THE RELATIVE EFFECTIVENESS OF CHIROPRACTIC MANIPULATION IN CONJUNCTION WITH SOFT TISSUE TREATMENT, AS COMPARED WITH SOFT TISSUE TREATMENT ALONE, IN THE MANAGEMENT OF TENSION-TYPE HEADACHES IN CHILDREN.

A dissertation submitted to the Faculty of Health, Technikon Natal, in partial compliance with the requirements for the Master's Degree in Technology: Chiropractic.

By

Nikki Lauren de Busser

I, Nikki Lauern de Busser, do hereby declare this dissertation is representative of my own work, both in concept and execution, except where otherwise indicated in the text.

22/01/01

Nikki Lauren de Busser Date

Approved for final submission

22/01/01

Dr. C. S. Penter Date
M.Dip.C (SA) CCSP (USA)
Supervisor

ACKNOWLEDGEMENTS

First and foremost, to the Almighty God for granting me the strength and ability to complete these past six years.

To my parents, who's support and belief in me has been unwavering and for all their help with my research. Thanks for keeping me going. To the rest of my family and to my friends, especially Johan and Lynn, for your assistance, encouragement and prayer support.

To Dr Chris Penter, for his advice and speedy marking.

To Jacque Cloete for his assistance with the statistics of this study.

Finally, thank you to all the patients involved in this study and without whom this study would not have been possible. A special thanks to Sister Woods and the boys from the Glenwood Boarding Establishment.

ABSTRACT

Episodic tension-type is a highly prevalent condition with a significant functional impact at home and school (Schwartz et al. 1998). In children as in adults, it is the most common form of headache that a chiropractor will encounter in clinical practice (Davies 2000). The purpose of this study was to investigate the relative effectiveness of chiropractic manipulation in conjunction with soft tissue treatment, as compared with soft tissue treatment alone, in the management of Episodic tension-type headache in children and adolescents.

It was hypothesised that manipulation in conjunction with soft tissue treatment would provide a significant long-term benefit in comparison to soft tissue treatment alone. This study was performed as a clinical trial conducted at the Technikon Natal Chiropractic Day Clinic. Thirty children between the ages of eight to eighteen presenting with Episodic tension-type headache were selected to participate in the study and were randomly allocated into two equal groups.

Patients in both groups were treated six times over a period of three weeks and were monitored with respect to their headache using a headache diary for one week prior to and one week following the course of treatment. A final assessment was performed once the patients had completed the headache diary for the second time. Both groups received a ten minute massage of the cervical and upper thoracic musculature, while patients in group A received chiropractic manipulation of the cervical and upper thoracic spine as well.

The subjective responses of each patient were recorded by means of the Short-form McGill Pain Questionnaire, a headache questionnaire and headache diary. The McGill was completed at the first and eighth visits, the headache questionnaire at the first visit and the headache diary for one week prior to and one week following the course of treatment. The objective data consisted of pressure pain sensitivity measurements obtained by Algometer readings taken at the superior and middle portion of the Sternocleidomastoid muscle and at the trapezius insertion on the first, fifth and eighth visits. The subjective and objective was analysed using the two-sample unpaired t-test and the Mann-Whitney U-test for inter-group comparison with respect to each continuous and categorical variable. The two-sample paired t-test and the Wilcoxon signed ranks test were used for intra-group comparison with respect to each continuous and categorical variable. The degree of significance was set at a 95% level of confidence ($\alpha = 0.05$) and data was commented on if it reached a 90% level of confidence.

A statistically significant improvement in headache frequency was recorded at week five for both groups A and B. No significant changes were noted in terms of headache duration, severity and level of distress caused for either group, although group A showed a trend toward reduction in headache duration. In terms of the objective findings, group A showed statistically significant improvements in pain pressure sensitivity as recorded by the Algometer for all three muscles tested on the left from visits two to five, five to eight and two to five, and on the right from visits two to five. No such changes were noted for group B. In terms of inter-group analysis, a significant result was recorded in favour of group A for pain pressure sensitivity at the middle portion of the sternocleidomastoid muscle on the left at visit eight. Aside from this result, there were no other statistically significant changes recorded during or following treatment.

In comparing the two different forms of treatment, manipulation in conjunction with soft tissue with soft tissue alone, manipulation was not found to be more effective than soft tissue treatment, contrary to the proposed hypothesis. Both treatments however were successful in reducing the frequency of headache the children experienced and manipulation reduced pericranial tenderness associated with headache. Both forms of treatment may be of some benefit in the management of Episodic tension-type headache in children and adolescents.

TABLE OF CONTENTS

LIST OF TABLES, GRAPHS AND PIE CHARTS

APPENDICES

DEFINITIONS

Adjustment – A specific form of direct articular manipulation utilising either long or short leverage techniques with specific contacts, characterised by a dynamic thrust of controlled velocity, amplitude and direction (Gatterman 1990:405).

Chiropractic – A system of therapeutics that attributes disease to dysfunction of the nervous system, and attempts to restore normal function by manipulation and treatment of the body structures especially those of the vertebral column (Dorland 1982:141)

Drugs – Those chemical substances prescribed by a medical doctor for the treatment and prevention of disease.

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 the joint is in movement (Gatterman 1990:408).

Headache – A diffuse pain in different portions of the head and neck and not confined to any nerve distribution area. The medical term for headache is cephalalgia. The pain varies in intensity from mild to severe and may be either acute or chronic (Jones 1999:241,346).

Manipulation – Manual procedure that involves a direct thrust to move a joint past the physiological range of motion, without exceeding the anatomical limit (Gatterman 1995:474), with the object of restoring mobility to restricted areas (Gatterman 1990:410).

Motion Palpation – Palpatory diagnosis of passive and active segmental joint range of motion (Gatterman 1995:474).

Subluxation – A motion segment, in which alignment, movement integrity, and/or physiologic function are altered although contact between joint surfaces remains intact (Gatterman 1995:475).

CHAPTER ONE

1. Introduction

Headache is an extremely common complaint in the industrialised world (Nilsson 1997:12). According to Diamond (1987:172) of all the headache patients seen by the general practitioner, 80% suffer from tension-type headache, the greatest onset occurring during the second decade of life (Rasmussen 1993:67).

Episodic tension-type headache is a highly prevalent condition with a significant functional impact at home and school. Chronic tension-type headache is much less prevalent than Episodic tension-type headache. Despite its greater individual impact, chronic tension-type headache has a smaller societal impact than Episodic tension-type headache (Schwartz et al. 1998:381).

Although the paediatric chiropractic practice often is sought out for childhood conditions, tension-type headache is more common than most doctors realise (Anrig 1995:1). Lewit (1991:20) reports that the majority of child patients presenting a real problem are those who suffer from headache, commonly tension-type headache. He proposes the cervical spine to be one of the most frequent causative sites. Symptoms begin before twenty years of age in 40% of patients with tension-type headache (Raskin 1988:216). King and Sharpley (1990) studied tension-type headache and migraine activity in children and adolescents and found that those children who experienced these types of headache were absent from school more often than the headache free children were. The children also reported that their headache affected their ability to concentrate in class and on their homework.

When a child first complains of headache, parents often seek medical attention to rule out a brain tumour or other serious condition (Anrig 1995:1). According to a headache survey conducted by Lewis et al. (1996:227), children require three answers from their physician: "Do I have a serious or life-threatening disease?", "What is the cause of my headache?" and "What will make it better?" Once the child has been examined and is diagnosed with tension-type headache, it usually starts down the path of having to learn "to live with it"(Anrig 1995:1).

A wide variety of treatment for Episodic tension-type headache is offered, that variety often being due to different practitioners focusing on their field of expertise. Medical management is primarily drug orientated. If there is no underlying organic disease or history of trauma, symptomatic relief medication is usually given. A wide variety of preparations have been and are currently used to relieve headache symptoms. Analgesics and non-steroidal anti-inflammatory drugs are most commonly given. However, the list may include anti-emetics, ergotamines, 5-HT agonists and dopamine antagonists (Anrig & Plaugher 1998). Other forms of treatment include massage of the neck muscles (Penter 1994), relaxation techniques (Haynes et al. 1976) and biofeedback of the pericranial muscles (Chesney & Shelton 1976). Injection of tender points may also be advocated in managing tension-type headache (Travell & Simons 1983:202). The use of chiropractic cervical manipulation in adults has been shown in numerous studies to provide both immediate and long-term benefits to patients suffering from tension-type headache (Vernon 1995, Boline et al. 1995).

The purpose of this study was to determine the relative effectiveness of chiropractic manipulation with soft tissue treatment, as compared with soft tissue treatment alone, in the management of tension-type headache in children and adolescents, with reference to patients' perceptions of the treatment and the objective findings. Group A of this study received a ten-minute massage as well as adjustments to the cervical and upper thoracic spine. Group B received a ten-minute massage. The patients' perceptions of the treatment were measured using the Short-form McGill Pain Questionnaire (Melzack 1987) at the first and last visits. Their headache were measured in terms of frequency, duration, level of distress caused and severity by filling in a headache diary, completed for one week prior to and one week following treatment. The objective findings were obtained using Algometer readings (Fischer 1986), to measure the pain pressure threshold of the superior and middle portions of Sternocleidomastoid muscle and the trapezius insertion at the first, fifth and last visits. Other data collected was the headache questionnaire completed prior to the commencement of treatment.

The wide variety of treatments used to manage tension-type headache seems to point to the need for a more effective standard method of treating the condition. Ideally the treatment should reduce the number of visits required to the physician's office, prolong the symptom free period the patient experiences and reduce the cost of treatment. It should aid in preventing the conversion of Episodic tension-type headache to Chronic tension-type headache in later life. The extent of the side effects of the treatment and the possibility of dependency on the treatment should also play a role in determining the most appropriate and effective treatment.

