B

18.1 Descriptive statistics for headache duration - group B

	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache Duration	7.7000	7.7957	.50	24.00
Headache Duration during treatment	2.2240	2.0198	.00	8.00

18.2 Mean Ranks for headache duration - group B

		N	Mean Rank
Headache Duration during treatment -	Negative Ranks	17 <sup>a</sup>	11.09
Pre-treatment	Positive Ranks	3 <sup>b</sup>	7.17
Headache Duration	Ties	0 <sup>c</sup>	
	Total	20	

- a. Headache Duration during treatment < Pre-treatment  
Headache Duration
- b. Headache Duration during treatment > Pre-treatment  
Headache Duration
- c. Pre-treatment Headache Duration = Headache Duration  
during treatment

Table 19: Headache frequency - Group C

19.1 Descriptive statistics for headache frequency - group C

	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache Frequency	2.6000	.5982	1.00	3.00
Headache Frequency during treatment	1.9500	1.8274	.00	7.00

## 19.2 Mean ranks for headache frequency - group C

			Mean Rank
Headache Frequency during treatment - Pre-treatment Headache Frequency	Negative Ranks	12 <sup>a</sup>	6.54
	Positive Ranks	2 <sup>b</sup>	13.25
	Ties	6 <sup>c</sup>	
	Total	20	

- a. Headache Frequency during treatment < Pre-treatment Headache Frequency
- b. Headache Frequency during treatment > Pre-treatment Headache Frequency
- c. Pre-treatment Headache Frequency = Headache Frequency during treatment

Table 20: Headache Intensity - Group C

## 20.1 Descriptive statistics for headache intensity - group C

	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache Intensity	8.0000	2.2711	2.00	10.00
Headache Intensity during Treatment	2.1610	1.3275	.00	5.00

## 20.2 Mean Ranks for headache intensity - group C

		N	Mean Rank
Headache Intensity during Treatment - Pre-treatment Headache Intensity	Negative Ranks	20 <sup>a</sup>	10.50
	Positive Ranks	0 <sup>b</sup>	.00
	Ties	0 <sup>c</sup>	
	Total	20	

- a. Headache Intensity during Treatment < Pre-treatment Headache Intensity
- b. Headache Intensity during Treatment > Pre-treatment Headache Intensity
- c. Pre-treatment Headache Intensity = Headache Intensity during Treatment

Table 21: Headache Duration - Group C

21.1 Descriptive statistics for headache duration - group C

	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache Duration	8.6750	10.9006	.50	48.00
Headache Duration during treatment	2.3055	2.6226	.00	8.00

21.1 Mean Ranks for headache duration - group C

		N	Mean Rank
Headache Duration during treatment -	Negative Ranks	16 <sup>a</sup>	11.81
Pre-treatment	Positive Ranks	4 <sup>b</sup>	5.25
Headache Duration	Ties	0 <sup>c</sup>	
	Total	20	

- a. Headache Duration during treatment < Pre-treatment  
Headache Duration
- b. Headache Duration during treatment > Pre-treatment  
Headache Duration
- c. Pre-treatment Headache Duration = Headache Duration  
during treatment

4.5.1.2 OBJECTIVE MEASURES

Table 22: Myofascial Diagnostics Scale scores - Group A

22.1 Descriptive statistics for MFDS scores - group A

	Mean	Std. Deviation	Minimum	Maximum
Myofascial diagnostic scale scores at treatment 1	10.85	.81	10	12
Myofascial diagnostic scale scores at treatment 3	9.80	2.12	1	11
myofascial diagnostic scale scores at treatment 5	9.00	2.41	1	11

## 22.2 Mean Ranks for MFDS scores - group A

### Ranks

	Mean Rank
Myofascial diagnostic scale scores at treatment 1	2.60
Myofascial diagnostic scale scores at treatment 3	1.88
myofascial diagnostic scale scores at treatment 5	1.52

Table 23: Myofsascial Diagnostic scale scores - Group B

## 23.1 Descriptive statistics for MFDS scores - group B

	Mean	Std. Deviation	Minimum	Maximum
Myofascial diagnostic scale scores at treatment 1	11.15	.67	10	12
Myofascial diagnostic scale scores at treatment 3	8.75	2.36	5	12
myofascial diagnostic scale scores at treatment 5	4.60	4.28	1	10

23.2 Mean Ranks for MFDS scores - group B

Ranks	
	Mean Rank
Myofascial diagnostic scale scores at treatment 1	2.92
Myofascial diagnostic scale scores at treatment 3	1.90
myofascial diagnostic scale scores at treatment 5	1.17

Table 24: Myofascial Diagnostic Scale scores - Group C

24.1 Descriptive statistics for MFDS scores - group C

	Mean	Std. Deviation	Minimum	Maximum
Myofascial diagnostic scale scores at treatment 1	11.20	.70	10	12
Myofascial diagnostic scale scores at treatment 3	8.60	3.36	1	11
myofascial diagnostic scale scores at treatment 5	5.75	4.45	1	10



24.2 Mean Ranks for MFDS scores - group C

	Mean Rank
Myofascial diagnostic scale scores at treatment 1	2.90
Myofascial diagnostic scale scores at treatment 3	1.83
myofascial diagnostic scale scores at treatment 5	1.27

Table 25: Algometer Readings - Group A

25.1 Descriptive statistics for algometer readings - group A

	Mean	Std. Deviation	Minimum	Maximum
Algometer Reading at tx 1	1.3613	.1973	1.10	1.80
Algometer Reading at tx 3	1.5175	.2548	1.00	2.00
Algometer Readings at tx 5	1.6450	.2514	1.35	2.30

2

5.2 Mean Ranks for Algometer readings - group A

**Ranks**

	Mean Rank
Algometer Reading at tx 1	1.16
Algometer Reading at tx 3	1.96
Algometer Readings at tx 5	2.88

Table 26: Algometer readings - Group B

26.1 Descriptive statistics for Algometer readings - group B

	Mean	Std. Deviation	Minimum	Maximum
Algometer Reading at tx 1	1.2486	.2354	1.00	1.80
Algometer Reading at tx 3	1.4786	.2359	1.00	1.80
Algometer Readings at tx 5	1.6750	.3056	1.30	2.30

26.2 Mean Ranks for Algometer readings - group B

	Mean Rank
Algometer Reading at tx 1	1.07
Algometer Reading at tx 3	2.04
Algometer Readings at tx 5	2.89

Table 27: Algometer Readings - Group C

27.1 Descriptive statistics for Algometer readings - group C

	Mean	Std. Deviation	Minimum	Maximum
Algometer Reading at tx 1	1.2800	.2426	1.00	1.90
Algometer Reading at tx 3	1.4600	.2414	1.00	2.10
Algometer Readings at tx 5	1.6733	.2764	1.10	2.30

27.2 Mean Ranks for Algometer readings - group C

	Mean Rank
Algometer Reading at tx 1	1.10
Algometer Reading at tx 3	1.93
Algometer Readings at tx 5	2.97

4.5.2 INTER - GROUP COMPARISONS

4.5.2.1 SUBJECTIVE DATA

Table 28: Numerical Pain Rating scale (NRS 101)

28.1 Descriptive statistics for NRS 101 - Groups A, B, C

	N	Mean	Std. Deviation	Minimum	Maximum
Numerical Rating Scale scores at treatment 1	60	78.45	18.35	25	100
Numerical Rating Scale scores at treatment 3	60	46.32	27.27	0	90
Numerical Rating Scale scores at treatment 5	60	21.53	21.65	0	80
group	60	2.00	.82	1	3

## 28.2 Mean Ranks for NRS 101 - groups A, B, C

	group	N	Mean Rank
Numerical Rating Scale scores at treatment 1	1	20	25.38
	2	20	31.25
	3	20	34.88
	Total	60	
Numerical Rating Scale scores at treatment 3	1	20	23.30
	2	20	33.53
	3	20	34.67
	Total	60	
Numerical Rating Scale scores at treatment 5	1	20	32.72
	2	20	25.15
	3	20	33.63
	Total	60	

Table 29: Headache Characteristics - Group A

## 29.1 Descriptive statistics - group A

	N	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache frequency	20	2.2500	.7864	1.00	3.00
Pre-treatment Headache Intensity	20	6.4500	1.7313	3.00	10.00
Pre-treatment Headache Duration	20	6.5250	5.1337	.50	24.00
Headache Frequency during Treatment	20	1.5400	1.5779	.00	5.50
Headache Intensity during treatment	20	1.9075	1.3814	.00	4.35
Headache Duration during Treatment	20	1.9265	1.6246	.00	4.58

## 29.2 Mean Ranks - group A

		N	Mean Rank	Sum of Ranks
Headache Frequency during Treatment - Pre-treatment Headache frequency	Negative Ranks	14 <sup>a</sup>	9.64	135.00
	Positive Ranks	4 <sup>b</sup>	9.00	36.00
	Ties	2 <sup>c</sup>		
	Total	20		
Headache Intensity during treatment - Pre-treatment Headache Intensity	Negative Ranks	20 <sup>d</sup>	10.50	210.00
	Positive Ranks	0 <sup>e</sup>	.00	.00
	Ties	0 <sup>f</sup>		
	Total	20		
Headache Duration during Treatment - Pre-treatment Headache Duration	Negative Ranks	19 <sup>g</sup>	10.58	201.00
	Positive Ranks	1 <sup>h</sup>	9.00	9.00
	Ties	0 <sup>i</sup>		
	Total	20		

- a. Headache Frequency during Treatment < Pre-treatment Headache frequency
- b. Headache Frequency during Treatment > Pre-treatment Headache frequency
- c. Pre-treatment Headache frequency = Headache Frequency during Treatment

Table 30: Headache Characteristics - Group B

30.1 Descriptive statistics - group B

	N	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache Frequency	20	4.2000	6.5823	1.00	32.00
Pre-treatment Headache Intensity	20	7.2000	1.9084	3.00	10.00
Pre-treatment Headache Duration	20	7.7000	7.7957	.50	24.00
Headache Frequency during treatment	20	1.7250	1.2822	.00	4.50
Headache Intensity during Treatment	20	2.2165	1.2999	.00	5.00
Headache Duration during treatment	20	2.2240	2.0198	.00	8.00

30.2 Mean Ranks - group B

		N	Mean Rank	Sum of Ranks
Headache Frequency during treatment - Pre-treatment Headache Frequency	Negative Ranks	17 <sup>a</sup>	9.71	165.00
	Positive Ranks	1 <sup>b</sup>	6.00	6.00
	Ties	2 <sup>c</sup>		
	Total	20		
Headache Intensity during Treatment - Pre-treatment Headache Intensity	Negative Ranks	20 <sup>d</sup>	10.50	210.00
	Positive Ranks	0 <sup>e</sup>	.00	.00
	Ties	0 <sup>f</sup>		
	Total	20		
Headache Duration during treatment - Pre-treatment Headache Duration	Negative Ranks	17 <sup>g</sup>	11.09	188.50
	Positive Ranks	3 <sup>h</sup>	7.17	21.50
	Ties	0 <sup>i</sup>		
	Total	20		

a. Headache Frequency during treatment < Pre-treatment Headache Frequency

b. Headache Frequency during treatment > Pre-treatment Headache Frequency

c. Pre-treatment Headache Frequency = Headache Frequency during treatment

Table 31: Headache Characteristics - Group C

31.1 Descriptive statistics - group C.

	N	Mean	Std. Deviation	Minimum	Maximum
Pre-treatment Headache Frequency	20	2.6000	.5982	1.00	3.00
Pre-treatment Headache Intensity	20	8.0000	2.2711	2.00	10.00
Pre-treatment Headache Duration	20	8.6750	10.9006	.50	48.00
Headache Frequency during treatment	20	1.9500	1.8274	.00	7.00
Headache Intensity during Treatment	20	2.1610	1.3275	.00	5.00
Headache Duration during treatment	20	2.3055	2.6226	.00	8.00

31.2 Mean Ranks - group C

		N	Mean Rank	Sum of Ranks
Headache Frequency during treatment - Pre-treatment Headache Frequency	Negative Ranks	12 <sup>a</sup>	6.54	78.50
	Positive Ranks	2 <sup>b</sup>	13.25	26.50
	Ties	6 <sup>c</sup>		
	Total	20		
Headache Intensity during Treatment - Pre-treatment Headache Intensity	Negative Ranks	20 <sup>d</sup>	10.50	210.00
	Positive Ranks	0 <sup>e</sup>	.00	.00
	Ties	0 <sup>f</sup>		
	Total	20		
Headache Duration during treatment - Pre-treatment Headache Duration	Negative Ranks	16 <sup>g</sup>	11.81	189.00
	Positive Ranks	4 <sup>h</sup>	5.25	21.00
	Ties	0 <sup>i</sup>		
	Total	20		

a. Headache Frequency during treatment < Pre-treatment Headache Frequency

b. Headache Frequency during treatment > Pre-treatment Headache Frequency

c. Pre-treatment Headache Frequency = Headache Frequency during treatment

#### 4.5.2.2 OBJECTIVE DATA

Table 32: Myofascial Diagnostic Scale - Groups A, B, C

##### 32.1 Descriptive statistics for MFDS scores - Groups A, B, C

	N	Mean	Std. Deviation	Minimum	Maximum
Myofascial diagnostic scale scores at treatment 1	60	11.07	.73	10	12
Myofascial diagnostic scale scores at treatment 3	60	9.05	2.68	1	12
myofascial diagnostic scale scores at treatment 5	60	6.45	4.20	1	11
group	60	2.00	.82	1	3

##### 32.2 Mean Ranks for MFDS scores - Groups A, B, C

	group	N	Mean Rank
Myofascial diagnostic scale scores at treatment 1	1	20	25.85
	2	20	32.25
	3	20	33.40
	Total	60	
Myofascial diagnostic scale scores at treatment 3	1	20	36.05
	2	20	26.92
	3	20	28.52
	Total	60	
myofascial diagnostic scale scores at treatment 5	1	20	39.97
	2	20	23.40
	3	20	28.13
	Total	60	



Table 33: Algometer Readings - Group A, B, C

33.1 Descriptive statistics for Algometer readings - Groups A, B, C

	N	Mean	Std. Deviation	Minimum	Maximum
Algometer Reading at tx 1	143	1.2906	.2020	1.00	1.90
Algometer Reading at tx 3	107	1.4967	.2449	1.00	2.10
Algometer Readings at tx 5	71	1.6528	.2621	1.10	2.30
Group	145	2.05	.82	1	3

33.2 Mean Ranks for Algometer Readings - Groups A, B, C

	Group	N	Mean Rank
Algometer Reading at tx 1	1	44	81.03
	2	48	61.82
	3	51	73.78
	Total	143	
Algometer Reading at tx 3	1	43	54.76
	2	30	56.83
	3	34	50.54
	Total	107	
Algometer Readings at tx 5	1	41	34.98
	2	14	35.82
	3	16	38.78
	Total	71	

#### 4.6 THE DUNN PROCEDURE (MULTIPLE COMPARISON TEST)

If the null hypothesis ( $H_0$ ) is rejected for the Friedman's t - test or the Kruskal-Wallis H - test, then this multiple comparison procedure will have to be applied to determine between which treatments a significant improvement occurred (Daniel 1978).

##### 4.6.1 Friedman's T test coupled with the Dunn procedure

Let  $R_j$  and  $R_{j^1}$  be the  $j^{\text{th}}$  and  $j^{1^{\text{th}}}$  treatment rank totals.

Let  $\alpha$  be the experiment-wise error rate. Usually  $\alpha = 0.10$

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

In the above formula:  $b$  = the number of blocks

$k$  = the number of treatments

$z$  = value in the inverse normal distribution corresponding to  $(1 - \{\alpha/k(k-1)\})$

For this study,  $k = 3$ ,  $b = 20$ ,  $z = 2.12$ , and  $\alpha = 0.10$ .

i.e If the difference of rank totals  $\geq 13.408$ , then  $R_j$  and  $R_{j^1}$  are declared significant.

For the purpose of this study,  $R_1$  is the 1<sup>st</sup> treatment,  $R_3$  is the 3<sup>rd</sup> treatment, and  $R_5$  is the 5<sup>th</sup> treatment.

#### 4.6.2 Kruskall - Wallis H-test coupled with the Dunn Procedure

Let  $R_i$  and  $R_j$  be the means of the ranks of the  $i^{\text{th}}$  and the  $j^{\text{th}}$  samples respectively. Let  $\alpha$  be the experiment-wise error rate. The values of  $\alpha$  are usually 0.15, 0.20 and 0.25 depending on the value of  $k$  (as  $k$  increases,  $\alpha$  increases).

If  $|R_i - R_j| > Z_{(1 - \{\alpha/k(k-1)\})} \sqrt{[N(N+1) / 12] \times [1/n_i + 1/n_j]}$ , then the difference  $|R_i - R_j|$  is declared significant at the  $\alpha$  level.

In the above formula:  $k$  = number of samples

$N$  = number of observations in all samples combined

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

For this study,  $k = 3$ ,  $z = 1.96$  and  $\alpha = 0.15$

i.e. if the difference of rank totals is  $\geq 10.82$ , then  $R_i - R_j$  are declared significant.

For the purpose of this study,  $R_1$  represents the 1<sup>st</sup> treatment,  $R_2$  represents the 2<sup>nd</sup> treatment, and  $R_3$  represents the 3<sup>rd</sup> treatment.

#### 4.6.3 INTER - GROUP COMPARISONS

Table 34: Dunn's Procedure for NRS 101- Group A

	Rank Total	Difference	Rank Total	
Tx 1	59.4	22.8	36.6	Tx 3
Tx 3	36.6	12.6	24.0	Tx 5
Tx 1	59.4	35.4	24.0	Tx 5

$Tx\ 1 - Tx\ 3 = 22.8 \geq 13.408$ , therefore between treatments **1 and 3** the result is declared statistically significant.

$Tx\ 3 - Tx\ 5 = 12.6 \leq 13.408$ , therefore between consultations **3 and 5** the result is not significant.

$Tx\ 1 - Tx\ 5 = 35.4 \geq 13.408$ , therefore between treatments **1 and 5** the result is declared statistically significant.

This indicates that a statistically significant difference was noted between treatments 1 & 3, and treatments 1 & 5. No significant difference was noted between treatments 3 & 5. Therefore, in Group A, a subjective decrease in pain perception was evident between treatments 1 & 3, and 1 & 5.

Table 35: Dunn's Procedure for NRS 101- Group B

	Rank Total	Difference	Rank total	
Tx 1	56.6	16.0	40.6	Tx 3
Tx 3	40.6	17.6	23.0	Tx 5
Tx 1	56.6	33.6	23.0	Tx 5

$Tx\ 1 - Tx\ 3 = 16.0 \geq 13.408$ , therefore between treatments **1 and 3** the results are declared **statistically significant.**

$Tx\ 3 - Tx\ 5 = 17.6 \geq 13.408$ , therefore between treatments **3 and 5** the results are declared **statistically significant.**

$Tx\ 1 - Tx\ 5 = 33.6 \geq 13.408$ , therefore between treatments **1 and 5** the results are declared **statistically significant.**

The above results indicated a statistically significant difference between treatments 1 & 3, 3 & 5, and 1 & 5 with respect to subjective pain levels for group B.

Table 36: Dunn's Procedure for NRS 101 – Group C

	Rank Total	Difference	Rank Total	
Tx 1	59.0	20.6	38.4	Tx 3
Tx 3	38.4	15.8	22.6	Tx 5
Tx 1	59.0	36.4	22.6	Tx 5

$Tx\ 1 - Tx\ 3 = 20.6 \geq 13.408$ , therefore between treatments **1 and 3** the results are declared **statistically significant.**

$Tx\ 3 - Tx\ 5 = 15.8 \geq 13.408$ , therefore between treatments **3 and 5** the results are declared **statistically significant.**

$Tx\ 1 - Tx\ 5 = 36.4 \geq 13.408$ , therefore between treatments **1 and 5** the results are declared **statistically significant.**

The above results indicate that a significant improvement was noted in terms of pain perception between treatments 1 & 3, 1 & 5, and treatments 3 & 5.

Table 37: Dunn Procedure for MFDS – Group A

	Rank Total	Difference	Rank Total	
Tx 1	52.0	14.4	37.6	Tx 3
Tx 3	37.6	7.2	30.4	Tx 5
Tx 1	52.0	21.6	30.4	Tx 5

Tx 1 – Tx 3 = 14.4  $\geq$  13.408, there between treatments 1 and 3 the results are declared **statistically significant.**

Tx 3 – Tx 5 = 7.2 < 13.408, therefore between treatments 3 and 5 the results are declared **insignificant.**

Tx 1 – Tx 5 = 21.6  $\geq$  13.408, therefore between treatments 3 and 5 the results are declared **statistically significant.**

The above results indicate a statistically significant difference between treatments 1 & 3, and 1 & 5. No significant difference was noted between treatment 3 & 5, with respect to myofascial pain.

Table 38: Dunn Procedure for MFDS – Group B

	RankTotal	Difference	Rank Total	
Tx 1	58.4	20.4	38.0	Tx 3
Tx 3	38.0	14.6	23.4	Tx 5
Tx 1	58.4	35.0	23.4	Tx 5

Tx 1 – Tx 3 = 20.4  $\geq$  13.408, therefore between treatments **1 and 3** the result is declared statistically significant.

Tx 3 – Tx 5 = 14.6  $\geq$  13.408, therefore between treatments **3 and 5** the result is declared statistically significant.

Tx 1 – Tx 5 = 35.0  $\geq$  13.408, therefore between treatments **1 and 5** the result is declared statistically significant.

The above results indicate that a significant improvement exists between treatments 1 & 3, 3 & 5, and treatments 1 & 5, with respect to Myofascial pain.



Table 39: Dunn Procedure for MFDS – Group C

	Rank Total	Difference	Rank Total	
Tx 1	58.0	21.4	36.6	Tx 3
Tx 3	36.6	11.4	25.2	Tx 5
Tx 1	58.0	32.8	25.2	Tx 5

Tx 1 – Tx 3 = 21.4  $\geq$  13.408, therefore between treatments 1 and 3 the result is declared **statistically significant.**

Tx 3 – Tx 5 = 11.4  $\geq$  13.408, therefore between treatments 3 and 5 the result is declared **statistically significant.**

Tx 1 – Tx 5 = 32.8  $\geq$  13.408, therefore between treatments 3 and 5 the result is declared **statistically significant.**

The above results indicate that a significant difference exists between treatments 1 & 3, 3 & 5, and treatments 1 & 5, with respect to myofascial pain.

Table 40: Dunn Procedure for Algometer Readings – Group A

	Rank Total	Difference	Rank Total	
Tx 1	23.2	16.0	39.2	Tx 3
Tx 3	39.2	18.4	57.6	Tx 5
Tx 1	23.2	34.4	57.6	Tx 5

$Tx\ 1 - Tx\ 3 = 16.0 \geq 13.408$ , therefore between treatments **1 and 3** the result is declared **statistically significant.**

$Tx\ 3 - Tx\ 5 = 18.4 \geq 13.408$ , therefore between treatments **3 and 5** the result is declared **statistically significant.**

$Tx\ 1 - Tx\ 5 = 34.4 \geq 13.408$ , therefore between treatments **1 and 5** the result is declared **statistically significant.**

The above results indicated that a statistically significant difference exists between treatments 1 & 3, 3 & 5, and treatments 1 & 5, with respect to pressure pain thresholds in Group A.

Table 41: Dunn Procedure for Algometer Readings – Group B

	Rank Total	Difference	Rank Total	
Tx 1	21.4	19.4	40.8	Tx 3
Tx 3	40.8	17.0	57.8	Tx 5
Tx 1	21.4	36.4	57.8	Tx 5

$Tx\ 1 - Tx\ 3 = 19.4 \geq 13.408$ , therefore between treatments **1 and 3** the result is declared statistically significant.

$Tx\ 3 - Tx\ 5 = 17.0 \geq 13.408$ , therefore between treatments **3 and 5** the result is declared statistically significant.

$Tx\ 1 - Tx\ 5 = 36.4 \geq 13.408$ , therefore between treatments **1 and 5** the result is declared statistically significant.

The above results indicate that a statistically significant difference exists between treatments 1 & 3, 3 & 5, and treatments 1 & 5, with respect to pressure pain thresholds in Group B.

Table 42: Dunn Procedure for Algometer Readings – Group C

	Rank Total	Difference	Rank Total	
Tx 1	22.0	16.6	38.6	Tx 3
Tx 3	38.6	20.8	59.4	Tx 5
Tx 1	22.0	37.4	59.4	Tx 5

Tx 1 – Tx 3 = 16.6  $\geq$  13.408, therefore between treatments **1 and 3** the result is declared statistically significant.

Tx 3 – Tx 5 = 20.8  $\geq$  13.408, therefore between treatments **3 and 5** the result is declared statistically significant.

Tx 1 – Tx 5 = 37.4  $\geq$  13.408 therefore between treatments **1 and 5** the result is declared statistically significant.

The above results indicate that a statistically significant difference exists between treatments 1 & 3, 3 & 5, and treatment 1 & 5, with respect to pressure pain thresholds for Group C.

#### 4.6.4 INTER-GROUP COMPARISONS

Table 43: Dunn Procedure for NRS 101 at Treatment 5

	Rank Total	Difference	Rank Total	
Group A	39.97	16.57	23.40	Group B
Group B	23.40	4.73	28.13	Group C
Group A	39.97	11.84	28.13	Group C

Group A - Group B  $\geq 10.82$ , therefore between **Groups A and B** at treatment 5 the result is declared statistically significant.

Group B - Group C = 4.73, therefore between **Groups B and C** at treatment 5 the result is declared insignificant.

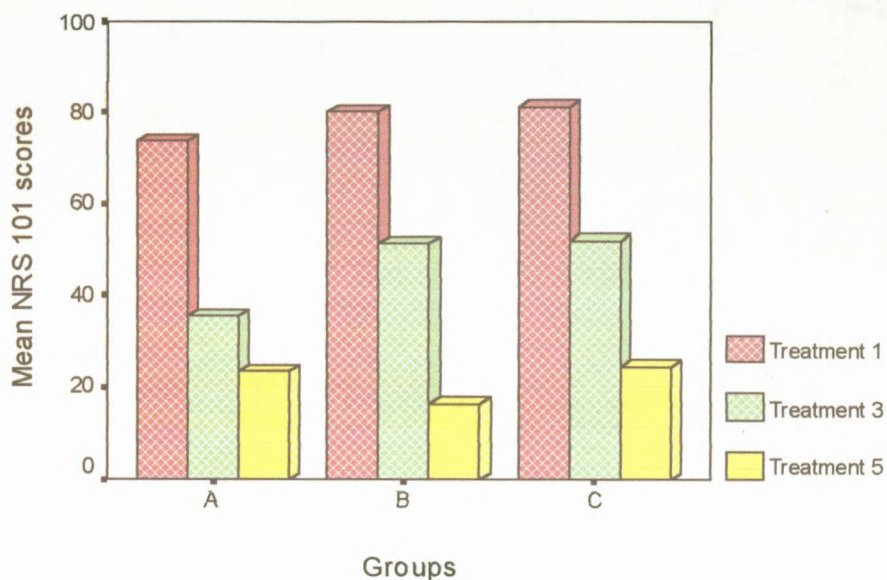
Group A - Group C  $\geq 10.82$  therefore between **Groups A and C** at treatment five the result is declared statistically significant.