Chiropractic may offer a faster and cheaper form of treatment by decreasing the number of patient consultations and achieving longer lasting results, while preventing both the side effects of or dependency on pain medication. According to Stano (1993) in a study comparing health care costs of chiropractic and medical patients, preliminary results suggest significant cost savings for users of chiropractic care in respect of common musculoskeletal disorders.

Chiropractic has been found to be effective in the treatment of headache in adults, especially tension-type headache. Research has revealed headache in children and adolescents to be a more common problem than previously believed; yet few studies have shown the effectiveness of various treatment approaches. Thus, the purpose of this study was to determine the effectiveness of chiropractic manipulation in the treatment of Episodic tension-type headache in children and adolescents.

CHAPTER TWO

2. Literature review

Headache in children is a common complaint that increases in prevalence from early childhood to adolescence (Shillito & Stephenson 1994:761). In children, as in adults, tension-type headache is the most common form of headache that a chiropractor will encounter in clinical practice (Davies 2000). The management of the headache has differed greatly between medical professions, with varying success. It is thus important to review the relevant anatomy, physiology, differential diagnosis and treatment in respect to this condition (Vernon 1988:141).

2.1. Clinical presentation

2.1.1. Classification of tension-type headache

According to the International Headache Society (1988), tension-type headache can be classified into the following categories:

1. Episodic tension-type headache
2. Chronic tension-type headache
3. Headache of the tension-type not fulfilling the above criteria

2.1.2. Definition

The Headache Classification Committee of the International Headache Society (1988) describes Episodic tension-type headache as recurrent episodes of headache lasting minutes to days. The pain is typically pressing/ tightening in quality, of 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.

2.1.3. Prevalence

A study by Jansen (1998) on the prevalence of headaches in Afrikaans-speaking high school children revealed that, of the six types of headaches researched, including tension-type headache, migraine, sinus headache, eye or ear-related headache and cluster headache 75.2% of the children suffered from at least one of the above. Tension-type headache was found to be the most common form of headache, affecting 54.7% of these children. The age range of the group studied was from thirteen to nineteen years of age, the most common group affected being those between fourteen and seventeen years of age.

Episodic tension-type headache is by far the most prevalent form of tension-type headache, with fewer than 5% of tension-type headache sufferers in the "chronic" category (Schwartz et al. 1998). In a study of 900 Australian youth aged ten to eighteen years, 4.6% of the sample indicated that they experienced headache almost all the time, 12.1% once every few days, 12.7% once a week, 18.3% once every two to three weeks, 15.4% once a month and 36.8% never at all (King & Sharpley 1990). In Washington County, Maryland, a study by Linet et al. (1989) revealed that 56% of boys and 74% of girls between the ages of twelve and seventeen years had suffered a headache within the last month prior to the telephone interview.

2.1.4. Age

Rasmussen (1993) identified the age of onset of tension-type headache in the second decade of life (11 to 20 years of age) to be 49% in males and 58% in females, this being the single largest decade of onset. In the first decade (1 to 10 years of age), onset was 9% in boys and 8% in girls. Overall he noted the age of onset to be significantly lower for tension-type headache than for migraine.

According to Raskin (1988:216), symptoms begin before the age of twenty years in 40% of patients suffering tension-type headache, with a 16% onset between one and ten years of age and a 24% onset between ten and twenty years of age. Tension-type headache occurs with decreasing prevalence with the increasing age, thus younger subjects are more frequently affected than older subjects (Jensen 1999).

2.1.5. Male / Female ratio

The male to female ratio of tension-type headache sufferers changes from 1:1 in children, to approximately 4:5 in adults (Bille 1981; Rasmussen 1993). Hormonal factors may possibly act as both underlying, constitutional predisposing factors and attack provoking factors in female headache sufferers. Menstruation may predispose an attack (Rasmussen 1993).

2.1.6. Duration and frequency

In an epidemiological study of headache among adolescents and young adults, the average duration of the subject's most recent headache was 5.9 hours for males and 8.2

hours for females (Linet et al. 1989).

King & Sharpley (1990:51) recorded that 47% of respondents to a self-report questionnaire indicated that their average headache (either tension-type or migraine) lasted less than one hour, 35,8% indicated one to three hours, 9.3% indicated three to six hours, 2.9% indicated six to nine hours, 2.0% indicated nine to twelve hours and 2.8% indicated more than twelve hours. On average, girls reported longer headaches than boys.

2.1.7. Time of day

Tension-type headache is often present shortly after awakening and persists throughout the day (Raskin 1988:219). However, pain tends to be worse during school hours when children are most active, and eases again at the end of the day after they return home and have opportunity for food and rest. The headache rarely wakes a child from sleep (Davies 2000:96). If underlying depression is present, the headache episodes often appear at regular intervals in relation to daily life, or on weekends, Sundays, holidays and on the first days of vacation or after exams. Greatest incidence of 'nervous-type' tension headache occurs between four and eight a.m. and between four and eight p.m. (Diamond 1987:176).

2.1.8. Site and quality

Episodic tension-type headache is bilateral 90% of the time. It is usually described as dull, pressing or band like. It waxes and wanes in intensity during the day and has no predilection for any particular cranial location (Raskin 1988:219). The pain is typically global, involving the entire head, but at times the pain can be unilateral in which case there is often underlying temperomandibular joint dysfunction or cervical spine disorder (Kunkel 1991:596).

The site of the headache may vary, frequently occurring at the forehead and temples or at the back of the head and neck (Diamond 1987:172). The Classification Committee of the International Headache Society (1988) describes the pain as a pressure or tightening sensation, bilateral in location, steady and non-pulsating. Diamond (1998) also describes the pain as a vice-like ache, a weight and a bi-temporal/ bi-occipital tightness.

Tension-type headache sufferers often experience tenderness and soreness of the scalp during a headache episode. They may describe their scalp as feeling too tight, as if something is swelling and wants to "explode". Concurrently their neck is often stiff and tight, with tightness felt in the trapezius, upper back muscles (Kunkel 1991) and suboccipital muscles (Davies 2000). On occasion, movement of the neck in rotation or flexion will cause pain to radiate up to the vertex of the head (Kunkel 1991), similar to symptoms experienced in cervicogenic headache.

2.1.9. Associated symptoms

In tension-type headache, unlike migraine, there should be no vascular symptoms such as visual disturbance present. Nausea, vomiting and anorexia, which are common in migraine, are rarely present. Dizziness, fatigue and tiredness commonly accompany tension-type headache and anxiety may be evident in persons with recent onset of tension-type headache, while depression is quite prevalent in the chronic form (Kunkel 1991).

On examination, rigid muscles are readily recognised on palpation. The child may have a concomitant clinical history of recurrent, non-specific abdominal pain and other gastro-intestinal complications (Davies 2000).

Leviton et al. (1984) investigated age-related headache characteristics and found blurring, light sensitivity (photophobia), eye ache, faintness or light-headedness, trouble with concentration, numbness or tingling and lack of appetite to be more common in teenagers than younger children. Teenagers were also more likely to express emotions of irritability, frustration or anger prior to the onset of a headache.

2.1.10. Family history

Davies (2000) relates that there is often a positive family history of similar headache in at least one of the child tension-type headache sufferer's first-degree relatives.

2.1.11. Aggravating and relieving factors

In an epidemiological study of high school children by Jansen (1998), 64.3% of the tension-type headache sufferers revealed that their headache were aggravated by stress. Emotional and family problems are common causes of childhood stress. Other sources may include bullying, learning difficulties and changing schools (Shillito & Stephenson

1994). Fear of failure and school problems were found to have significant positive correlation with headache complaint in Passchier and Orlebeke's (1985) epidemiological study on school children.

Rasmusssen (1993) expressed the view that weather changes and menstruation were precipitants of tension-type headache, but that there was no significant association between coffee consumption and tension-type headache, despite a common belief of an association existing.

Episodic tension-type headache may be precipitated by excessive glare, flexion–extension injury to the neck, or neck strain from prolonged working in a single position. Other factors may include bruxism and teeth clenching (Kunkel 1991).

Tension-type headache can manifest itself in relationship to stress, depression, anxiety, emotional conflict, fatigue, repressed hostility or creating an environment too great for the patient to handle. Relief from the headache may be obtained by simply resting, or supporting the head in the hands (Diamond 1987:172).

2.1.12. School absence

Linet et al.'s (1989) epidemiological study of headache (including tension-type headache) among adolescents and young adults established that 10.1% of males and 8.6% of females had missed part of a school day because of headache. 2.4% of males and 2.7% of females had missed a full school day.

49% of students cited headache or stomach ache as having contributed to their absence from school and 44% of the students' guardians or parents agreed with their children's answer to this question (Klerman et al. 1987).

2.1.13. Consultation

Linet et al. (1989) demonstrated that of adolescent and young adult headache sufferers (including tension-type headache sufferers) 37.4% of males and 41% of females consulted a family practitioner, 23.1% of males and 21.9% of females consulted a paediatrician/ internist and only 1.1% of males and 2.2% of females consulted a chiropractor.

2.2. Anatomy

There are seven cervical vertebrae that together form the bony skeleton of the neck. They are the smallest and most movable vertebrae of the spine. A distinctive feature of these vertebrae is the oval transverse foramen through each transverse process (apart from C7), providing a pathway for the vertebral arteries. Atypical cervical vertebrae include C1, C2 and C 7. C1, the atlas, is kidney shaped and its concave superior articular facets receive the occipital condyles. It has no spinous process or vertebral body. C2, the axis, has the odontoid peg as its defining feature and is held in position by the transverse ligament. This ligament prevents horizontal displacement of the atlas, while allowing rotation of the atlas on the axis. C7, often named the vertebra prominens, has a very long spinous process (Moore 1992:331).

C3 to C6 have a typical vertebral structure and their spinous processes are short and bifid (Moore 1992:331). Each has a small vertebral body, which is concave on its superior surface and lipped by a raised edge of bone on its margin. It is correspondingly convex on its inferior surface, although the anterioinferior portion of the vertebral body tends to project downwards over the anterosuperior surface of the vertebra below (Sherk et al. 1989:11).

At approximately sixteen years of age, secondary centres of ossification appear in the typical vertebrae at the tips of transverse processes, the spinous processes and at the superior and inferior surfaces of the vertebral bodies. The secondary centres of ossification do not fuse until late into the second decade of life (Gatterman 1990:3).

2.2.1. Atlanto-occipital joint

This synovial-type joint which permits flexion and extension of the neck, is located on each side of the vertebral body, situated between the superior articular facets on the lateral masses of C1 and the occipital condyles (Moore 1992:349). The articular facets are concave, tilted medially and centrally constricted (Williams et al.1989:494). A fibrous capsule surrounds the occipital condyles and superior atlantal articular facets. It is thickened posterolaterally but thin and sometimes deficient medially, where the synovial cavities often connect with the bursa between the dens and the transverse ligament. Anterior and posterior atlanto-occipital membranes connect the skull to C1. The odontoid of C2 is held against the anterior arch of C1 and a synovial joint is situated between them. From the transverse ligament to the occiput superiorly and the body of C1 inferiorly, passes the vertically orientated cruciform ligament (Moore 1992:349).

2.2.2. Atlanto-axial joint

There are two lateral and one medial joint, which allow for rotation of the head, while excessive rotation is prevented by the alar ligament (Moore 1992:350). The two lateral atlanto-axial joints, which are surrounded by a thin, loose fibrous capsule attached at the articular margins, have ovoid articular surfaces, the atlantal surface being slightly concave and the axial surface reciprocally convex. The median atlanto-axial joint forms a pivot between the axial odontoid peg and a ring formed by the anterior atlantal arch and the transverse ligament. A facet on the anterior dental surface articulates with one on the posterior aspect of the anterior atlantal arch, having a weak, loose fibrous capsule lined by synovial membrane (Williams et al. 1989:493).

2.2.3. Intervertebral disc

The four components of the intervertebral disc include the nucleus pulposus (the interior of the disc), the cartilaginous end plates (one on each of the facing vertebral surfaces) and the annulus fibrosis. The annulus is composed of concentric lamellae of fibro-cartilage, running obliquely from one vertebra to another, inserting into the smooth, rounded rims on the articular surfaces of the vertebral body. These lamellae are arranged perpendicular to each other, allowing some movement between adjacent vertebrae, while providing a very strong bond between them. Posteriorly, lamellae are thinner and less numerous than anteriorly or laterally. The nucleus pulposus is the central core of intervertebral disc, it is highly elastic, more cartilaginous than fibrous and acts as a shock absorber for axial compression and like a semifluid ball-bearing during flexion, extension, rotation and lateral flexion of the column. It contacts the hyaline cartilage plates, is avascular and receives nourishment by diffusion from blood vessels at the periphery of the annulus fibrosis and adjacent surfaces of the vertebral bodies (Moore 1992:342-347). Intervertebral discs are more closely contained in the cervical spine than at other levels by the deeply concave superior surface of caudal vertebrae and more convex inferior surface of cephalid vertebrae (Sherk et al. 1989:14).

2.2.4. Posterior spinal articulations (Zygopophyseal joint)

These are true diarthrodial joints. They are supplied by sensory nerves and provide the brain with proprioceptive information. Superior facets are oval and flat, and directed backwards and upwards, reciprocating with similarly shaped inferior facets turned forwards and downward (Gatterman 1990:14).

The articular facets' flat surfaces are covered by hyaline cartilage. A thin, loose articular capsule which is attached to the articular margins, surrounds the joints. Fibrous capsules of the cervical region are longer and looser, with the result that flexion is greatest in the cervical spine. Facet joints allow gliding movement between the vertebrae. They bear some weight and help control flexion, extension and rotation of adjacent vertebrae (Moore 1992:347).

2.2.5. Spinal ligaments

These are arranged so as to provide postural support between the vertebrae with minimum energy expenditure, while also allowing adequate spinal motion. There are two sets of ligaments: the long spinal ligaments and the intersegmental ligaments (Gatterman 1990:207-210).

Long spinal ligaments include the anterior and posterior longitudinal ligaments and the supraspinous ligament. Intersegemental ligaments include the ligamentum flavum, interspinous, intertransverse and capsular ligaments. Regional accessory ligaments include the ligamentum nuchae, the accessory ligament between the axis and atlas, the transverse ligament of the atlas, the cruciform ligament of the atlas and the apical and alar ligaments of the odontoid peg of the axis (Gatterman 1990:207-210).

2.2.6. Intersegmental muscles

The deep transversospinal muscles form the intersegmental muscles extending between adjacent vertebrae only. They adjust small movements of the vertebral column and function as postural muscles, as well as ensuring the efficient action of longitudinal superficial muscles. Included in this group are the multifidus, rotatores, interspinales and intertransversarii (Gatterman 1990:16-18).

2.2.7. Intervertebral foramen

Intervertebral foramen are the principal routes of entry and exit to and from the vertebral canal. They are bounded superiorly and inferiorly by the pedicles of adjacent vertebrae, anteriorly by the intervertebral disc and posteriorly by the posterior joints and ligamentum flavum. These short elliptical canals allow the exit of segmental spinal nerves (Gatterman 1990:18). Each nerve, accompanied by a spinal artery, a small venous plexus and its own meningeal branch or branches together traverse the foramen. Cervical intervertebral foramen face anterolaterally, while thoracic intervertebral foramen face more laterally (Williams et al. 1989:491, 1125). The spinal canal is made up of the vertebral bodies and vertebral arches, thus protecting the spinal cord meninges and associated vessels. The blood vessels and nerve branches entering the foramen supply the spinal cord contents (Gatterman 1990:18).

2.2.8. The upper four thoracic vertebra

The first thoracic vertebra has circular upper costal facets articulating with the whole facet of the first costal heads. The inferior facets are smaller and semilunar, and articulate with the demifacet of a costal head. Its spinous process is thick, long, horizontal and often as prominent as C7. Thoracic vertebral bodies are shaped like a waisted cylinder and gradually change from a more cervical to a typically thoracic appearance, with two costal facets on each side. Intervertebral foramen and the spinal cord are smaller and more circular than in the cervical spine. The laminae are short, thick and broad and the large club-like transverse processes bear anterior oval facets which articulate with tubercles of the corresponding ribs. The superior articular processes are almost flat and face dorsally and a little superolaterally, while the inferior articular processes are directed forwards and a little superomedially (Williams et al. 1989:319-322).

2.3. Mechanism and pathophysiology of tension-type headache

2.3.1. Muscular factors

Diamond (1987) suggests the mechanism of tension-type headache is similar to that of chronic muscle contraction in other parts of the body. It involves three pathologic reflex arcs and four consecutive steps:

1. Muscle spasm is initiated usually by a multisynaptic reflex of withdrawal. Stimulation is caused by a local pathological process and the impulse is transmitted to the spinal cord, then to the ventral roots and next via efferent nerves to the neuromuscular junction, with resulting painful muscular contracture.
2. The initial impulse is conducted up the spinal cord via polysynaptic spinal pathways and the lemniscal system, to the thalamic and central levels. At these areas the stimulus is perceived as painful.
3. The brain next transmits impulses through the reticulospinal system to activate the gamma efferent neurons, which thus contract the muscle spindle.
4. During this contraction, a monosynaptic stimulus is evoked, travelling to the ventral horn. Efferent peripheral nerve discharge is augmented, as is the muscle contraction.

The third reflex arc i.e. muscle spindle contraction, is a monosynaptic pathway and is related to tendon stretch reflexes. The contracting muscle would ordinarily inhibit the firing of the muscle spindle, thus terminating the stretch reflex and causing muscle relaxation. The gamma motor system's activity level determines the degree of muscle tone. If the gamma efferent system continues to fire, the muscle spindle remains tight and will continue contracting until the contraction itself becomes painful (Diamond 1987).

2.3.2. Coping

In a study by Ukestad and Wittrock (1996) it was demonstrated that although both the tension-type headache group and the headache-free group reported similar use of cognitive coping strategies, the difference on catastrophising events revealed that headache sufferers cope less effectively with stressful events, with a greater degree of catastrophising or reliance on negative cognition. Headache individuals had a lower threshold for defining a stimulus as painful which may exacerbate the patients' experience of pain and further suggests that recurrent headache sufferers are more likely to report physical symptoms, not just to those producing physical discomfort.

2.3.3. Stress and anxiety

Psychosocial stress appears to be a major factor in paediatric tension-type headache. It is likely that the role of psychological factors is similar in adolescents and adults (Smith 1995). Sillanpaa (1982) equates the stress that a child experiences at school with that of the anxiety felt during an adult's working life. The child's headache frequency appears to correlate with the amount of psychosocial distress he is subjected to at the time (Smith 1995). Worry was perceived as the leading precipitant of headache after noise by King and Sharpley (1990) in their study of children suffering from tension-type headache and migraine.