The above result indicates a statistically significant difference in subjective pain measures between groups A and B, and groups A and C at treatments five. No significant difference exists between groups B and C at this treatment.

#### 4.7 COMPARISON OF TRENDS

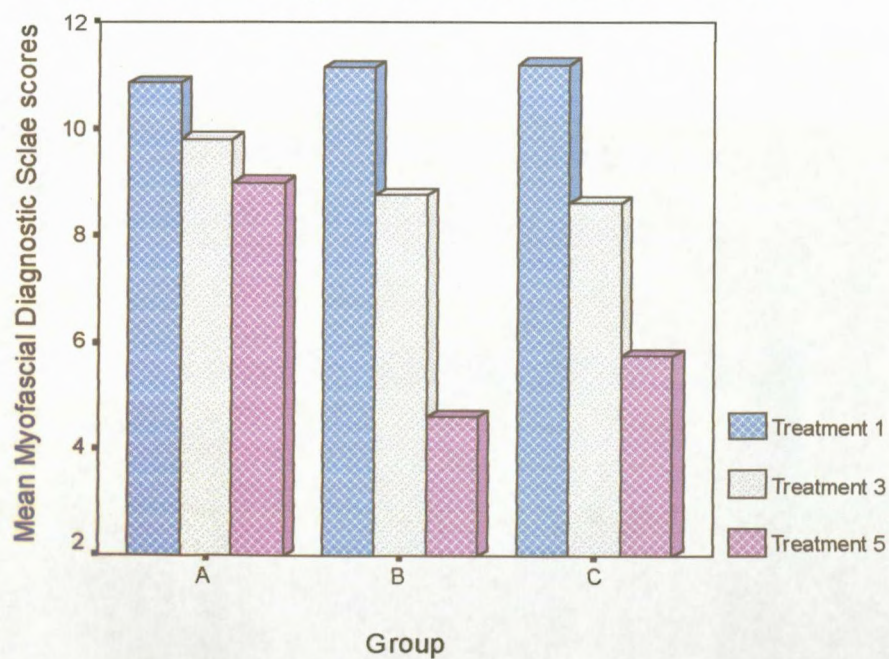
Graph 4: Mean NRS 101 Scores for groups A, B, C

Mean NRS 101 scores for Groups A, B and C  
at treatments 1, 3 and 5.



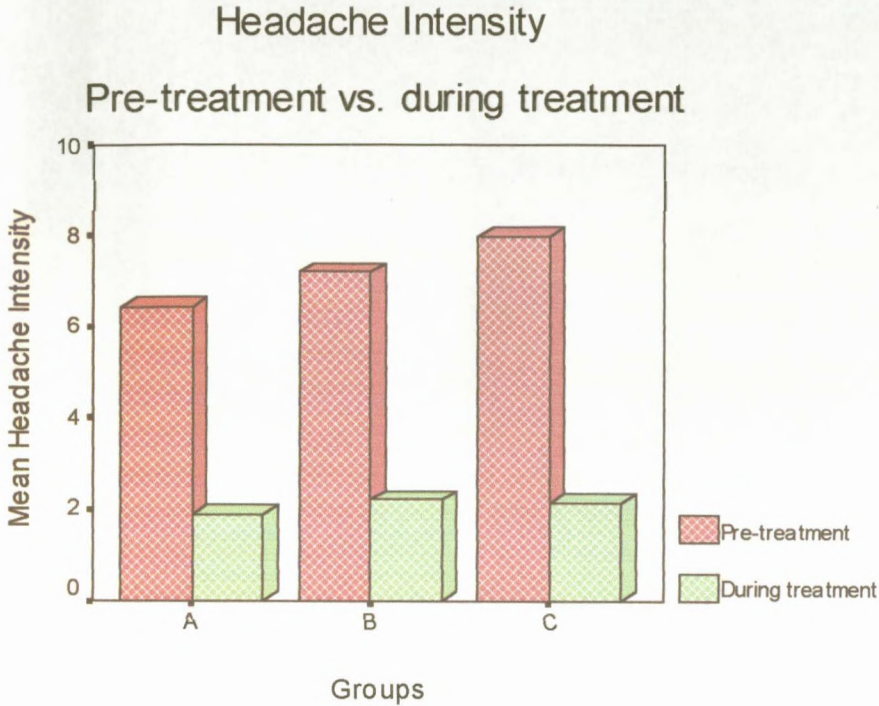
Graph 5: Mean MFDS scores for Groups A, B, C