2.3.4. Cervicogenic

Various authors have implicated the cervical spine as a possible cause of headache through experimental and clinical data. Edmeads (1988) reported that cervical spine dysfunction may result in headache. Diamond (1987) suggests that disorders of the cervical spine may create localised pain but may also produce referred pain to the head. Bogduk (1992) extrapolated that the pain of cervicogenic headache can be similar to the pain of migraine, tension-type headache or of intercranial lesions. He has shown that convergence between the trigeminal afferents and afferents from the first three cervical spinal nerves, will cause nociception from cervical spine structures (ligament, joint capsule and muscles) to be interpreted as head pain. Since the nociceptive neurons of the trigeminocervical nucleus have extensive receptive fields that encompass both the field of the trigeminal nerve and the fields of the first three cervical nerves and since they have central connections that are poorly organised somatotopically, information relayed by them is interpreted as arising from anywhere within the peripheral (trigeminocervical) receptive field and thus perceived as head pain.

Nagasawa et al.'s (1993) study disclosed that a large proportion of tension-type headache patients had straightened cervical spines, suggesting that sustained contraction of the neck flexors in tension-type headache patients interferes with maintenance of the physiologic cervical spine lordosis and results in straightened cervical spine. This may, in turn, exert a slight anteflexion of the cervical spine and cause passive loading of the occipitalis muscle and thus predispose a patient to tension-type headache. Such a tendency becomes more pronounced with increasing age.

Edmeads (1988) records that in certain situations such as congenital and acquired anomalies of the craniocervical junction or of the upper cervical spine, headache could result, owing to neck disease. He suggests that more evidence would be required to accept cervicogenic headache as a separate entity from other headaches, including tension-type headache and migraine.

Ng (1980) analysed x-rays of twenty-six patients suffering from occipital headache and twenty-five headache-free patients, with regard to the cervical curvature and disposition of the three upper cervical vertebrae. Results showed that C1 and C3 had significantly greater degrees of lateral inclination amongst headache sufferers, while a tendency toward a similar distortion existed at C2, revealing a definite association between abnormal upper cervical static mechanics and occipital headache.

2.3.5. Vascular factors

Onel et al. (1961) injected radioactive sodium into patients suffering from tension-type headache and found that there was an increase in the clearance rate of radioactive sodium during the tension-type headache, compared with that after the tension-type headache. He concluded that this did not exclude the possibility of relative ischeamia, but that this increased clearance rate could be an effect or concomitant of the factor producing the tension-type headache.

Few recent studies have discussed a possible vascular component, however a review of the literature reveals the following idea. Kabe et al. (1991) did thermographic studies on tension-type headache sufferers and reported that there were possible vasodilatory mechanisms occurring in patients who had tension-types for less than six months, since high temperatures were recorded in the painful pericranial areas. In those with a longer history of tension-type headache there appeared to be a change in sympathetic nerve regulation by some psychogenic or reflex mechanism. Patients with tension-type headache for a duration longer than six months had low temperature readings in the same painful areas.

2.3.6. Central nervous system involvement

Pain in tension-type headache is similar to myofascial pain elicited from other parts of the body, but whether it is strictly localised to muscle tissues or to other deeper tissues is still uncertain. Clinically, the pain resembles the type of pain experienced from the myofascial tissue, however components of both peripheral and central origin may contribute (Jensen 1999).

Tenderness of pericranial muscles is influenced by the actual headache state. But patients outside of the headache episode also have markedly increased tenderness compared with healthy controls (Bove & Nilsson 1999). Kim et al. (1995) found lower pain pressure thresholds in Episodic tension-type headache sufferers than in non-headache sufferers, especially of the superior and middle portions of the Sternocleidomastoid muscle and the trapezius insertion. Pericranial muscles are therefore likely to play an important role in the pathophysiology of tension-type headache (Jensen & Olesen 1996). Kim et al. (1995) proposed that the increased sensitivity of the muscles of the head and especially the neck region might be included in the pathogenetic mechanism of Episodic tension-type headache.

The initiating stimulus may be either a condition of mental stress, unphysiological motor stress, a local irritative process with release of various peptides, or a combination of the above. The deep tissue nociceptors are activated and afferent input is sent to the spinal dorsal horn and trigeminal nucleus. Secondary to this, the supraspinal pain perception structures may become activated and because of central modulation of incoming stimuli, in most subjects a self-limiting process will result. The slightly increased motor activity and insufficient relaxation in the pericranial and shoulder muscles may contribute to maintain the pain (Jensen & Olesen 1996; Jensen 1999). With increased nociceptive activity, central sensitisation may be induced. Central nociceptive perception and modulation may become disturbed and widespread, thus prolonged secondary hyperalgesia may result.

Once central sensitisation is sufficiently strong and widespread, pain becomes chronic because of self-perpetuating disturbances in pain perception. A vicious cycle sets in and results in an abnormal reaction to incoming peripheral stimuli, often maintained long after the stimulus/ stressor ceased (Jensen & Olesen 1996). In Jensen's (1999) study there was shown to be increased tenderness but otherwise normal pain sensitivity in Episodic tension-type headache sufferers as well as highly increased tenderness, slightly increased EMG activity and impaired pain sensitivity in patients with Chronic tension-type headache.

In Episodic tension-type headache patients with a disorder of pericranial muscles, the most likely mechanism is raised input from myofascial nociceptors projecting to a normal central pain perception system. Since Chronic tension-type headache often evolves from Episodic tension-type headache, it is suggested that prolonged painful input from the periphery may sensitise the central nervous system. Thus the pain in Chronic tension-type headache with associated muscular disorder, may be due to a central misinterpretation of incoming signals at the dorsal horn or trigeminal level (Langemark et al. 1988). This mechanism may be of importance in the conversion of Episodic tension-type headache to Chronic tension-type headache in tension-type headache associated with pericranial muscle disorder (Jensen et al. 1998).

Bove and Nilsson (1999) demonstrated that sensitivity levels of tender and non-tender points of the pericranial region did not differ based on the presence or absence of tension-type headache, in tension-type headache sufferers, suggesting that the muscle sensitivity in this headache type is constant. The observation that the sensitivity levels of both tender and non-tender points did not vary, suggests that the underlying mechanism or effect on tension-type headache is not restricted to tender muscles, but that supraspinal facilitation may also play a large role in this condition (Kim et al. 1995; Jensen 1999).

2.4. Differential diagnosis

2.4.1. Cervicogenic headache

This form of headache is not commonly reported in children, and thus the childhood incidence is unknown. Muscle contraction or tension-type headache probably describes most of its manifestation (Anrig & Plaugher 1998:578). The International Headache Society (1998) criteria for cervicogenic headache include pain localised to the neck and occipital region. The pain usually projects to the forehead, orbital region, temples, vertex or ears. Special neck movements or sustained neck posture may aggravate or precipitate the pain. There may be either resistance to or limitation of passive neck movements, changes in neck muscle contour, texture, tone or response to active and passive stretching and contraction or abnormal tenderness of neck muscles. Radiographic examination may reveal movement abnormalities in flexion and extension, abnormal posture or fractures, congenital abnormalities, bone tumours, rheumatoid arthritis or other direct pathology (excluding spondylosis or osteochondrosis).

2.4.2. Migraine headache

Migraines are classified with or without aura as classical or common migraine respectively in the previous classification systems (Anrig & Plaugher 1998). Aura is the complex of focal neurological symptoms, which initiates or accompanies the attack (International Headache Society 1988). In children suffering from migraine with aura, symptoms may include scotoma, nausea or vomiting. The pain is usually, but not always, one sided and frequently, especially in younger children, there may be no headache at all. The patient will complain of scalp tenderness, photophobia, perspiration and on occasion the migraine will be associated with the passage of a pale stool or diarrhoea. Occasionally neurological symptoms such as hemianopia, localised parasthesia, hemiplegia or aphasia may occur (Davies 2000:97).

Prodromal symptoms are rare in migraine without aura. Usually these headache come on suddenly without warning. The pain characteristics are similar to migraine with aura and the child may complain of scalp tenderness or photophobia (Davies 2000:97). The untreated duration of both migraine types ranges between four and seventy-two hours (International Headache Society 1988).

Abdominal migraines are more common in younger children, but may persist in adult life. Commonly the child will have recurrent bouts of midline abdominal pain of sufficient severity to disrupt normal daily activity. Headaches are variable, pallor may be seen and the child may experience nausea and vomiting (Davies 2000:97).

2.4.3. Similarity of tension-type and migraine headache

Nelson (1994) reiterated that tension-type and migraine headache were different expressions of a common underlying disorder. He showed that similarities existed between the two conditions:

1) In terms of pathophysiology, both headache types show EMG abnormalities in comparison with normal controls.
2) Psychological similarities exist in that both show personality and psychological traits that differ from controls.
3) Epidemiologically these headaches occur more commonly in women.
4) Symptomatic and diagnostic similarities were established, in that tension-type headache sufferers frequently complain of symptoms such as nausea, throbbing pain or a headache of unilateral location, symptoms which are common to migraine sufferers.

5) Therapeutic overlap between the two headache types was noted, as both conditions may effectively be treated by anti-depressants, biofeedback or spinal manipulation.

Rasmussen (1995) expressed similar findings in terms of an overlap of symptoms existing in migraine and tension-type headache in his study on the epidemiology of headache. He indicated, however, that although migraine symptoms do occur in tension-type headache, they are neither common nor severe and the symptoms tended to occur in clusters rather than singly. He concluded from his research that the two are separate entities, although they may co-exist and interrelate.

2.4.4. Mixed headache

Coexisting migraine and tension-type headache was previously known as mixed headache, tension-vascular headache or combination headache. Rasmussen (1993) stated that tension-type headache in migraineurs was not significantly more prevalent than in non-migraineurs and, except for greater severity and frequency, it did not deviate nosographically from pure tension-type headache thus supporting the idea that the two are distinct entities. Rasmussen (1995) emphasised the impossibility of finding a logical cut-off point to define a specific entity called combination headache and supports the fact that subject with co-existing migraine and tension-type headache should have both diagnoses. The International Headache Society (1988) comments that the mixed headache category represents a continuum and thus the concept of a mixed headache is arbitrary. Their recommendations are that the patient be coded for migraine and tension-type headache separately with the number of attacks per year for each type of headache in brackets after each diagnosis, thus making evaluation of the relative importance of the two conditions easy.

2.4.5. Myofascial trigger points

Travell and Simons (1983:184-5, 202-3, 306) reported that trigger points of the cervical muscles, trapezius and sternocleidomastoid muscles could refer pain to the head and neck area and that this pain referral may be confused with the onset of tension-type headache. It is thus important to check these muscles for trigger points, as myofasciitis may be part of the initial problem.

2.4.6. Warning signs

Warning signs of more serious headache include:

- Acute rise in blood pressure with resulting throbbing head pain.
- Chronic headache.
- A child who is ill, febrile and irritable and often has photophobia and neck stiffness with a severe throbbing headache, usually indicates an intracranial infection.
- Abnormal physical signs e.g. rash, arthritis or weight loss suggests vasculitis headache.
- Severe headache, associated with and relieved by effortless vomiting without nausea, which is worse with coughing, straining and bending forward, indicates raised intracranial pressure.

- Neurological signs may indicate a tumour. 50% of paediatric brain tumours are infratentorial, of which ataxia and cranial nerve abnormalities are the predominant signs. Sensory loss and seizures are suggestive of supratentorial lesions.
- Severe headache, maximal from onset, with a reduced level of consciousness is indicative of intracranial haemorrhaging.
- Headaches may occur postictal or as an ictal phenomenon. The patient will present with a history of abnormal movements of the limbs or eyes, an abnormal level of consciousness and postictal confusion (Shillito & Stephenson 1994).

2.4.7. Differential diagnosis

According to Davies (2000), the differential diagnosis of a paediatric headache should include the following:

1) Vascular:

Infection

Migraine

Toxic exposure to carbon monoxide

Hypertension

Postictal

Intracerebral haemorrhage

2) Muscular/ tension-type:

3) Non-organic headache:

Depression

Anxiety

Attention seeking

4) Neurological causes of headache:

Intracranial tumour

Raised intercranial pressure

5) Extracranial disorders:

Sinusitis

Dental problems

Allergic reactions and hypoglycaemia

Prescribed medication (side effect of anti-histamine preparations, diazepam, phenytoin and tetracycline)

Basillar impression syndrome

Disorders of the ear

6) Trauma induced.

2.5.Treatment

2.5.1. Medical management

Medical management of the child tension-type headache sufferer is primarily drug orientated. Once it is ascertained that there is no underlying organic disease or history of trauma, symptomatic relief-type medication is given. Analgesics and non-steroidal anti-inflammatory drugs are commonly prescribed (Anrig & Plaugher 1998).

Both Ibuprofen (400mg) and acetaminophen (1000mg) are efficacious analgesic agents for tension-type headache. They are two of the most commonly used over-the-counter analgesic agents (Schachtel et al. 1996:1120). When over-the-counter drugs are not effective, combination analgesics such as aspirin plus butalbital and caffeine, acetaminophen with butalbital or acetaminophen and butalbital and caffeine may be prescribed. If more pain relieving potency is required, either aspirin or codeine may be added. If properly used, these products can be highly effective with little chance of abuse or habituation (Diamond 1998).

Schnider et al. (1994) conducted a study on the use and abuse of analgesics in eighty patients suffering from tension-type headache for an average of twenty one years. Patients reported taking approximately six different drugs on average with cumulative doses reaching several kilograms. The most frequently used drugs included paracetamol, phenacetin, prophenazone and acetylsalicylic acid. They were taken primarily as components of compound tablets, often in combination with caffeine. Most drugs were classified as "moderately effective" by patients. "Very effective " ratings were assigned primarily to barbiturates, which are however no longer used as components of compound analgesic drugs. 21% of the group showed signs of possible analgesic-induced or ergotamine–induced headache and were therefore advised to undergo withdrawal therapy. Interestingly, many drugs with no known lasting effect on tension-type headache were prescribed. Furthermore, drugs with a considerable potential for addiction were also frequently prescribed.

King and Sharply (1990) examined tension-type and migraine headache activity in 900 Australian youths aged ten to eighteen years, using a self-report questionnaire and found that nearly half of the respondents took medication during a headache and by the time they entered adolescence it was a well established method of pain control.

2.5.2. Chiropractic intervention

Hoyt et al. (1979) investigated whether spinal manipulation was of any effect immediately after a single consultation, for pain during a tension-type headache episode. Twenty-two patients were allocated to three groups:

1) Spinal motion palpation and spinal manipulative therapy.
2) Spinal motion palpation only.
3) Ten minute supine rest.

Immediately after treatment the spinal manipulative therapy group reported 50% reduction in headache severity, the two control groups showed no improvement, hence proving spinal manipulative therapy to be effective and demonstrating a pathophysiological link between the active headache and the structures of the spine.

Vernon (1982), in a prospective study of chiropractic treatment of eighteen tension-type headache sufferers (20 to 47 years old), found statistically significant reductions in headache activity as measured by frequency, duration and intensity. These results were obtained in an average of nine treatment sessions of chiropractic manipulation, directed principally at the cervical spine. Average reduction in frequency was from twelve to two headache per month. The average duration was reduced from thirteen to three hours and the average severity decreased from three-and-a-half to one-and-a-half out of five.

Mootz et al. (1994) reported on eleven men (18 to 40 years old) suffering from chronic and episodic tension-type headache. The study included a two week, baseline non treatment period and an eight week treatment period of sixteen interventions. Treatment consisted of spinal manipulations (to the cervical spine), myofascial trigger point therapy and moist heat packs. A statistically significant reduction in headache frequency (6.4 headaches to 3.1 headaches per two weeks) and duration (6.7 to 3.9 hours per headache) was observed, as was a strong trend towards the reduction in the severity of the tension-type headache.

Boline et al. (1995) conducted a clinical trial of a hundred and fifty patients (18 to 70 years old) with Chronic tension-type headache, randomised into two groups, one receiving spinal manipulation for six weeks and other receiving anti-depressive medication (amitryptaline) for six weeks. Four weeks following the cessation of therapy the spinal manipulative group showed a 32% reduction in headache intensity, a 42% reduction in headache frequency and a reduction by 30% in analgesic use, whereas the amitryptaline group showed no improvement in any of these variables.

Bove and Nilsson (1998) conducted a randomised clinical trial of seventy five adult (20 to 59 years old) Episodic tension-type headache sufferers comparing soft tissue treatment (of the trapezius and muscles deep to it) combined with cervical spinal manipulation to soft tissue treatment combined with placebo laser. The study demonstrated a significant reduction in mean daily headache hours, and decrease in daily analgesic intake for the patients in each group. These changes were maintained throughout the observation period, although headache pain intensity was unchanged for the duration of the trial. This study showed that as an isolated intervention, manipulation does not seem to have a significant positive effect on Episodic tension-type headache.

A review of the literature as regards upper cervical chiropractic care of paediatric patients by Prax (1999:262) indicated that, despite public and medical criticism suggesting inadequate data documenting the efficacy of chiropractic care for children suffering from illnesses and trauma (including headache), anecdotal information and summaries of twenty five studies and cases suggested positive outcomes for a thousand children under chiropractic care.

2.5.3. Indications for manipulation

The primary indication for manipulation is a reversible mechanical derangement of the intervertebral joint that produces a barrier to normal motion. This is called joint fixation and can be determined clinically by motion palpation or stress radiographs (Gatterman 1990).

Dabbs and Lauretti (1995:530) in a review of the literature concerning risk assessment of cervical manipulation versus non-steroidal anti-inflammatory drugs (NSAIDS) for neck pain treatment, found that the best evidence indicates manipulation to be safer than the use of NSAIDS, by as much as a factor of several hundred times.

In a study to identify the most commonly used treatment by chiropractors for tension-type headache, Vernon and McDermaid (1998) found that among procedures which received the highest level of endorsement (used at least half the time by chiropractors in the field) were upper cervical and mid-cervical manipulation. Lower cervical and upper thoracic or rib spinal manipulative therapy were less commonly endorsed or used.

2.5.4. Contra–indications to manipulation

Contra-indications to manipulation as stated by Gatterman (1990:67-68) include the following:

1) Vertebral-basilar artery insufficiency
2) Atheroschlerosis of major blood vessels
3) Aneurysm
4) Tumours (lung, thyroid, breast, bone)
5) Bone infections (tuberculosis, osteomyelitis)
6) Traumatic injuries (fractures, instability or hypermobility, severe sprains or strains, unstable spondylolisthesis)
7) Arthritis (rheumatoid, ankylosing spondylosis, psoriatic arthritis, unstable stage and later stage osteoarthritis, uncoarthritis)
8) Metabolic disorders (clotting disorders, osteoporosis, osteomalacia)
9) Neurologic complications (disc lesions with advancing neurological deficits, space-occupying lesions).

2.5.5. Chiropractic in conjunction with massage

Upper cervical manipulation and soft tissue therapy, accompanied by a stretching exercise prescription, was offered as a set of "best-evidence practices" for use in chiropractic practice for the treatment of tension-type headache by Vernon and McDermaid (1998:215).

2.5.6. Effect of manipulation

Fitz–Ritson (1990) and Green (1997) attest that manipulation of the cervical spine causes an increase in the range of motion at the involved segment, reduction in pain and reduction in muscle tone, as muscle spasm is reflexly relieved by stimulation of the facet mechanoreceptors. Curl (1994) describes that the therapeutic effects of manipulation can be explained on the grounds of mechanical and reflex mechanisms, involving mechanoreceptor stimulation, stretching of the muscle spindles, breaking of articular adhesions and increase in active and passive joint motion. Following manipulation, there is reflex inhibition of pain, inhibition of muscle spasm and stimulation of the autonomic nervous system. Cassidy et al. (1992) demonstrated that cervical manipulation results in an immediate increase in range of motion in all directions, especially rotation, and a decrease in pain. Viti and Paris (2000:27-28) also consider the placebo effect of the audible pop to give added benefit.