Myofascial Diagnostic Scale Mean Scores

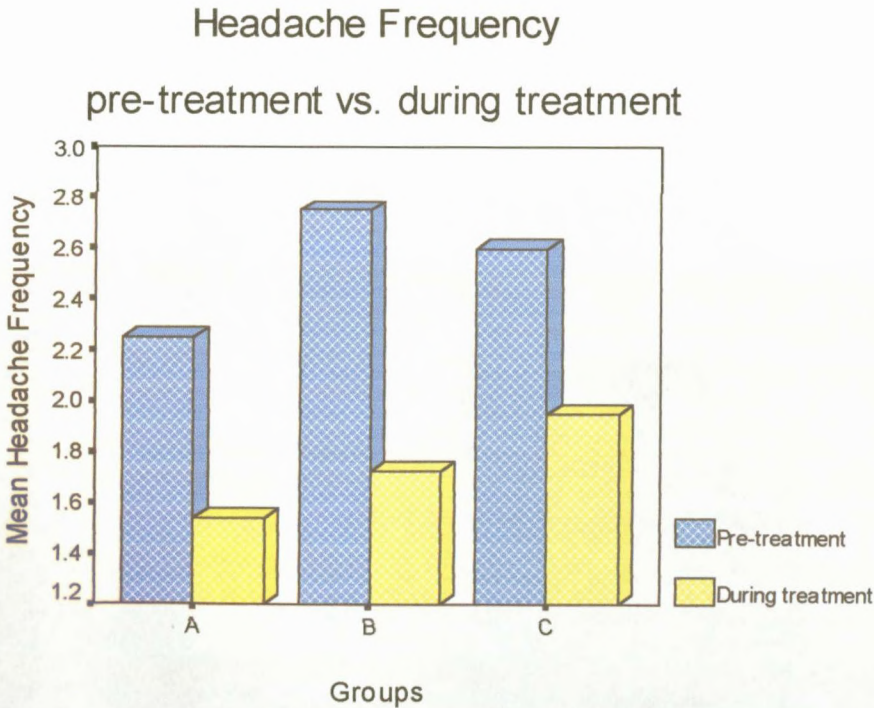




Graph 6: Mean headache Intensity for Groups A, B, C

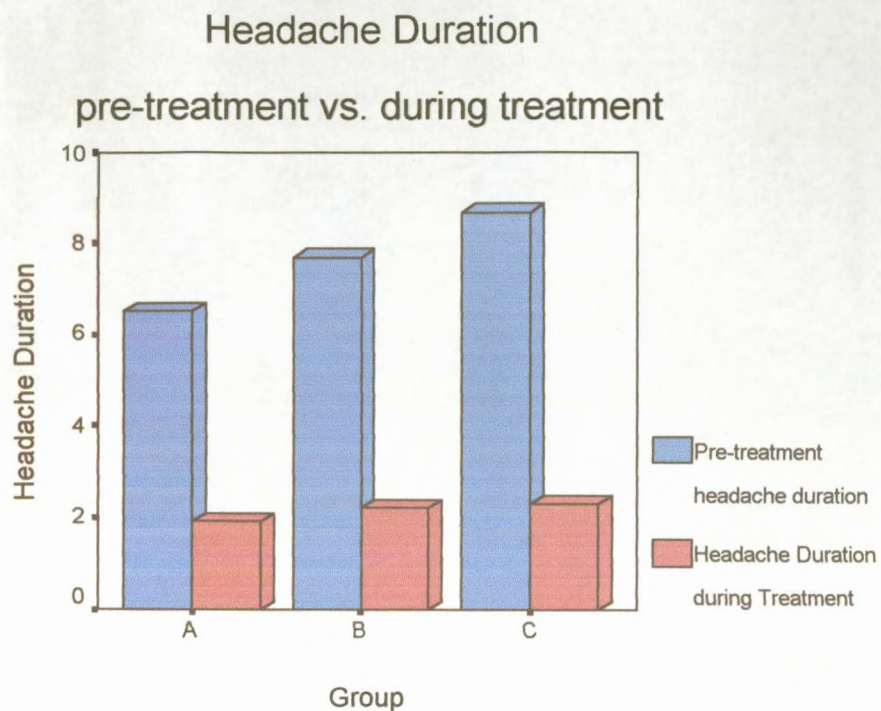


Graph 7: Mean headache Frequency for Groups A, B, C

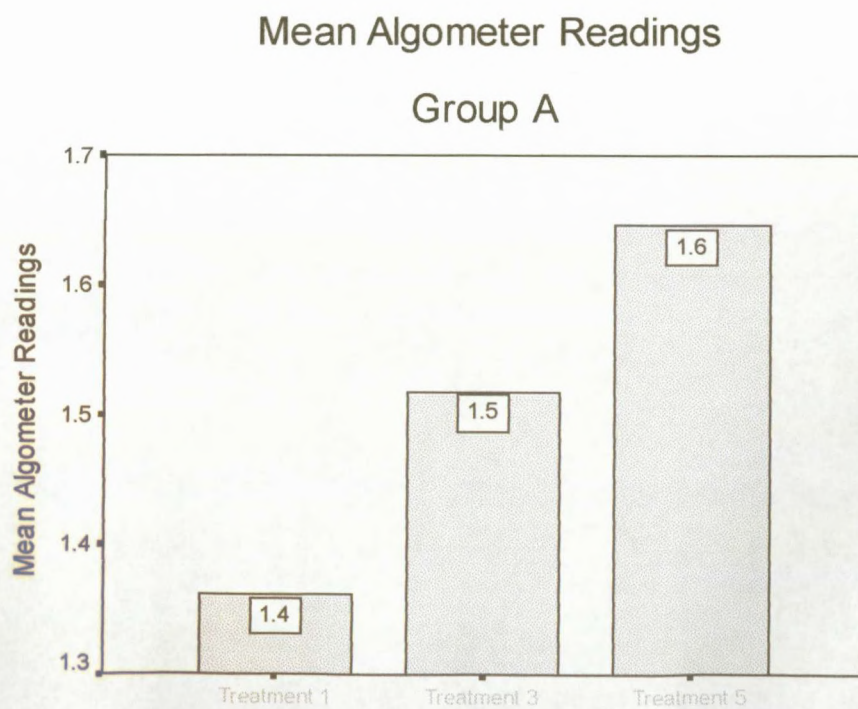




Graph 8: Mean Headache Duration for Groups A, B, C

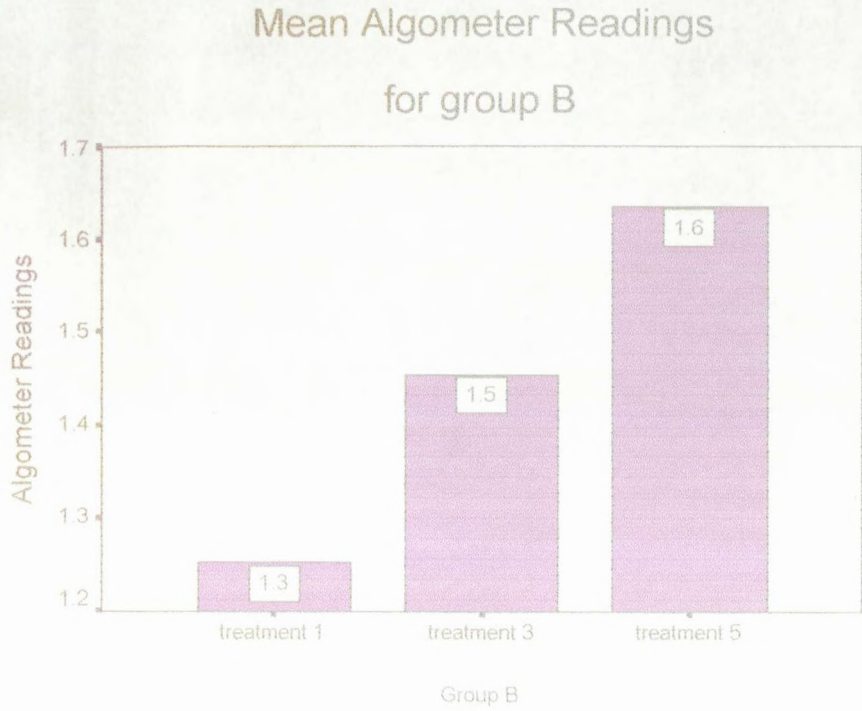


Graph 9: Mean Algometer Radings for Group A

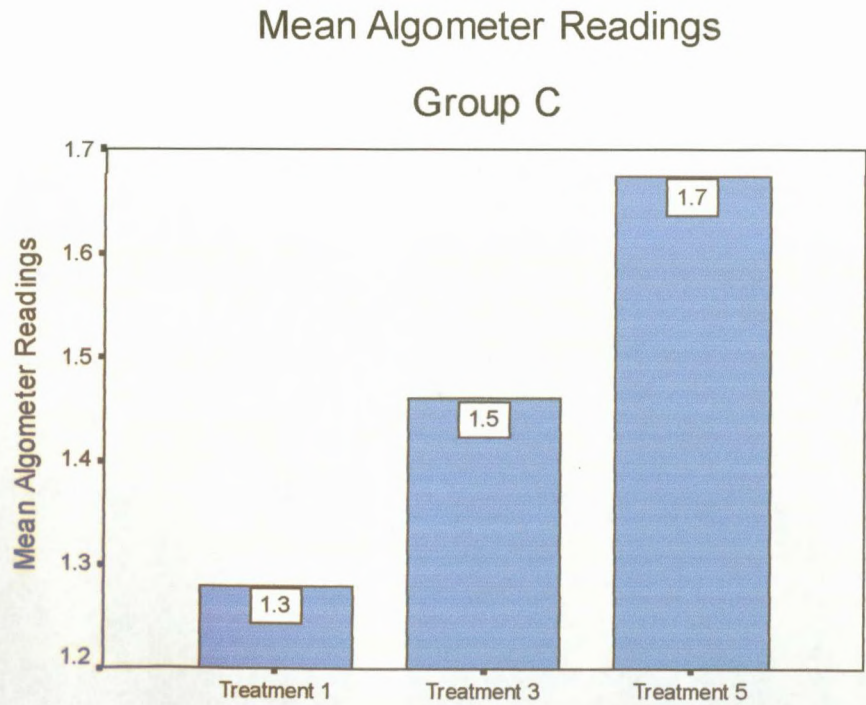




Graph 10: Mean Algometer Readings for Group B



Graph 11: Mean Algometer Readings for Group C



## CHAPTER FIVE

### DISCUSSION OF THE RESULTS

#### 5.1 INTRODUCTION

This chapter focuses on the analysis of the demographic data, subjective data and objective data. Analysis of the subjective and objective data includes inter-group and intra-group comparisons. The results of this study will then be compared to published research in this area to determine if this study compares favourably with previously documented trends in Episodic tension-type headache research.

#### 5.2 DEMOGRAPHIC DATA

Eighty-five candidates applied to participate in the study, of which 60 were accepted. The remaining 25 candidates were excluded for the following reasons: 5 candidates were migraine headache sufferers, 2 had neck pain with no accompanying headache, 1 candidate had a cervical spine fusion operation, 2 candidates had a recent history of stroke with neurological deficit, 4 reported that they would not be able to attend all five treatments, 1 patient had taken a voltaren injection and did not experience headaches anymore, 1 suffered from uncontrolled epileptic attacks, 2 did not fall within the specified age category and 2 were severely hypertensive. In addition, 14 patients were dropped from the study due to non-compliance and 14 extra patients were recruited to replace them. Each group was randomly allocated 20 patients.

### 5.2.1 Gender distribution

Refer to Table 1

In total, 19 males (31.6%) and 41 females (68.3%) were accepted into the study. The ratio of male: female for the study was 1: 2.16. Group A comprised 7 males (35%) and 13 females (65%), group B comprised 9 males (45%) and 11 females (55%) and group C comprised 3 males (15%) and 17 females (85%). The small male: female ratio may affect the intergroup statistical analysis to a certain extent but further confirms that Episodic tension-type headache is more prevalent among females.

Similar male: female ratios were found in previous studies on tension-type headaches. Donkin (1998) and Kidson (2001) both found a male: female ratio of 1:2, comparatively similar to this study. Bove and Nilsson (1998) found a male: female ratio of 1:1.89 and Thomson (1999) found a male: female ratio of 1:1.4 in their studies. Hatch (1991) found a male: female ratio of 1:3.7 while Srikiatkachom (1997) found a ratio of 1:5.6 in their respective studies.

### 5.2.2 Age Distribution

Refer to graph 1

The age range of group A was 18 – 63 with a mean range of 38.75 years. The age range of group B was 19 – 62 with a mean range of 41.55 years, and the age range of group C was 20 – 64 with a mean range of 46.25 years. The three groups were considered similar and comparable with regards to their ages and this strengthens the statistical results from the study. Episodic tension-type headache was most prominent in the 41 – 50 age group (30%) followed by the 51 – 60 age group (25%), 18 – 20 years (13%), 21 – 30 (11.7%), 31 – 40 (11.7%) and in the 61 – 65 age category (8.3%).

Jensen *et al.* (1998) calculated the average age of ETTH subjects in his study to be 39.8 years, compared to 42.0 years in the control group. Kidson (2001) found the

average age of his experiment group to be 33.2 years compared to 29.4 years in the control group. Sandrini et al. (1993) calculated the average age of ETTH subjects in his study to be 27.3 years compared to 36.0 years for migraine and 37.4 years for chronic tension-type headache subjects.

The average ages calculated for this study were thus consistent with that found in previous studies.

#### 5.2.3 Occupations Affected

Refer to Graph 3

Among the occupational fields most frequently affected by headache in this study, 20% were home executives, 16.6% were students, 8.3% were secretary/receptionists, and 6.6% were accountants.

#### 5.2.4 Headache Frequency

Refer to Table 2

15% of patients experienced headaches 1 - 2 times per week; 45% 2 - 3 times per week; and 20% 3 - 4 times per week. 3.3% were affected by headache 2 - 3 times per month; 6.6% 3 - 4 times per month; 1.6% 4 - 5 times per month; 1.6% 5 - 6 times per month; 3.3% 11 - 12 times per month, and 1.6% each at 12 - 13 and 13 - 14 times per month.

Thomson (1999) found that 51.35% of patients in her experiment and 48.57% of patients in her control groups suffered from headaches 1 - 2x/wk, 40.54% of the experiment and 40.0% of the control group suffered headaches 1 - 3x/wk, while 8.11% of the experiment and 4.0% of the control groups suffered from headaches 1 - 4x/wk.

For the present study, the mean headache frequency calculated per month for group A = 9, B = 16.8 and C = 10.4. Kidson (2001) found similar headache frequencies for his experiment group A (11.0/mth) and control group B (10.5/mth). Thus the headache frequencies calculated in this study are consistent with those found in earlier studies.

#### 5.2.5 Headache Duration

Refer to Table 3

The average duration of the headaches varied between 30 mins. – 1 hr. to 3 - 4 days. 17% of patients experienced headaches that lasted 30 mins – 1 hr, 20% reported headaches that lasted 1 - 2 hrs, 25% reported that their headaches lasted 3 - 4 hrs, 18% reported an average headache duration of 4 - 6 hrs, 2% reported headaches of 10 - 12 hrs duration, and 10% reported headaches between 12 hrs -1 day. In 2% of patients the headaches lasted 1 day, in 3% it lasted 2 days, and in 3% it lasted 3 - 4 days.

Thomson (1999) found that 27% of the experiment group and 31.4% of the control group in her study reported an average headache duration of 4 hrs, 37.8% and 25.7% of the experiment and control groups respectively reported an average duration of 6 hrs, while 21.6% and 28.6% respectively reported an average duration of more than 6 hours.

In the present study the average pre-treatment headache duration for group A = 6.53 hrs, B = 7.70 hrs and C = 8.68 hrs. Kidson (2001) found that the average headache duration for the experiment and control groups in his study were 05.2 and 05.5 hrs respectively. Thus the average headache duration in the present study compared favourably with that recorded in past studies.

#### 5.2.6 Onset of Headache

The onset of the headache varied between 3 months and 20 years. In 12% of patients the headache began less than 3 months prior to presentation at the clinic; 2% reported an onset of between 3 - 6 months; 5% stated that their headaches began 6 months - 1 yr ago, and 28% reported the onset of the headaches to be between 1 - 2 yrs ago. 13% of patients had an onset of between 3 - 5 yrs; 13% between 6 - 10 yrs; 13% between 10 - 15 yrs; 8% between 15 - 20 years and more.

Similar time periods with regard to the onset of headaches were found in previous studies. Srikiatkhachorn (1997) found that the onset of headache among subjects in his study varied between 6 months to 30 years prior to presentation for the study while Jensen *et al.* (1998) found that the number of years with episodic tension-type headache among subjects in his study varied between 2 - 40 years.

#### 5.2.7 Location of Pain

Refer to Table 4

The headache occurred bilaterally in all patients. The most commonly affected cranial areas were: occipital (68%), temporal (47%), frontal (28%), orbital (28%), vertex (15%), parietal (12%) and other (3%). The majority of patients in the study experienced a headache in a combination of cranial sites. If a patient experienced a headache in more than one specified cranial area, all areas were recorded for that patient.

Thomson (1999) found the most commonly affected cranial locations to be occipital (66.6%) and temporal areas (70.8%) followed by the frontal (30.5%) and parietal (8.3%) areas. Kidson (2001) found the frontal area of the cranium to be most frequently affected by the headache (58.3%), followed by the occipital (51.7%), temporal (40%), vertex (10%) and parietal (1.6%) areas of the cranium. Vernon *et al.* (1992) found the most commonly affected cranial locations of headache in his study were occipital (87%), frontal (81%), orbital (40%) and temporal (34%).

The most frequently affected cranial location for episodic tension-type headache is thus consistent between this and prior studies.

#### 5.2.8 Description of Pain

Refer to Table 5

The most common headache pain description was a "heaviness of the head" (65%), followed by a "pressing quality" of headache (25%); a "tightness of the head" (23%); a "dull ache" (8%); a "squeezing sensation" (2%); a "cramping sensation" (2%), and a "constricting sensation" (8%). Many patients experienced more than one type/quality of pain. If a patient described more than one type/quality of pain, all descriptions were recorded separately for the patient.

The most common headache pain descriptions in a study by Kidson (2001) were "dull ache" (58.3%), "oppressive" (13.3%) and "band-like" (11.6%). Thomson (1999) found the most frequently used headache pain descriptions in her study were "dull ache" (27.7%), "pressure sensation" (19.4%), "tight band" (29.16%) and "throb" (5.5%). Srikiatkachorn (1997) found the most frequent pain description used in his study was "dull ache" (65%) followed by "pulsating" (46.7%), "nuchal tenderness" (21.7%) and "sharp/stabbing" (1.6%).

Comparison of this study to previous studies showed that patients within the current study favoured similar pain descriptions as with previous studies. Although the number of patients describing their headache as a "dull ache" remained relatively consistent between previous studies, as described above, a comparatively small percentage of patients in the current study used this description. Instead, in 65% of circumstances the pain was described as a "heaviness of the head."

#### 5.2.9 Precipitating and Provoking Factors

Refer to Table 7

Eighty-seven percent of patients indicated that stress/tension aggravated their headaches. Noise aggravated the headache in 60% of patients, and light in 28% of patients. 17% reported that head/neck movements aggravated their headaches, 4% implicated posture as a precipitant of the headache, and 4% stated that studying worsened their headaches. Smoking worsened the headache in 15% of people, and alcohol in 5%. 12% of females reported an aggravation of their headaches during their menstrual cycles. Other precipitants or provoking factors of the headaches included: heat (8%), foodstuff (3%), extremes of temperature (7%), inadequate sleep (2%), hypoglycemia (2%), and exercise (1%). If a patient reported more than one precipitant or provoking factor of the headache, all factors were recorded separately for the patient.

Kidson (2001) reported similar precipitants among tension-type headache subjects in his study. Stress was listed as the most frequent precipitating factor (65%) followed by light (53%), heat (33.3%), computers (30%), sound/noise (20%), fatigue (5%) and menstruation (3.3%). Srikiatkachorn (1997) also reported psychological stress to be the most common aggravating factor (56.7%) followed by head motion (16.7%), menses (13.7%), sleep deprivation (11.7%), heat (5%), alcohol ingestion (3.3%) and strong sunlight (1.7%). Vernon *et al.* (1992) found that tension aggravated the headaches in 75% of patients, weather (60%), head/neck movements (47%), exertion (40%), hunger (40%) and menstruation (12%). Rasmussen (1993) found that 71% of tension-type headache patients in his study reported stress to be the main precipitating factor of their headache, followed by smoking (36%), alcohol consumption (27%), climatic changes (26%) and menstruation (39%).

A comparison between the present study and previous studies shows that stress/tension still remains the number one precipitant of tension-type headaches. This is followed not so closely, in descending order of frequency, by noise, light, smoking, menstruation and head/neck movements, among others. This also indicates that tension-type headaches may be aggravated by a wide variety of factors as listed above, and knowledge of these precipitants may assist in reducing the intensity of an already present headache.



#### 5.2.10 Cause of the Headache

Refer to Table 6

Seventeen patients attributed the cause of their headaches to studying. Two patients reported divorce and 3 patients reported marital discord to be the cause of their headaches. Thirty-two patients implicated stress as the possible causative factor of their headaches. Three patients indicated that trauma or a previous motor vehicle accident could have caused their headaches, and 1 female attributed the cause of her headache to an epidural. Three patients reported that their headaches began as a result of retrenchment/loss of their job, and 2 subjects reported that the loss of a family member caused their headache.

#### 5.2.11 Relief of the Headache

Refer to Table 9

Medication was used by 90% of the subjects for the relief of their headaches. Twenty-four subjects (40%) stated that sleep relieved their headaches, and 25 subjects (42%) indicated the massage significantly relieved their headaches. Twenty-one subjects (35%) found relief from the headache after taking a hot shower. Two subjects each (3% each) found relief from relaxation and exercise and 1 subject each (2% each) found reflexology, ayurvedic medication and ischemic compression relieved their headaches.