Reasons for improvement of headache when manipulating the upper thoracic spine are postulated by Viti and Paris (2000:27-28) to include:

1) Postural/mechanical factors:

Improved range of motion, therefore improved thoracic extension and decreased forward head posture and subcranial backward bending resulting in decreased compression of this region and thus in reduction of the symptoms.

2) Reflexive/muscular factors:

Many muscles including the semispinalis capitis, longissimus capitis and multifidus attach to the transverse process of C7, T1 to T6 or T7. Quick stretch of the golgi tendon organs may reflexively inhibit these muscles.

3) Reflexive/sympathetic factors:

Innervation to the head and neck originate from T1 to T2 spinal levels.

2.5.7. Traction

Donkin (1998) concluded that manual traction did not enhance the effect of the cervical adjustment and appears to have limited value in the treatment of the tension-type headache.

2.5.8. Massage

Gatterman (1990:250) included massage as one of the treatment options for tension-type headache. Penter (1994) demonstrated that massage could be an effective short-term treatment for tension-type headache. In his study comparing the effects of massage combined with manipulation to massage alone in tension-type headache sufferers, he concluded that both groups fared equally well. The manipulation group fared slightly better than the massage group after one month follow-up with regard to the disability and pain intensity. Both groups however, showed a reduction in pain intensity, duration, frequency and disability of headache.

Massage is the application of systematic manipulation to the soft tissue of the body for therapeutic purposes (Geiringer et al. 1993:452). Classical massage involves stroking and gliding (effleurage), percussion (tapotement) and kneading (petrissage) to the soft tissue of the body. Stroking and gliding movements are helpful in detecting abnormal tone or painful areas that require further attention. Stroking aids muscle relaxation and kneading helps removal of unwanted fluid and waste products (Geiringer et al. 1993).

2.5.9. Physiological effects of massage

Mechanical effects:

1) Massage assists venous blood return and improves blood flow.
2) It stimulates sensory endings, causing a reflex response mediated by the spinal cord.
3) Allows for tissue healing and repair.

Reflexive effects:

1) Massage causes changes in electrical threshold and activity associated with the neurologic system.
2) It has a sedative or general relaxation effect when slowly administered.
3) It can have possible physiological effects on the gamma motor system (Geiringer et al. 1993).

2.5.10. Indications for massage

1) Restoration of tight muscles to normal resting length.
2) Mobilise tissue that is abnormally adhered to surrounding structures.
3) Increase tolerance of tissues to pressure.
4) Relief of pain.
5) Specific and general relaxation.
6) Enhanced physiological well-being (Geiringer et al. 1993).

2.5.11. Contra indications to massage

1) When medically contra-indicated.
2) When the particular technique used is inappropriate for the condition being treated.
3) When an appropriate technique is incorrectly applied (Geiringer et al. 1993).

Geiringer et al. (1993) expressed fears that in the current socio-economic climate surrounding health care, unless both therapeutic efficacy and cost effectiveness of massage can be demonstrated its continued use will be threatened.

2.5.12. Relaxation and/or biofeedback

In a study by Haynes et al. (1975) relaxation training was significantly more effective in the treatment of tension-type headache than no treatment and was equally as beneficial as EMG biofeedback of the frontalis muscle. Chesney and Shelton (1976) found muscle relaxation treatment or in combination with EMG, more effective than biofeedback alone in reducing headache frequency and duration. Raskin (1988) suggests that simple measures such as massage, manual stretching of the muscles of the neck and shoulder girdle, hot tub baths and application of local heat should be taught to patients. He states that some patients prefer techniques such as meditation, hypnosis or yoga and that relaxation methods are often preferable since patients can continue to practice them at home.

2.5.13. Myofascial trigger points

Travell and Simons (1983: 86-93) listed and discussed treatment protocol to be used for myofascial complaints. Included were trigger point injection and stretch and spray. Alternatively ischeamic compression, massage, stretch without spray and ultrasound were advocated. Useful adjuncts included heat, drug therapy, biofeedback and transcutaneous electrical stimulation.

2.5.14. Psychosocial therapy

Psychosocial factors actually may precipitate or augment recurrent paediatric headache, including tension-type headache. It is important to identify and remove these factors if possible. In the presence of a psychiatric condition or a dysfunctional psychosocial situation, referral to a mental health specialist is most appropriate (Smith 1995:456-457).

Eliminating the cause of stress, if one exists, is curative. Any associated depression needs to be recognised and referral to a child psychiatrist considered (Shillto & Stephenson 1994). King and Sharpley (1990) added that coping strategies of children and adolescents with headache included peaceful imagery, head massage and attention focusing.

2.6. Subluxation, subluxation complex and subluxation syndrome:

Prax (1999) believes sport, interactive play and emotional stress are all factors that can lead to subluxation in the paediatric patient. He states that too often children are not evaluated for subluxations. Gatterman (1995:7) defines subluxation as a motion segment in which alignment, movement integrity, and/or physiologic function is altered, although joint surface contact remains intact. Vernon et al. (1992) demonstrated a high occurrence of cervical joint dysfunction, reduced/absent cervical curve, tender points of the upper cervical spine, as well as neck and occipital pain during headache. He calls into question the narrow prescriptive definition of "cervicogenic headache".

Bogduk (1992) extrapolated that joint dysfunction affecting the upper cervical synovial joints may play a role in the source of headache. Although the exact pathology that occurs in these joints has yet to be clearly established, the presence of abnormal palpatory and motion findings, as well as relief from headache upon anaesthetisation of the responsible joint, strongly implicates these joints in headache.

If cervical joint dysfunction is related to headache, then according to Haldeman (2000) three theories of subluxation must be considered:

1) The nerve compression theory, in which abnormal biomechanic relations among vertebrae can cause compression of spinal nerve roots that in turn cause interference with normal nerve root function resulting in pain or other clinical symptoms or pathology. This theory, however, is still not well established scientifically.

2) The reflex theory proposes that subluxation is caused by aberrant biomechanic relations, which stimulate receptors in the spinal and paraspinal tissue (including muscles, ligaments and facets). Neural reflex centres within the spinal cord or higher centres are activated by stimulation of these spinal structures, which in turn causes somato-somatic responses resulting in muscle spasm.

3) Finally the pain relief theory suggests that the adjustment can result in hypoalgesia. Often this theory is explained in terms of a singular cause for spinal pain e.g. facet fixation or muscle spasm. However, the relative importance of each of the various spinal structures still needs to be established.

Despite a need for further investigations into the subject, Haldeman concluded that the neurologic effects of the adjustment can no longer be disputed.

2.7. Conclusion

Episodic tension-type headache in children and adolescents can be seen to be more common than generally appreciated. The data currently available on the efficacy of chiropractic care in adults with headache is encouraging. However, the management of the condition has varied considerably, with no universally supreme treatment identified. There is thus a specific opportunity for chiropractic to develop and demonstrate further expertise with the problem as it relates to children and adolescents. This study sought to identify the effects of chiropractic manipulation and massage as compared with massage alone, in order to determine the effectiveness of chiropractic manipulation in the management of this condition.

CHAPTER THREE

3. Materials and methods

3.1. Introduction

The object of this study was to determine the relative effectiveness of each treatment protocol in terms of objective and subjective measurements. The study attempted to identify whether the combination of chiropractic manipulative therapy and soft tissue treatment had a relatively greater effect in the management of Episodic tension-type headache than soft tissue treatment alone. This chapter describes the methods used for collection of the objective and subjective data, as well as the methods used for statistical interpretation and presentation.

3.2. Study design and protocol

This study was designed to be an uncontrolled, unblinded, randomised comparative clinical trial. Patients in group A received a ten minute massage and chiropractic manipulation of the cervical and upper thoracic spine (T1 to T4) and patients in group B received a ten minute massage. Firstly, intra-group changes were considered for the two groups and secondly, inter-group differences were analysed to determine which of the two treatment protocols were, if at all, more effective.

3.3. Data

Two types of data were used in this study: primary and secondary data.

3.3.1. Primary data

The primary data consisted of the following:

- Patients' pain perception, as determined by a Short-form McGill Pain Questionnaire (Appendix 6)
- Patients' headache frequency and duration, as determined by a time graph in the headache diary (Appendix 7).
- Patients' pain intensity, as determined by the affective visual scale and a colour coded pain-rating scale as part of the headache diary (Appendix 7).
- Patients' disability, as determined by the headache questionnaire (Appendix 8).
- Patients' pain sensitivity, as measured using an Algometer (Appendix 10).

3.3.2. Secondary data

The secondary data was collected from a search of the related literature.

3.4. Research methodology and materials

Volunteers suffering from Episodic tension-type headache were recruited by means of advertisements in the local newspapers, at numerous local schools and by talking to learners during school guidance classes. It was advertised that free treatment was available for pupils suffering from tension-type headache who were willing to participate in the study and who agreed to abide by the treatment restrictions defined by the experimental design. Interested persons contacted the Technikon Natal Chiropractic Day Clinic whereupon the nature of the study was explained. Following the explanation, an initial consultation was arranged for willing and suitable subjects.

3.4.1. Inclusion and exclusion criteria

Male and female volunteers between the ages of eight and eighteen, in good health, were eligible to participate. Each patient was to have been suffering from a minimum of six and a maximum of fifteen headache days a month. Patients presenting with any illness that may have affected, perpetuated or caused a headache were excluded from the study. For the duration of the study, patients were not allowed to take any analgesic medication for a headache and were immediately excluded if they did. No patient was to have any contra-indications to spinal manipulation (Gatterman 1990:55-62) on clinical examination and if a patient sustained a neck or head injury, which had not been evaluated and x-rayed at the time of injury or subsequent to the injury, that patient was immediately excluded from the study. If a patient sought other treatment for a headache, such as massage, aromatherapy or physiotherapy, they were excluded from the study.

The patient had to fulfil the diagnostic requirements for Episodic tension-type headache as outlined by the International Headache Society (1988) as follows:

A. At least ten previous headache episodes fulfilling criteria B-D listed below. Number of days with such headache fewer than a hundred and eighty a year (fewer than fifteen a month).

B. Headache lasting from thirty minutes to days.

C. At least two of the following characteristics:

   1. Pressing/tightening (non-pulsating) quality.
   2. Mild or moderate intensity (may inhibit, but does not prohibit activity).
   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 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. 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 investigation.
   3. Such a disorder is present, but tension-type headache does not occur for the first time in close temporal relation to the disorder.

3.4.2. Procedure

At the initial consultation, the patients were screened and examined by the researcher to determine if they presented with Episodic tension-type headache, or with any condition that would prevent them from participating in this study. Volunteers underwent a full case history (Appendix 3), physical examination (Appendix 4) and regional cervical examination (Appendix 5). During the cervical regional examination, facet joints with restricted motion segments, i.e. joint fixations, were located in the cervical and upper thoracic spine by means of motion palpation (Schafer and Faye 1989:100-109).

Once the patients and their parents or legal guardians had signed the informed consent form (Appendix 2), they were randomly allocated into group A or group B. Thirty pieces of paper were used for this purpose, fifteen pieces with group A written thereon and fifteen pieces with group B written thereon. For each patient one piece of paper was drawn from the original thirty pieces and the patient was then allocated to that particular group. This procedure continued until all thirty subjects were randomly allocated to either group A or group B. Group A received cervical and upper thoracic (T1 to T4) manipulation and soft tissue treatment and group B received soft tissue treatment.

There was no blinding of either the patient or the researcher in this study. At the initial consultation the patient was required to answer a headache questionnaire and a Short-form McGill Pain Questionnaire (Melzack 1987). No treatment was given at the initial consultation. For the first week (i.e. for seven days following the initial consultation) the patient was required to fill out a headache diary and at the end of that week they came for their second visit. At this visit pressure threshold readings were obtained by means of an Algometer. The patient was then treated with manipulation and massage or massage alone depending on which group they had been allocated to.

The most fixated cervical and upper thoracic articulation or articulations were identified using motion palpation as a screening method. At each visit, including the last visit, motion palpation was repeated and the fixation listing was noted.

Both group A and group B received soft tissue treatment, which involved a ten minute massage of the upper thoracic and cervical musculature administered in the form of effluerage and gentle kneading by the researcher with the patient lying first prone and then supine.

Group A alone received manipulation, which was administered by the examiner. Diversified technique was used, including the following types of adjustments, which will be briefly explained:

1. Hypothenar occiput, for restricted rotation, lateral flexion and extension of C0 to C1. Patient lying supine, with head turned away from side of dysfunction. Researcher stands at the head of the table on the adjustive side at a 45 - 90° angle to the patient. Researcher uses a hypothenar contact, contacting the patient at the posterior supramastoid groove, just posterior to the ear. Researcher's indifferent hand cradles the patient's head. Researcher thrusts in the direction of the fixation once joint slack is removed e.g. lateral to medial and superior to inferior to induce lateral flexion (Bergmann et al. 1993: 264).
2. Atlas index pillar (supine), for restricted rotation, lateral flexion and extension of C1 to C2. Patient lying supine, researcher stands at the head of table on the adjustive side at a 45 - 90° angle to the patient. Researcher uses the proximal ventro-lateral surface of the index finger to contact the lateral, posterolateral or posterior aspect of the atlas to induce lateral flexion, rotation and extension respectively. Researcher's indifferent hand cradles the patient's head. Once joint tension is established the thrust is directed

in a posterior to anterior direction with clockwise or anticlockwise rotation to induce rotation, posterior to anterior to induce extension and medial to lateral to induce lateral flexion (Bergmann et al. 1993: 367).

3. Lower cervical index pillar (supine), for restricted rotation, lateral flexion and extension of C2 to C7, this technique is the same as described above (Bergmann et al. 1993:368).
4. Thumb spinous (prone), for restricted rotation and/or lateral flexion of C6 to T3. Researcher stands in a low fencer stance on the side opposite the adjustive contact, with the patient lying prone. The researcher's forward leg approximates the level of the patient's head and the body weight is centered over the midline of the patient. The distal palmar surface of the researcher's thumb contacts the lateral surface of the patient's spinous process, while the indifferent hand supports the patient's upper cervical spine. Once joint slack is removed the thrust is directed in a lateral to medial direction with slight posterior to anterior angulation, the indifferent hand generates a slight impulse as the thrust is delivered (Bergmann et al. 1993:353).
5. Bilateral thenar transverse, for restricted flexion and extension of T1 to T4. Patient lying prone. Researcher stands at the head of the table facing caudad, with bilateral thenar contacts running parallel to the spine, contacting the patient's transverse processes. Researcher thrusts in a posterior to anterior and superior to inferior direction to induce extension, or in a posterior to anterior and inferior to superior to direction to induce flexion (Bergmann et al. 1993:357).
6. Bilateral hypothenar transverse (crossed bilateral), for restricted rotation, lateral flexion, flexion and extension of T4. Patient lying prone. Researcher stands in fencer stance on either side of patient, with bilateral hypothenar contacts, contacting the

patients transverse processes. The thrust is applied in a posterior to anterior and inferior to superior direction with the caudad hand and posterior to anterior and superior to inferior with the cephalid hand, once all tissue slack is removed (Bergmann et al. 1993: 366).

7. Supine thoracic opposite side contact, for restricted rotation, lateral flexion, flexion and extension of T3 to T4. Patient sits or lies supine with arms crossed and hands grasping opposing shoulders. Researcher stands in a modified fencer stance and reaches around patient to establish the posterior contact. The researcher's clenched fist contacts the patients transverse process, while the indifferent hand contacts the patients crossed arms. The thrust is directed in an anterior to posterior and inferior to superior direction to produce flexion or lateral flexion, and posterior to anterior to produce extension or rotation (Bergmann et al. 1993: 375).

The cervical spine was not rotated beyond 45° in any of the above procedures. Selection of the technique used for each adjustment was based on the spinal level to be treated, the direction of joint fixation, the patient's build and position of comfort. No stretching or strengthening exercises were prescribed and no advice on pain management was given to patients in either group.

The study spanned five weeks, with the first week being allocated to the completion of a headache diary. Each patient then received six treatments extending over a three week period of massage in conjunction with chiropractic manipulation or massage alone, according to which group they were allocated. Treatments commenced at visit two and were concluded at visit seven, following which the patient was required to complete the headache diary during week five of the study. At the final visit, Algometer readings were taken and the patient completed the Short-form McGill Pain Questionnaire again. At the conclusion of visit eight the patient was discharged from the study.

3.5. Measurements and observations

Subjective and objective measurements were taken to record any changes arising from the treatment, with regard to Episodic tension-type headache.

3.5.1. Subjective measurement

The Short-form McGill Pain Questionnaire was completed at visit one and visit eight, the headache questionnaire was completed at visit one and the headache diary was filled in for one week prior to and one week following the course of treatment.

3.5.1.1. Short-form Pain McGill Questionnaire

The Short-form McGill Pain Questionnaire (Melzack 1987) was used to provide subjective information on the sensory, affective and overall intensity of pain. This questionnaire correlates highly with other recognised questionnaires and is sensitive for measuring the effectiveness of traditional clinical therapies (Melzack 1987). It is divided into two sections, questions one to eleven assessing the sensory perception of pain and questions twelve to fifteen assessing the affective dimension of pain. For each question a minimum score of zero is allocated for no pain, and a maximum score of three is allocated for the most severe pain. The patient was required to answer the questionnaire while the researcher was available to provide assistance if deemed necessary. The sum of the completed questions gave a score out a total possible score of forty-five. The McGill pain questionnaire has been found to be both valid and reliable (Melzack & Katz 1992).

3.5.1.2. Headache diary

Andrasik (1992:353) maintains that subjective ratings of head pain including frequency, intensity and duration have become the "gold standard" with regard to quantifying headache activity in both research and clinical settings. A headache diary adapted from Andrasik (1992:354), McGrath (1990) and Varni et al. (1987) was used to measure these parameters. In terms of this study:

1. Headache frequency pertains to the number of Episodic tension-type headache experienced over the specified interval, recorded for one week prior to and one week following treatment. Frequency was calculated by dividing the number of discreet headache periods by seven, representing the number of days in the week.
2. The duration pertains to the length of time in minutes between headache onset and offset. Duration was calculated by averaging the number of tension-type headache minutes per headache episode over the one week period.
3. The affective visual scale is used to determine a child's pain and distress (McGrath 1990) and integrates the more emotional aspect of pain. This was calculated by averaging the value of the "face" chosen per headache episode over the one week period.
4. The colour coded pain-rating scale is a sensitive measure of pain severity in the paediatric patient (Varni et al. 1987) and was used to determine intensity of the pain experienced. This was calculated by averaging the intensity of each headache episode over the week period.

Blanchard et al. (1981) compared ratings obtained from the significant others of treated headache patients with the daily dairy ratings made by the patients themselves and the results were found to be statistically significant. Thus proving the social validity of the headache diary. Varni et al. (1987) proved the colour coded pain-rating scale to be a developmentally sensitive measure of pain severity. McGrath (1990) indicated that results from the affective visual scale confirmed it to be a measure of overall pain affect and not pain intensity.