Srikiatkhachorn (1997) found that 58.3% of patients reported daily and 21.7% reported occasional analgesic use for relief of their headaches. Rest/sleep was shown to relieve the headache in 35% of patients, while local massage at a pain site produced relief in only 3.3% of patients.

The three most common ameliorating factors of the headache i.e. analgesic intake, sleep and massage were found to be consistent between this and previous studies.

#### 5.2.12 Other Practitioners visited

Prior to entering the study, 26 subjects (43%) indicated that they had visited a General Practitioner at some stage during their headache history. Six subjects (10%) had consulted a Neurologist, and 1 subject (2%) had consulted a Neurosurgeon about their headaches. Fifteen subjects (25%) underwent between 1-12 sessions of physiotherapy for the relief of their headaches, and 1 subject (2%) regularly visited a massage therapist. Two subjects each (3%) had consulted a Psychologist and Psychiatrist respectively about their headaches. One subject (2%) consulted a traditional healer, 2 subjects (3%) had consulted a kinesiologist, and 2 subjects (3%) consulted a reflexologist. Five subjects (8%) had previously consulted a Chiropractor for their headaches.

#### 5.2.13 Associated Signs and Symptoms

Refer to Table 8

Twenty-one subjects (35%) reported nausea during their headache episode, without any vomiting. Seven subjects (12%) reported a mild photophobia, and a further 7 subjects (12%) experienced slight phonophobia during the headaches. Three subjects (5%) experienced dizziness on at least one occasion during their headache episode. Three subjects (5%) noticed increased perspiration on their palms and face during their headaches, and 6 subjects (10%) reported that they had slight blurring of vision during their headaches. Fifteen subjects (25%) indicated that their appetites reduced during a headache episode, and 3 subjects (5%) indicated that it increased, possibly due to medication taken for the headache. Forty-three subjects (72%) indicated that their headaches affected their sleep patterns. In 17 subjects (28%) sleep was disrupted due to the headache, and in 23 subjects (43%) the headache prevented the subject from falling off to sleep.

Comparison of this study to previous studies shows that the three most common associated symptoms of the headache were nausea, photophobia and phonophobia. Although the IHS (1991:29) excludes nausea as an associated headache symptom, nausea was found to accompany the headache in 43% - 63% of patients (Vernon et

al. 1992 and Srikiatkachorn, 1997). Photophobia accompanied the headache in 70% and phonophobia in 56.7% of patients (Srikiatkachorn, 1997). The percentage of patients that reported nausea as an accompanying headache symptom in the present study (35%) was consistent with that of other studies.

#### 5.2.14 Cervical Spine Fixations

Refer to Table 11

The most commonly fixated level was C2, followed by C4, C3, C5, C6 and C7. 42 subjects (70%) had a fixation at C2 level; 34 subjects (57%) had a fixation at C4 level; 33 subjects (55%) had a fixation at C3 level; 16 subjects (27%) had C5 fixations; 14 subjects (23%) had fixations at C6, and 6 subjects (10%) had fixations at C7 level.

Thomson (1999) also found C2 to be the most commonly fixated cervical spine level (79.2%) followed by C1 (48.6%), C3 (33.3%), C0 (11.1%), C5 (9.7%), C5 and C6 (1.4% each) and C7 (4.2%). The most commonly fixated cervical spine levels in a study by Kidson (2001) were C7 (73.3%), C1 (46.6%), C0 (43.3%), C3 (28.3%), C6 (26.6%), C2 (18.3%) and C4 (11.6%).

The present study compares more favourably with Thomson (1999). Analysis of all three studies indicates that the upper cervical spine tends to be more commonly fixated among tension-type headache subjects.

#### 5.2.15 Active Myofascial Trigger Points

Refer to Table 10

Active myofascial trigger points of the posterior cervical muscles were more frequently found on the left side than the right. A total of 18% of patients had an active left trigger point one, and 13% had an active right trigger point one. Forty-two

percent of the patients had an active left trigger point two, and 35% had an active right trigger point two. Eighty percent of patients had an active left trigger point three, and 72% had an active right trigger point three.

The results of this study are consistent with that of Jansen (1998) who found that a total of 66.6% of patients in her study had an active trigger point three and 62.7% had an active trigger point two. This indicates that the posterior cervical muscles may contribute significantly to the tension-type headaches.

### 5.3 INTRA-GROUP ANALYSIS

#### 5.3.1 SUBJECTIVE DATA

##### 5.3.1.1 Numerical Pain Rating Scale (NRS 101)

Refer to Table 12

Analysis of the NRS 101 scores indicated a reduction in the subjective measure of pain for all patients at all three treatments. The mean ranks of all three groups at treatment one were similar ( $A = 2.97$ ;  $B = 2.83$  and  $C = 2.95$ ) indicating that the average pain intensity experienced during a headache episode prior to treatment was similar for all three groups. Thus the groups were considered similar and comparable with respect to the pain experienced during a headache episode, and this strengthened the statistical results from the study.

#### Group A

Test statistics indicated a significant difference in NRS 101 scores between treatments:  $p = 0.000$  ( $p < 0.01$ ) thus the null hypothesis is rejected for Group A. A statistically significant difference occurred between treatments 1 & 3, and treatments 1 & 5, with the greatest difference occurring between treatments 1 & 5. This indicates

a significant improvement in the patients pain levels till the third treatment, after which improvement is still noted, but is not significant enough.

Mean ranks decreased from 2.97 at treatment one to 1.83 at treatment three, to 1.20 at treatment five. Maximum and minimum NRS 101 scores decreased from 100 & 30 respectively at treatment one, to 80 & 0 respectively at treatment three, and 60 & 0 respectively at treatment five, indicating a reduction in pain levels as the treatments progressed.

#### Group B

A statistically significant difference was found between all treatments for group B:  $p = 0.000$  ( $p < 0.01$ ) thus the null hypothesis is rejected. The greatest difference was found between treatments 1 & 5, followed by treatments 3 & 5, and treatments 1 & 3. The reduction in pain levels were similar between treatments 1 & 3, and treatments 3 & 5, indicating a constant reduction in the subjective measure of pain throughout the study.

Mean ranks decreased from 2.83 at treatment one, to 2.03 at treatment three, and 1.15 at treatment 5. Maximum and minimum NRS 101 scores reduced from 100 & 50 respectively at treatment one, to 90 & 0 respectively at treatment three, and 80 & 0 respectively at treatment five, also indicating a reduction in the subjective measure of pain as the study progressed.

#### Group C

A statistically significant difference was found between all treatments for group C:  $p = 0.000$  ( $p < 0.01$ ) thus the null hypothesis is rejected for this group. The greatest difference was found between treatments 1 & 5, followed by treatments 3 & 5, and treatments 1 & 3.

Mean ranks decreased from 2.95 at treatment one to 1.92 at treatment three, to 1.13 at treatment five. The maximum and minimum NRS 101 scores reduced from 100 & 25 respectively at treatment one to 90 & 0 respectively at treatment three, and 60 & 0

respectively at treatment five, which also indicates a reduction in the perceived levels of pain as the treatments progressed.

#### **5.3.1.2 Headache Diary**

A significant reduction in the frequency, intensity and duration of headaches was noted for all three groups.

##### **Group A**

Refer to Table 13

Analysis of pre-treatment headache frequency compared to the frequency during treatment showed a statistically significant difference ( $p = 0.03$ ), thus the null hypothesis is rejected. The mean headache frequency decreased from 2.25 episodes per week prior to treatment, to 1.54 episodes per week during treatment. 14 patients experienced a reduction in the number of headache episodes per week, and in 2 patients the frequency of headaches remain unchanged. 4 patients experienced an increase in the number of headaches during treatment, but closer investigation of the data revealed a significant decrease in the intensity of duration of the headache in these patients.

Refer to table 14

Analysis of the pre-treatment headache intensity compared to the intensity during treatment indicated a statistically significant difference:  $p = 0.000$  ( $p < 0.01$ ) thus the null hypothesis is rejected. The mean headache intensity decreased from 6.45 (out of a score of 10) prior to treatment, to 1.91 at the end of the five treatments. All patients in group A experienced a reduction in the intensity of their headaches.

Refer to Table 15

A statistically significant difference:  $p = 0.000$  ( $p < 0.01$ ) was found when comparing pre-treatment headache duration to the headache duration during the study. The null hypothesis is thus rejected. Headache duration (in hours) decreased from an average of 6.5 hours per week prior to treatment, to 1.93 hours after treatment. 1 patient experienced an increase in the duration of their headaches but closer investigation of the data revealed a significant reduction in the headache intensity and frequency for this patient. 19 patients experience a reduction in the duration of their headaches.

#### Group B

Refer to Table 16

Analysis of pre-treatment headache frequency compared to the headache frequency during treatment revealed a statistically significant difference:  $p = 0.000$  ( $p < 0.01$ ) thus the null hypothesis is rejected. The mean headache frequency decreased from 4.2 episodes per week prior to treatment, to 1.73 episodes per week for the duration of the study. 17 patients experienced a reduction in the number of headaches experienced during treatment, and in 2 patients the headache frequency remained unchanged. 1 patient experienced an increase in the number of headaches during the course of the treatment but closer investigation of the data revealed a reduction in the headache intensity for this patient.

Refer to Table 17

Comparison of pre-treatment headache intensity to the intensity during treatment also revealed a statistically significant difference:  $p = 0.000$  ( $p < 0.01$ ). Thus the null hypothesis is rejected. The average headache intensity decreased from 7.2 (out of a score of 10) prior to treatment, to 2.21 following five treatments. All patients showed a reduction in the intensity of their headaches.

Refer to Table 18

A statistically significant difference was found in headache duration prior to treatment, in comparison to after five treatments. The average headache duration decreased from 7.7 hours per headache episode to 2.22 hours per episode. 17 patients experienced a reduction in the duration of their headaches during the study. 3 patients experienced an increase in the duration of their headaches, but closer investigation of the data revealed a reduction in the headache frequency and intensity for these patients.

### Group C

Refer to Table 19

Comparison of pre-treatment headache frequency with frequency during treatment did not reveal a statistically significant difference ( $p = 0.100$ ). The mean headache frequency decreased from 2.6 episodes to 1.95 episodes per week. 12 patients experienced a reduction in number of headaches experienced during treatment, 2 patients experienced an increase in the frequency of their headaches, and in 6 patients the headache frequency remained unchanged.

Refer to Table 20

The mean headache intensity decreased from 8.0 (out of a score of 10) prior to treatment, to 2.16 after five treatments, indicating a statistically significant difference  $p = 0.000$  ( $p < 0.01$ ). The null hypothesis is thus rejected. All patients experienced a reduction in the intensity of their headaches during treatment.



Refer to Table 21

A statistically significant difference was found in the pre-treatment headache duration compared to the duration during the study ( $p = 0.002$ ). The null hypothesis is thus rejected. Mean headache duration decreased from 8.68 hours per episode prior to treatment, to 2.31 hours during the study. 16 patients experienced a reduction in the duration of their headaches and 4 patients experienced an increase in their headache duration. A closer investigation of the data for these four patients revealed reductions in their headache frequencies and intensities, despite the increase in the headache duration.

### 5.3.2 OBJECTIVE DATA

#### 5.3.2.1 Myofascial Diagnostic Scale

Analysis of the Myofascial Diagnostic Scale (MFDS) scores for the duration of the study indicated a significant improvement in myofascial pain, and tenderness of trigger points of the posterior cervical muscles. Mean MFDS scores at treatment one for the groups were as follows: A = 10.85; B = 11.15 and C = 11.20, and mean ranks for the groups at treatment one were: A = 2.60; B = 2.92 and C = 2.90. These values were considered similar and comparable with respect to the degree of myofascial pain and tenderness felt at the posterior cervical muscles, and thus strengthened the statistical analysis of the data.

#### Group A

Refer to Table 22

Test statistics indicated a significant difference  $p = 0.000$  ( $p < 0.01$  between treatments, thus the null hypothesis is rejected. A statistically significant difference was found between treatments 1 & 3, and treatments 1 & 5.

Mean Ranks decreased from 2.60 at treatment one, to 1.88 at treatment three and 1.52 at treatment five. The highest maximum and minimum MFDS scores recorded at treatment one were 12 and 10 respectively, and reduced at 11 and 1 respectively at treatment five, indicating improvement in myofascial pain and tenderness of the posterior cervical muscles.

#### Group B

Refer to Table 23

A statistically significant difference was found between all three treatments:  $p = 0.000$  ( $p < 0.01$ ) thus the null hypothesis is rejected. The greatest difference was recorded between treatments 1 & 5, followed by treatments 1 & 3, and treatments 3 & 5, indicating a continuous improvement as the treatments progressed.

Mean ranks decreased from 2.92 at treatment one, to 1.91 at treatment three and 1.17 at treatment five. The maximum and minimum MFDS scores recorded at treatment one were 12 and 10 respectively and these decreased to 10 and 1 respectively at treatment five, indicating a reduction in myofascial pain and tenderness of the posterior cervical muscles.

#### Group C

Refer to Table 24

A statistically significant difference was noted between all treatments:  $p = 0.000$  ( $p < 0.01$ ) thus the null hypothesis is rejected. The greatest difference was noted between treatments 1 & 5, followed by treatments 1 & 3, and treatments 3 & 5.

Mean ranks decreased from 2.90 at treatment one, to 1.83 at treatment three, and 1.27 at treatment five. The maximum and minimum MFDS scores recorded at treatment one were 12 and 10 respectively, and these decreased to 10 and 1

respectively at treatment five, indicating a continuous improvement in myofascial pain and tenderness.

#### 5.3.2.2 Algometer readings

Algometer readings were indicative of the pressure pain thresholds of myofascial trigger points, and therefore also represented trigger point sensitivity. Analysis of these readings indicated a significant reduction in the trigger point sensitivity in all three groups as the treatments progressed.

#### Group A

Refer to Table 25

Statistically significant differences were found between all treatments for group A:  $p = 0.000$  ( $p < 0.01$ ) thus the null hypothesis is rejected. The greatest difference was noted between treatments 1 & 5, followed by treatments 3 & 5, and treatments 1 & 3, indicating an increasing improvement in trigger point sensitivity as the study progressed.

Mean ranks increased from 1.16 at treatment one, to 1.96 at treatment three and 2.88 at treatment five, indicating a constant level of improvement between the three treatments. The maximum algometer reading recorded at treatment one was 1.8 kg and at treatment five it was 2.30 kg. The minimum algometer reading recorded at treatment one was 1.10 kg and this improved to 1.35 kg at treatment five. Both these measurements indicate a significant improvement in the pressure pain thresholds of the posterior cervical muscle trigger points.

### Group B

Refer to Table 26

A statistically significant difference in pressure pain thresholds was found between all treatments:  $p = 0.000$  ( $p < 0.01$ ). The greatest difference was noted between treatments 1 & 5 followed by treatments 1 & 3, and treatments 3 & 5, indicating a constant decrease in trigger point sensitivity as the treatments progressed.

Mean ranks decreased from 1.07 at treatment one, to 2.04 at treatment three and 2.89 at treatment five. The maximum algometer reading at treatment one was 1.80 kg and increased to 2.30 kg at treatment five. The minimum algometer reading at treatment one was 1.00 and increased to 1.30 kg at treatment five. Both readings indicate that the pressure pain thresholds of the trigger points decreased slightly as the treatments progressed.

### Group C

Refer to Table 27

Analysis of algometer readings for group C showed a statistically significant difference between treatments:  $p = 0.000$  ( $p < 0.01$ ). The greatest difference was noted between treatments 1 & 5, followed by treatments 3 & 5, and treatments 1 & 3. This indicates an increasing improvement as the treatments progressed.

Mean ranks increased from 1.10 at treatment one, to 1.93 at treatment three and 2.97 at treatment five. The maximum algometer reading recorded at treatment one was 1.00 and increased to 1.10 at treatment five. The minimum algometer reading recorded at treatment one was 1.00 and increased to 1.10 at treatment five. Both readings indicate an improvement in the pressure pain thresholds as the treatments progressed.

## 5.4 INTER - GROUP ANALYSIS

### 5.4.1 SUBJECTIVE DATA

#### 5.4.1.1 Numerical Pain Rating scale (NRS 101)

Refer to Table 28

No statistically significant difference was noted between any of the groups with respect to the subjective levels of pain recorded.

#### 5.4.1.2 Headache Activity

##### Headache frequency

The average headache frequency of headaches per week, prior to treatment, for group A = 2.25, B = 4.20 and C = 2.60. Two groups were considered comparable with respect to pre-treatment headache frequency and this strengthens the statistical analysis of the study.

Refer to Tables 29 - 31

Group A showed a reduction from 2.25 episodes per week prior to treatment, to 1.54 episodes per week during treatment, representing a 32% reduction in the number of headaches experienced. Group B showed a reduction from 4.20 episodes per week prior to treatment, to 1.73 episodes per week during treatment, representing a 59% reduction in headache frequency. Group C showed a reduction in headache frequency from 2.60 episodes per week prior to treatment, to 1.95 episodes per week

during treatment, representing a 25% reduction in headache frequency during the study.

The above results indicate that Group B responded the best in terms of headache frequency, and experienced a reduction of more than half of their headaches. Groups A and C showed an almost equal response.

#### Headache Intensity

The average pre-treatment headache intensity (out of a score of 10) for group A = 6.45, B = 7.20 and C = 8.00. The groups were considered similar and comparable with respect to headache intensity, and this strengthens the statistical analysis of the study.

Headache intensity for group A decreased from 6.45 prior to treatment, to 1.9 during treatment, indicating a 70% reduction in pain experienced during a headache episode. Group B showed a reduction in headache intensity from 7.20 prior to treatment, to 2.22 during treatment, representing a 69.2% reduction in the intensity of their headaches. Group C showed a reduction from 8.00 prior to treatment, to 2.16 during treatment, a reduction of 73% in headache intensity.

The above results indicate that all groups experienced a significant and almost equal reduction in the intensity of their headaches, leading to the conclusion that all three interventions were equally effective in reducing the headache intensity.

#### Headache Duration

The average pre-treatment headache duration (in hours) for group A = 6.53, B = 7.70 and C = 8.68. The groups were considered similar and comparable with respect to the headache duration, and this strengthened the statistical analysis of the study.

Headache duration for group A decreased from 6.53 hours prior to treatment, to 1.93 hours during treatment, a 70% reduction in the duration of the headache. Group B headache duration decreased from 7.70 hours prior to treatment, to 2.22 hours

during treatment, a reduction of 71.2% in headache duration. Group C pre-treatment headache duration decreased from 8.00 hours to 2.31 hours during treatment, a reduction in headache duration of 71.1%.

All groups showed a significant reduction in headache duration, and an equal response to the interventions under study. However, when all three headache measures (frequency, intensity and duration) were assessed together for all groups, group B displays the best response to treatment. From this it can be concluded that a combination of spinal manipulative therapy and interferential current therapy is an effective short-term treatment in the management of episodic tension-type headaches.

#### 5.4.2 OBJECTIVE DATA

##### 5.4.2.1 Myofascial Diagnostic Scale (MFDS)

Refer to Table 32

The average MFDS scores at treatment one were 25.85 for group A, 36.05 for group B and 39.97 for group C. Two of the three groups were considered similar and comparable with respect to MFDS scores, and this strengthens the statistical analysis of the study.

A statistically significant difference in MFDS scores was found between the groups at treatment five. The greatest difference was noted between groups 1 & 2, followed by groups 1 & 3. A comparison of the MFDS scores at each treatment for each group showed that group A worsened during the study. Mean ranks for group A increased from 25.85 at treatment one, to 36.05 at treatment three and 39.97 at treatment five. Group B showed a reduction in mean ranks from 32.25 at treatment one, to 26.92 at treatment three, to 23.40 at treatment five. Group C showed a similar response to group B, with mean ranks decreasing from 33.40 at treatment one to 28.52 at treatment three. However, a negligible reduction occurred from 28.52 at treatment three, to 28.13 at treatment five. Thus, group B showed the greatest reduction, and consequently the best improvement in myofascial pain from the three groups.

#### 5.4.2.2. Algometer Readings

Refer to Table 33

No statistically significant difference was noted for algometer readings between the groups at each treatment, indicating that all groups showed a similar reduction in trigger point sensitivity and tenderness for the duration of the study.

Mean ranks at treatment one for group A = 81.03, B = 61.82 and C = 73.78. The number of trigger points recorded at the initial consultation were 44 for group A, 48 for group B and 51 for group C. the groups were considered similar and comparable with respect to trigger point sensitivity and the number of active trigger points at the initial consultation, and this strengthens that statistical analysis of the study.

At treatment three, the mean ranks decreased from 81.03 to 54.78 for group A, from 61.82 to 56.83 for group B and from 73.78 to 50.54 for group C. Group A showed the greatest reduction in trigger point sensitivity between treatments 1 & 3, followed by closely by group C. At treatment five, the mean ranks decreased from 54.76 to 34.98 for group A, from 56.83 to 35.82 for group B, and from 50.54 to 34.98 for group C. The mean ranks for all groups at treatment five were similar. However, group B showed the greatest reduction in trigger point sensitivity between treatments 3 & 5. Followed by group A and C. This indicates that all groups responded equally to treatment in terms of their reduction in trigger point tenderness and sensitivity.

Groups B and C showed an almost equal reduction in the number of active trigger points recorded during the study. 48 trigger points were recorded for group B at the initial consultation, and decrease to 14 at the final consultation, a decrease of 71%. 51 active trigger points were recorded at the initial consultation for group C, and decreased to 16 at the final consultation, a decrease of 69%. Group A recorded 44 active trigger points at the initial consultation, and this decreased to 41 at the final consultation, a decrease of 7%.

Although no statistically significant difference exists between the three groups for algometer readings, the above results indicate that group B responded better than groups A and C to treatment, and showed the greatest reduction in the number of active trigger points, as well as trigger point sensitivity.



## **5.5 PROBLEMS ENCOUNTERED WITH THE SUBJECTIVE AND OBJECTIVE DATA**

Few problems were encountered during the course of the study. Fourteen patients were dropped from the study due to non-compliance with the attendance criteria and were quickly replaced. The remainder of the patients complied with the terms and regulations of the study, and adhered to the treatment protocol and schedule. A small proportion of patients initially found difficulty in understanding how to complete the headache diaries, but a repeated explanation by the researcher solved this problem. No problems were experienced with the NRS 101 scales as they were completed in the presence of the researcher. The myofascial diagnostic scale however, proved to be inadequate for the present study. The MFDS is designed to assess the pressure pain threshold of a single trigger point per muscle, and the majority of patients in the present study had more than one active trigger point of the posterior cervical muscles. In addition, although many trigger points remained active for the duration of the study, the zone of referred pain and intensity of the pain reduced considerably in many patients. Accommodation will have to be made for these on the MFDS, as will be discussed under "Recommendations." One patient in group B presented with active trigger points at treatment 1, for which she received SMT and IFC. At treatment 3 the trigger points were latent, and no IFC was administered. At treatment 4 the trigger points reactivated, and IFC was continued. At treatment 5 the trigger points became latent again. This pattern may have biased the results to a small degree. It would have been of interest to note what effect IFC had on this patient at all treatments, even though the trigger points were latent.

No side effects were noted by any of the patients. Most of the patients indicated that they would continue treatment for their headaches in this manner.

## **5.6 COMPARISON OF THIS STUDY WITH PAST RESEARCH**

The Male: Female ratio for the present study was 1: 2.16, consistent with the findings of Weisberg *et al.* (1989) and Rasmussen (1991) who found greater male: female ratio's in their studies as well.

Stress and tension were identified as the most frequent causative factor, or precipitating factor of the headache, a consistent finding between the present study and Rasmussen (1993). Rasmussen (1993) also found that smoking, posture, climatic changes, menstruation and activity affected the headaches, all of which were found in the present study as well.

The majority of patients in this study presented with headaches in a combination of locations, a finding also supported by Vernon *et al.* (1992). Vernon *et al.* (1992) found that tension-type headache sufferers demonstrated high occurrences of occipital and neck pain during a headache episode, as well as tender points in the cervical region, another consistency with the present study. These findings support the hypothesis that the neck plays an important role in the manifestation of the headache.

Patients in the present study exhibited pericranial and cervical muscle tenderness and were examined for pressure pain thresholds. Hyung-Suk *et al.* (1995) demonstrated that decrease pain pressure thresholds of the pericranial muscles is related to tension-type headache.

Muller (1999) and Jansen (1998) found that tension-type headaches were positively associated with active myofascial trigger points of the posterior cervical muscles, and this study demonstrated that treatment to these trigger points does indeed impact favourably on the headache.

Joint fixations were identified in all patients in the present study, and quite often fixations were identified in more than one direction. These findings compare favourably to those of Kidson (2001) who found motion restrictions in more than one direction, and proposed that musculo-skeletal dysfunction of the neck is a contributing factor in the pathogenesis of tension-type headache.

Penter (1994) and De Busser (2001) compared the effects of spinal manipulative therapy of the cervical spine in combination with non-specific soft tissue therapy of the neck muscles, to non-specific soft tissue therapy alone, and found that the soft tissue therapy favourably influenced the headache. Bove and Nilsson (1998) performed a similar study and also found that soft tissue therapy to the neck muscles reduced the daily duration of the headache, and analgesic intake.

Statistical analysis of the results of the current study indicated that all groups responded to the interventions under study. Spinal manipulative therapy (SMT) alone

was not found to be more effective in the management of episodic tension-type headache than a combination of treatments, a finding consistent with Bove and Nilsson (1998), Vernon (1982), Mootz et al. (1994), Vernon (1992), Boline et al. (1995) and Rasmussen (1993).

Unfortunately no prior studies have been documented investigating specific myofascial trigger point therapy of the posterior cervical muscles in the treatment of adult episodic tension-type headache to determine the effect of myofascial trigger point therapy (MFTPT) on the headache. The results of this study indicate that the both groups that received MFTPT showed a greater improvement than the group receiving SMT alone, indicating that myofascial pain may contribute significantly to the headache, and thus treatment of the active trigger points does improve all aspects of the headache.

## CHAPTER SIX

### CONCLUSIONS AND RECOMMENDATIONS

#### 6.1 CONCLUSIONS

Inter-group and intra-group analysis of subjective and objective that indicated that all three groups responded favourably to the treatment.

Group A showed a reduction of 59.6% in NRS 101 scores, and 41.5% in myofascial diagnostic scale scores from the first to the fifth treatments. No statistically significant difference was found in the headache frequency before and during treatment.

Headache intensity reduced by 70.1% and the headache duration decreased by 70.0% of their normal levels. Fourteen patients experienced a reduction in headache frequency, all patients experienced a reduction in headache intensity, and 19 patients experienced a reduction in their headache duration. Pressure pain thresholds improved by 1.72kg over the five treatments, and the number of active trigger points decreased by 7% of their original number.

Group B demonstrated a reduction of 59.4% in NRS 101 scores, and 59.9% in myofascial diagnostic scale scores for the duration of the study. Headache frequency decreased by 59.0%, intensity decreased by 69.2% and the duration decreased by 71.2%. Seventeen patients experienced a reduction in their headache frequencies, all patients experienced a reduction in their headache intensities, and 17 patients experienced a reduction in their headache duration. Pressure pain thresholds improved by 1.82kg from the first to the fifth treatments, and the number of active trigger points decreased by 71% of their original number.

Group C experienced a reduction of 61.6% in subjective pain levels, as recorded by the NRS 101, and 56.2% in the myofascial diagnostic scale scores for the duration of the study. No statistically significant difference was found for the headache frequency between the first and fifth treatments. Headache intensity decreased by 73% and headache duration decreased by 71.1%. Twelve patients experienced a reduction in their headache frequency, all patients experienced a reduction in headache intensity, and 16 patients experienced a reduction in their headache duration.

Pressure pain thresholds improved by 1.87 kg from the first to the fifth treatments, and the number of active trigger points decreased by 69% of their original number.

The above results indicate that all groups showed an almost equal response to the treatment. However, group B showed a slightly greater improvement in trigger point tenderness and sensitivity than the other two groups. Headache intensity and duration decreased equally among all groups, but only group B showed a significant improvement in headache duration as well. Pressure pain thresholds improved equally among the three groups, and the number of active trigger points decreased by almost the same percentage for groups B and C.

### **FINAL CONCLUSION**

The results of this study indicate that specific myofascial trigger point therapy (in the form of interferential current therapy) is equally as effective as spinal manipulative therapy in the short-term management of adult episodic tension-type headaches. However, a combination of spinal manipulative therapy and interferential current therapy produces a slightly better improvement in all aspects of the headache and its associated pain, than either intervention by itself, as evidenced by the above results.

This study also supports the hypothesis that pericranial muscle tenderness is positively associated with episodic tension-type headache, and contributes significantly to the clinical presentation of the headache.

A combination of spinal manipulative therapy and interferential current therapy would therefore be the treatment of choice in the short-term management of adult episodic tension-type headache.

### **6.2 RECOMMENDATIONS**

The Numerical Pain Rating scale 101 was easy to administer and analyse, and is recommended for use in future studies to assess the subjective level of pain. The Algometer was easy to use and caused no excess discomfort to the patient. The

Headache diary should be modified to include a 24-hr period that begins at 12 am and ends at 12 am the following morning, so that it becomes easier to understand. The myofascial diagnostic scale proved to be inadequate for the present study. Modifications to the format should be made to enable the assessment of more than one trigger point on the same sheet. In many patients trigger point remained active, but the extent of the zone of referred pain and the intensity of the referred pain reduced by as much as 60%. Therefore, the fourth indicator of the 'presence of referred pain in the zone of reference' should be further sub-graded to accommodate for reductions in trigger point pain reference.

The present study investigated the short-term effects of myofascial trigger point therapy in the treatment of adult episodic tension-type headaches. A pre-treatment headache evaluation for a minimum of two weeks is recommended, as is a two-week post-treatment headache evaluation, to determine the intermediate long-term effects of myofascial trigger point therapy in the management of adult episodic tension-type headache.

More local studies are needed investigating all aspects of tension-type headaches among the South African population, which can be used in future studies for statistical purposes.

Further studies could investigate other types of myofascial trigger point therapies commonly used, to other pericranial muscles, to determine the role that these muscles could possibly play in the pathogenesis of the headache.

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## APPENDIX 1

### INFORMED CONSENT FORM (To be completed in Duplicate by Patient/Subject)

**Date:** \_\_\_\_\_

**Title of Research:**            **The effectiveness of Myofascial trigger point therapy in the treatment of Episodic tension-type headache in Adults. A comparison of 3 Manual Interventions applied to the Posterior Cervical Musculature.**

**Name of Supervisor:**        **Dr. T. MacDougall (Ph: 031-204 2205)**

**Name of research Student : Ashna Prithipal (Ph: 031-204 2205)**

**Please circle the appropriate answer**

**YES      NO**

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

**If you have answered No to any one of the above, please obtain the information before signing.**

**Please print in Block letters:**

**Patient/Subject name:** \_\_\_\_\_ **Signature:** \_\_\_\_\_

**Witness Name:** \_\_\_\_\_ **Signature:** \_\_\_\_\_

**Research Student Name :** \_\_\_\_\_ **Signature:** \_\_\_\_\_

## APPENDIX 2

### DURBAN INSTITUTE OF TECHNOLOGY: CHIROPRACTIC CLINIC LETTER OF INFORMATION.

TITLE OF RESEARCH: The effectiveness of Myofascial trigger point therapy in the treatment of Episodic tension Type headaches in Adults: A comparison of 3 Manual Therapies applied to the Posterior Cervical Musculature.

PRINCIPAL INVESTIGATOR: A. Prithipal (Chiropractic Intern) (031 - 204 2205)

SUPERVISOR: Dr. T. MacDougall (031- 204 2205)

Dear Participant,

Thank you for considering enrolling in this study.

The purpose of this study is to investigate the effect of three different types of treatments in Episodic tension-type headaches. 60 patients in total will be chosen for the study, and they will be randomly divided into 1 of 3 groups. Patients in the first group will receive a manipulation of the Cervical spine, patients in the second group will receive a manipulation and Interferential Current therapy to the Posterior Cervical muscles of the neck, and patients in the third group will receive Interferential Current therapy only. Some patients may experience post-manipulation neck soreness following the adjustment, but this is temporary. Patients receiving IFC may develop a slight skin irritation, which is also temporary.

The study consists of Five (5) treatments given over a two-week period. As a patient, you will be required to attend all five treatments within the allocated two weeks. During this period you will not be allowed to consume any medication for your headache. If you do, you will be excluded from the study. You will be free to withdraw from the study at any time, should you wish, with no explanation required. However, you may be excluded from the study if you:

1. fail to comply with the rules of the study
2. undergo any kind of operation
3. sustain any injury to the head and/or neck
4. develop any illness/disorder that may be a contra-indication to you receiving Spinal Manipulative therapy or Interferential Current therapy e.g.
  - ~ tumors, fever, infections, inflammations, TB, osteomyelitis
  - ~ arthritis, severe osteoporosis, calcification/ossification of soft tissue structures, bursitis, spondylolisthesis
  - ~ neurological or muscular problems
  - ~ thrombosis, or where hemorrhage is a possibility
  - ~ in patients with a pacemaker
  - ~ pregnancy



All treatments will be free of charge as long as you remain part of the study.

Patient confidentiality will be maintained at all times, even after the conclusion of the study. No patient information will be revealed in any published literature at any time.

Should you have any queries/questions regarding the study, please feel free to contact the researcher or the Supervisor on the above numbers.

Thank You.

A.Prithipal  
(Research Intern)

**APPENDIX 3**  
**DURBAN INSTITUTE OF TECHNOLOGY**  
**CHIROPRACTIC DAY CLINIC**  
**CASE HISTORY**

Patient: ..... Date: .....

File # : ..... Age : .....

Sex : ..... Occupation: .....

Intern : ..... Signature: .....

**FOR CLINICIANS USE ONLY:**

Initial visit

Clinician: ..... Signature : .....

**Case History:**

Examination:

Previous:

Current:

X-Ray Studies:

Previous:

Current:

Clinical Path. lab:

Previous:

Current:

**Case Status:**

PTT:	Signature:	Date:
------	------------	-------

**CONDITIONAL:**

Reason for Conditional:

Signature:	Date:
------------	-------

Conditions met in Visit No:	Signed into PTT:	Date:
-----------------------------	------------------	-------

Signed off:	Date:
-------------	-------

**Intern's Case History:**

1. **Source of History:**
2. **Chief Complaint : (patient's own words):**
3. **Present Illness:**

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

Complaint 1	Complaint 2

4. **Other Complaints:**

5. **Past Medical History:**

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

**6. Current health status and life-style:**

- Allergies
- Immunizations
- Screening Tests incl. xrays
- Environmental Hazards (Home, School, Work)
- Exercise and Leisure
- Sleep Patterns
- Diet
- Current Medication  
Analgesics/week:
- Tobacco
- Alcohol
- Social Drugs

**7. Immediate Family Medical History:**

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

**8. Psychosocial history:**

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

## 9. Review of Systems:

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

## APPENDIX 4

**DURBAN INSTITUTE OF TECHNOLOGY**  
**CHIROPRACTIC DAY CLINIC**  
**PHYSICAL EXAMINATION**

Patient: \_\_\_\_\_ File#: \_\_\_\_\_ Date: \_\_\_\_\_

Clinician: \_\_\_\_\_ Signature: \_\_\_\_\_

Student: \_\_\_\_\_ Signature: \_\_\_\_\_

1. VITALS

Pulse rate:

Respiratory rate:

Blood pressure:                      R                      L

**Medication if hypertensive:**

Temperature:

Height:

Weight: Any change Y/N If Yes : how much gain/loss \_\_\_\_\_  
Over what period \_\_\_\_\_

## 2. GENERAL EXAMINATION

**General Impression:**

Skin:

**Jaundice:**

Pallor: .

**Clubbing:**

**Cyanosis (Central/Peripheral):**

### Oedema:

### Lymph nodes - Head and neck:

- Axillary:

- Epitrochlear:

- Inguinal:

**Urinalysis:**

### 3. CARDIOVASCULAR EXAMINATION

### 1) Is this patient in Cardiac Failure ?

2) Does this patient have signs of Infective Endocarditis ?

3) Does this patient have Rheumatic Heart Disease ?

**Inspection**

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

**Palpation:**

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

- Pulses:**
- General Impression:
  - Radio-femoral delay:
  - Carotid:
  - Radial:
  - Dorsalis pedis:
  - Posterior tibial:
  - Popliteal:
  - Femoral:
- Percussion:** - borders of heart
- Auscultation:** - heart valves (mitral, aortic, tricuspid, pulmonary)  
 - Murmurs (timing, systolic/diastolic, site, radiation, grade).

#### 4. RESPIRATORY EXAMINATION

1) Is this patient in Respiratory Distress ?

- Inspection**
- Barrel chest:
  - Pectus carinatum/cavinatum:
  - Left precordial bulge:
  - Symmetry of movement:
  - Scars:
- Palpation**
- Tracheal symmetry:
  - Tracheal tug:
  - Thyroid Gland:
  - Symmetry of movement (ant + post)
  - Tactile fremitus:
- Percussion**
- Percussion note:
  - Cardiac dullness:
  - Liver dullness:
- Auscultation**
- Normal breath sounds bilat.:
  - Adventitious sounds (crackles, wheezes, crepitations)
  - Pleural frictional rub:
  - Vocal resonance
    - Whispering pectoriloquy:
    - Bronchophony:
    - Egophony:

#### 5. ABDOMINAL EXAMINATION

1) Is this patient in Liver Failure ?

- Inspection**
- Shape:
  - Scars:
  - Hernias:
- Palpation**
- Superficial:
  - Deep = Organomegally:
  - Masses (intra- or extramural)
  - Aorta:
- Percussion**
- Rebound tenderness:
  - Ascites:
  - Masses:
- Auscultation**
- Bowel sounds:
  - Arteries (aortic, renal, iliac, femoral, hepatic)

## Rectal Examination

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

## 6. G.U.T EXAMINATION

External genitalia:

Hernias:

Masses:

Discharges:

## 7. NEUROLOGICAL EXAMINATION

### Gait and Posture

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

### Higher Mental Function

- Information and Vocabulary:
- Calculating ability:
- Abstract Thinking:

### G.C.S.:

- Eyes:
- Motor:
- Verbal:

### Evidence of head trauma:

### Evidence of Meningism:

- Neck mobility and Brudzinski's sign:
- Kernigs sign:

### Cranial Nerves:

#### I Any loss of smell/taste:

Nose examination:

#### II External examination of eye:

- Visual Acuity:
- Visual fields by confrontation:
- Pupillary light reflexes = Direct:
- = Consensual:
- Fundoscopy findings:

#### III Ocular Muscles:

Eye opening strength:

#### IV Inferior and Medial movement of eye:

- V
- a. Sensory
    - Ophthalmic:
    - Maxillary:
    - Mandibular:
  - b. Motor
    - Masseter:
    - Jaw lateral movement:
  - c. Reflexes
    - Corneal reflex
    - Jaw jerk

#### VI Lateral movement of eyes



- VII a. Motor - Raise eyebrows:  
                                   - Frown:  
                                   - Close eyes against resistance:  
                                   - Show teeth:  
                                   - Blow out cheeks:  
       b. Taste - Anterior two-thirds of tongue:

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

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

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

- XII Inspection of tongue (deviation):

**Motor System:**

- a. Power  
    - Shoulder = Abduction & Adduction:  
                   = Flexion & Extension:  
    - Elbow = Flexion & Extension:  
    - Wrist = Flexion & Extension:  
    - Forearm = Supination & Pronation:  
    - Fingers = Extension (Interphalangeals & M.C.P's):  
    - Thumb = Opposition:  
    - Hip = Flexion & Extension:  
               = Adduction & Abduction:  
    - Knee = Flexion & Extension:  
    - Foot = Dorsiflexion & Plantar flexion:  
               = Inversion & Eversion:  
               = Toe (Plantarflexion & Dorsiflexion):  
 b. Tone  
    - Shoulder:  
    - Elbow:  
    - Wrist:  
    - Lower limb - Int. & Ext. rotation:  
    - Knee clonus:  
    - ankle clonus:  
 c. Reflexes  
    - Biceps:  
    - Triceps:  
    - Supinator:  
    - Knee:  
    - Ankle:  
    - Abdominal:  
    - Plantar:

## **Sensory System:**

- a.     Dermatomes
  - Light touch:
  - Crude touch:
  - Pain:
  - Temperature:
  - Two point discrimination:
- b.     Joint position sense
  - Finger:
  - Toe:
- c.     Vibration:
  - Big toe:
  - Tibial tuberosity:
  - ASIS:
  - Interphalangeal Joint:
  - Sternum:

## **Cerebellar function:**

Obvious signs of cerebellar dysfunction:

- = Intention Tremor:
- = Nystagmus:
- = Truncal Ataxia:

Finger-nose test (Dysmetria):

Rapid alternating movements (Dysdiadochokinesia):

Heel-shin test:

Heel-toe gait:

Reflexes:

Signs of Parkinsons:

## **8.     SPINAL EXAMINATION:(See Regional examination)**

Obvious Abnormalities:

Spinous Percussion:

R.O.M:

Other:

## **9.     BREAST EXAMINATION:**

Summon female chaperon.

- Inspection**
  - Hands rested in lap:
  - Hands pressed on hips:
  - Arms above head:
  - Leaning forward:
- Palpation**
  - masses:
  - tenderness:
  - axillary tail:
  - nipple:
  - regional lymph nodes:

**DURBAN INSTITUTE OF TECHNOLOGY**  
**REGIONAL EXAMINATION - CERVICAL SPINE**

Patient: ..... File No: .....

Date: ..... Student: .....

Clinician: ..... Sign: .....

**OBSERVATION:**

Posture  
 Swellings  
 Scars, discolouration  
 Hair line  
 Body and soft tissue contours

Shoulder position

Left :

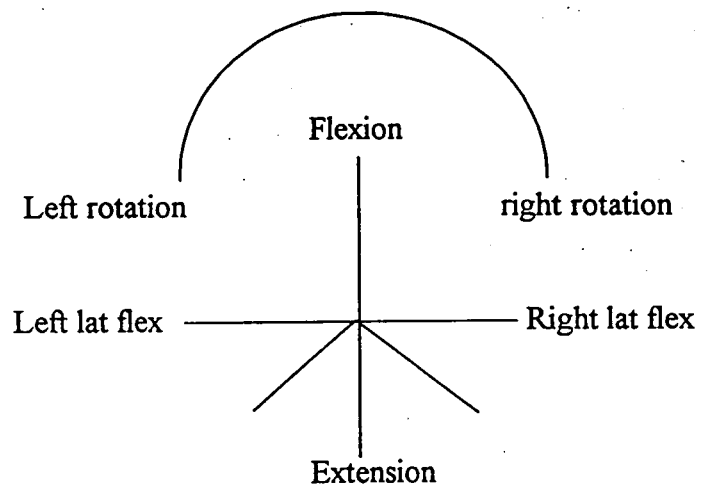
Right :

Shoulder dominance ( hand ):

Facial expression:

**RANGE OF MOTION:**

Extension ( 70°):  
 L/R Rotation ( 70°):  
 L/R Lat flex (45°):  
 Flexion ( 45°):



**PALPATION:**

Lymph nodes  
 Thyroid Gland  
 Trachea

**ORTHOPAEDIC EXAMINATION:**

Tenderness		Right	Left
Trigger Points:	SCM		
	Scalenii		
	Post Cervicals		
	Trapezius		
	Lev scapular		

	Right	Left		Right	Left
Doorbell sign			Cervical compression		
Kemp's test			Lateral compression		
Cervical distraction			Adson's test		
Halstead's test			Costoclavicular test		
Hyper-abduction test			Eden's test		
Shoulder abduction test			Shoulder compression test		
Dizziness rotation test			Lhermitte's sign		
Brachial plexus test					

# NEUROLOGICAL EXAMINATION:

Dermatones	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					
Cerebellar tests:		Left		Right				
Disdiadochokinesis								

VASCULAR:	Left	Right		Left	Right
Blood pressure			Subclavian arts.		
Carotid arts.			Wallenberg's test		

## MOTION PALPATION & JOINT PLAY:

Left: Motion Palpation:  
Joint Play:  
Right: Motion Palpation:  
Joint Play:

Upper Thoracics:  
Motion Palpation:  
Joint Play:

BASIC EXAM: SHOULDER:  
Case History:

BASIC EXAM: THORACIC SPINE:  
Case History:

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

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

**APPENDIX 6**

**Numerical Rating Scale - 101 Questionnaire**

Date: \_\_\_\_\_ File no: \_\_\_\_\_ Visit no: \_\_\_\_\_

Patient name: \_\_\_\_\_

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

Please write only **one** number.

\_\_\_\_\_

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

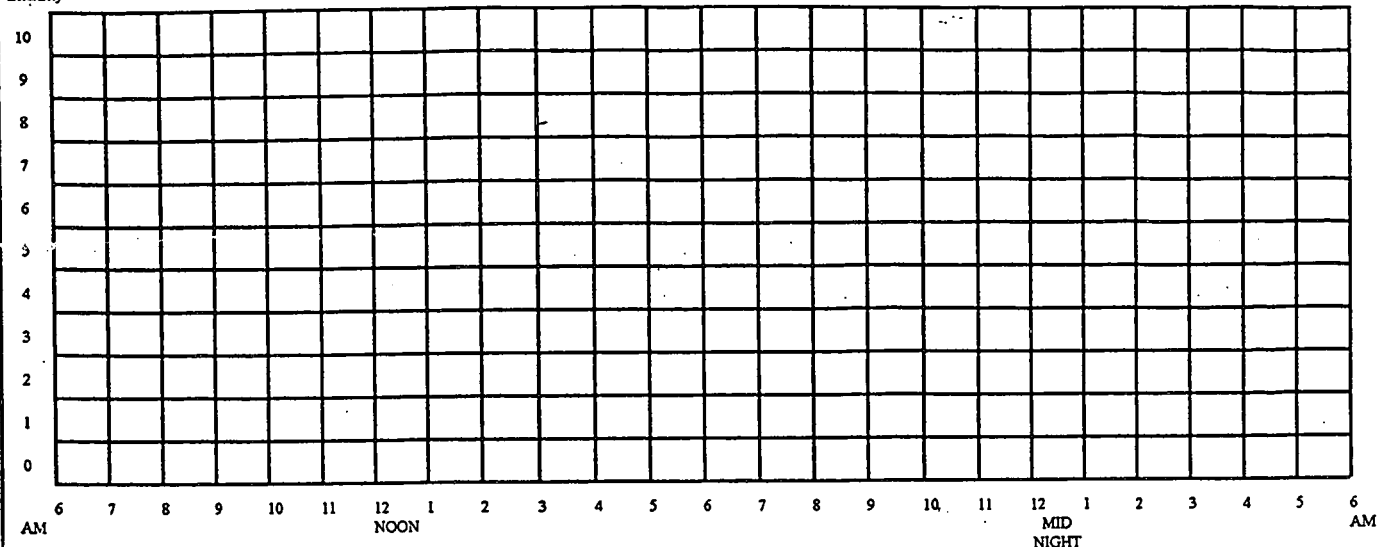
Please write only **one** number.

\_\_\_\_\_

# APPENDIX 7

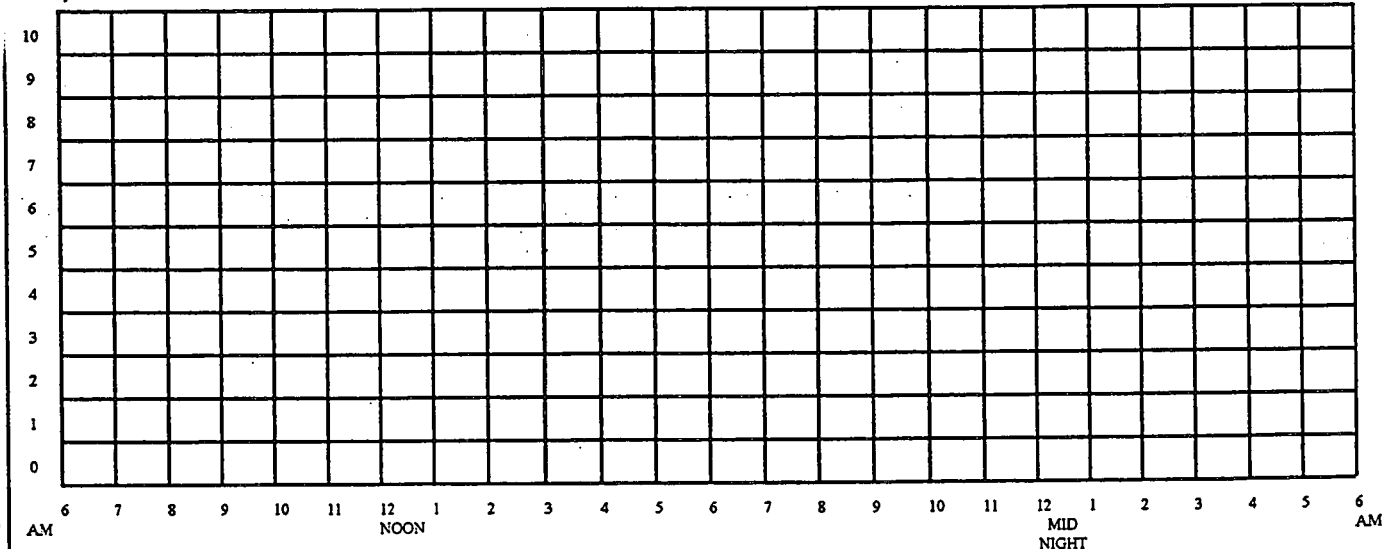
NAME: ..... Date: .....

Intensity



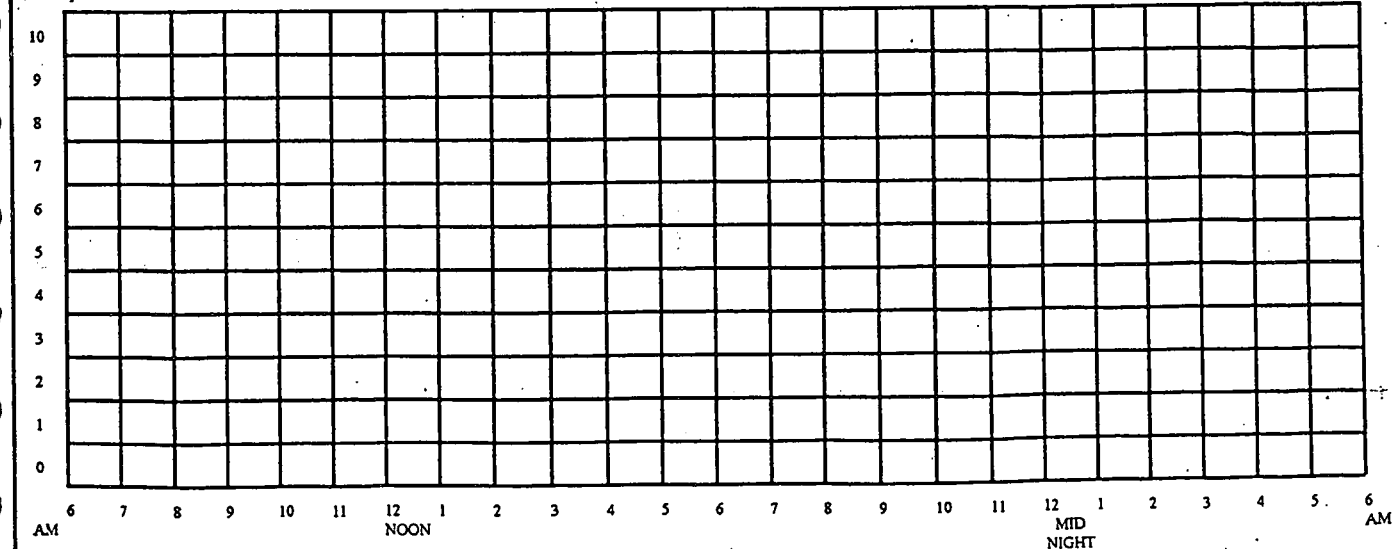
NAME: ..... Date: .....

Intensity



NAME: ..... Date: .....

Intensity



## APPENDIX 8

### Myofascial Diagnostic Scale

Patient's Name: \_\_\_\_\_  
Treatment No. \_\_\_\_\_

Muscle: \_\_\_\_\_

Circle the appropriate  
Letter A B C D

**Signs:**

- |     |   |   |
|-----|---|---|
| 1)  | Soft tissue tenderness  |   |
|     | Grade   |   |
| 0   | No tenderness   | 0 |
| i   | Tenderness to palpation WITHOUT Grimace or flinch   | 1 |
| ii  | Tenderness WITH grimace and/or Flinch to palpation  | 2 |
| iii | Tenderness with WITHDRAWAL ("Jump sign")  | 3 |
| iv  | Withdrawal ("Jump sign") To non-noxious stimuli (ie. Superficial palpation, pin prick, gentle percussion) | 4 |
| 2)  | Snapping palpation of the trigger point evokes a local twitch response.                                   | 4 |
| 3)  | The trigger point is found in a palpable taut band.   | 4 |
| 4)  | Moderate, sustained pressure on the trigger point Causes or intensifies pain in reference zone.           | 5 |

Total

**APPENDIX 9**

**ALGOMETER MEASUREMENTS**

**Posterior cervical muscle**

Patient Name:.....

File No:

Date:.....			Visit No: 1
TP	LEFT	RIGHT	
1			
2			
3			
Date:.....		Visit No: 3	
1			
2			
3			
Date:.....		Visit No: 5	
1			
2			
3			