3.5.1.3. Headache questionnaire

The examiner formulated the headache questionnaire in order to determine the extent to which each child's headache affected their presence or absence from school, their participation in extra-mural activities and their level of concentration, for a six month period prior to the study.

3.5.2. Objective measurement

Algometer readings were taken at the second and fifth visits prior to treating the patients, and again at the eighth visit.

3.5.2.1. Algometer

The pressure threshold meter (Algometer) manufactured by Wagner Instruments (P O Box 1217, Greenwich, CT 06836, USA) was used in order to measure pressure pain sensitivity. Pressure readings were taken at:

1. The superior portion of the sternocleidomastoid muscle at the point immediately below the mastoid process.

2. The middle portion of the sternocleidomastoid muscle at the midpoint between the superior sternocleidomastoid point and the insertion of the sternocleidomastoid muscle.
3. The trapezius insertion muscle at the superior insertion of the trapezius immediately below the occipital bone.

The flat pad of the Algometer was placed at these specific points and a gradual increase in pressure was applied by the examiner. The patient was instructed to indicate when the pressure became uncomfortable by clearly saying "NOW". The reading was then recorded and the Algometer reset. This procedure was repeated at each of the three spots bilaterally. Algometer measurements have been proven to be reliable by Fischer (1986). Kim et al.'s (1995) study on pain pressure threshold in Episodic tension-type headache sufferers supports the notion that increased pain sensitivity of the sternocleidomastoid and trapezius insertion muscles may be one of the characteristics of an individual suffering from this form of headache.

3.6. Statistical analysis

3.6.1. Method of data analysis

The sample size of the study was fifteen per group. Statistical analysis of the following data was collected:

1. The scores from the Short-form McGill Pain Questionnaire and the headache questionnaire.
2. The scores from the headache diary represented in terms of frequency, duration in minutes, affective visual scale and colour coded pain-rating scale.

3. The scores from the Algometer readings taken at the superior and middle sternocleidomastoid muscle and trapezius muscle insertion fibres.

Continuous variables were analysed using parametric methods, while categorical variables were analysed using non-parametric methods regardless of the sample size per group.

3.6.2. Procedure 1

The Mann-Whitney U-test was used to compare group A and group B with respect to each categorical variable. Each group was treated as being independent of the other (unpaired) in order to determine whether there was any significant difference between the two groups at a 95% confidence level. In each test, the null hypothesis states that there is no statistically significant difference between groups A and B with respect to the variable of interest, at the alpha (α) = 0.05 level of significance. The alternative hypothesis states that there is a significant difference at the same level.

According to Zar (1996), the Mann-Whitney U test is one of the most powerful non-parametric tests.

Decision rule: The null hypothesis is rejected at the α level of significance if p, which is the observed level of significance, is less than α. Otherwise, the null hypothesis is accepted at the same level.

3.6.3. Procedure 2

The two-sample unpaired t-test was used to compare groups A and B with respect to each continuous variable. In each test, the null hypothesis states that there is no significant difference between groups A and B with respect to the variable of comparison, at the alpha = 0.05 level of significance. The alternative hypothesis states that there is a significant difference at the same level of significance.

Decision rule: The null hypothesis is rejected at the α level of significance if p, which is the observed level of significance, is less than α. Otherwise, the null hypothesis is accepted at the same level.

3.6.4. Procedure 3

Wilcoxon's signed ranks test was used to compare results from related samples within group A with respect to categorical variables. In each test, the null hypothesis states that there is no significant improvement between the two related samples being compared at the α level of significance. The alternative hypothesis states that there is a significant improvement.

According to Zar (1996), the Wilcoxon signed ranks test has its most significant application in paired sampling testing.

Decision rule: The same as for procedure 2.

3.6.5. Procedure 4

The two-sample paired t-test was used to compare results from related samples within group A with respect to continuous variables. The same rules were applied to procedure 4 for the null hypothesis, alternative hypothesis and decision rule as used in procedure 3.

3.6.6. Procedure 5

Procedure 3 was repeated within group B, with the same decision rule.

3.6.7. Procedure 6

Procedure 4 was repeated within group B, with the same decision rule.

3.6.8. Procedure 7

Selected visual summaries of analytical findings are given by use of bar charts to compare groups A and B with respect to the variables of interest. Average (mean) readings will be used to construct bar charts.

3.6.9. Statistical packages

The statistical package SPSS was used for entry and analysis.

3.7. The specific treatment of each objective

3.7.1. Objective one

The first objective of this study was to investigate the relative effectiveness of chiropractic manipulation in conjunction with soft tissue treatment as opposed to soft tissue treatment alone in terms of objective clinical findings, in order to determine the more effective treatment in the management of Episodic tension-type headache in children and adolescents.

3.7.1.1. The data required

The data required for testing the hypothesis of objective one was obtained from the readings recorded by the Algometer (Appendix 9).

3.7.1.2. How the data was secured

All data was collected from the participating patients at the Tecknikon Natal Chiropractic Day Clinic. This data was recorded in each patient's file at the time of the visit. All data collection was performed by the researcher.

3.7.2. Objective two

The second objective of this study was to investigate the relative effectiveness of chiropractic manipulation in conjunction with soft tissue treatment as opposed to soft tissue treatment alone in terms of subjective findings, in order to determine the more effective treatment in the management of Episodic tension-type headache in children and adolescents.

3.7.2.1. The data required

The data required for testing the hypothesis of objective two included each patient's response to the Short-form McGill Pain Questionnaire (Appendix 6); the headache diary (Appendix 7) and the headache questionnaire (Appendix 8).

3.7.2.2. How the data was secured

The data required was obtained in the same manner as for objective one. All questionnaires were completed under the supervision of the researcher. The headache diary was explained to each patient and then filled out by the patient for one week prior to and one week following the course of treatment.

3.7.3. Objective three

The third objective of this study was to integrate the results of objectives one and two to investigate the relative effectiveness of chiropractic manipulation in conjunction with soft tissue treatment as opposed to soft tissue treatment alone, in terms of objective and subjective clinical findings, in order to determine the more effective treatment in the management of Episodic tension-type headache in children and adolescents.

3.7.3.1. The data required

The data required for testing the hypothesis of objective three was obtained from the responses of patients in both groups to the Short-form McGill Pain Questionnaire, the headache questionnaire, the headache diary and the Algometer.

3.7.3.2. How the data was collected

The data required was recorded in the files of all participating patients during the process of securing data for objectives one and two.

3.8. Conclusion

Thirty children suffering from Episodic tension-type headache were selected for this study and received either chiropractic manipulation and soft tissue treatment or soft tissue treatment alone. Each patient was assessed in terms of subjective and objective clinical findings and the data was recorded for further statistical analysis.

CHAPTER FOUR

4. Results

4.1. Introduction

In this chapter, the criteria governing the admissibility of the data will be outlined and the collected data from the study will be presented in tabulated form. Demographic data from the study will be presented, followed by the intra-group data and inter-group data.

4.2. Criteria governing the admissibility of the data

Information obtained from the case history, physical examination, regional examination, headache questionnaire, headache diary, Short-form McGill Pain Questionnaire and Algometer were used as the data for this study. The McGill Pain Questionnaire and the headache questionnaire were completed under supervision of the researcher. The headache diary was completed independently by each patient and returned to the researcher one week later. The researcher took all Algometer readings.

The null hypothesis (H_0) states that there is no significant difference between the two groups with respect to the variable of interest. The alternative hypothesis (H_1) states that there is a significant difference between the two groups.

For the following data, the level of significance (α) was set at 0.05 (5% level of significance).

The decision rule works as follows for the two tailed tests:

Reject H_0 if $P \leq \alpha/2 = 0.025$

Accept Ho if $P > \alpha/2 = 0.025$

P is the observed level of significance of the test.

4.2.1. Abbreviations

Group A: Chiropractic manipulation and soft tissue treatment.

Group B: Soft tissue treatment.

S.D.: Standard deviation.

Freq: Frequency.

Dur: Duration.

Severity & Sev: Colour coded pain-rating scale.

Face: Affective visual scale.

R: Right.

L: Left.

Sup: Superior portion of the sternocleidomastoid muscle.

Mid: Middle portion of the sternocleidomastoid muscle.

Trap: Trapezius muscle insertion.

Values written in **bold** denote statistically significant values at a 95% level of confidence.

Values written in *italics* denote statistically significant values at a 90% confidence level.

4.3. Demographic data table

	Group A	Group B
Size	n = 15	n = 15
Age range	11 - 18	8- 17
Mean age	15.07	13.66
Male:Female	6:9(2:3)	7:8
Race:	12	13
White	1	1
Black	2	0
Indian	0	1
Coloured		
Level of fixations found over the eight visits:		
C0	15	6
C1	58	66
C2	50	50
C3	17	35
C4	25	19
C5	9	8
C6	11	3
C7	5	4
T1	2	5
T2	13	13
T3	31	22
T4	43	30

	Group A	Group B
Associated neck or shoulder pain	12	9
Kemps test positive	8	9
Level: C0	2	0
C1	18	4
C2	7	5
C3	4	9
C4	4	9
C5	3	3
C6	1	2
C7	2	0
Muscle tenderness and/or hypertonicity:		
Trapezius	86	67
Sternocleidomastoid:		
Upper	37	15
Middle	26	33
Lower	3	5
Posterior Cervical:		
Upper	61	70
Middle	15	19
Lower	14	4
Levator Scapulae	11	20
Scaleni	7	1

	Group A	Group B
Headache Location:		
Frontal	10	12
Parietal	3	3
Temporal	6	7
Occipital	3	4
Headache questionnaire (Appendix 8):		
Question 1		
0	7	6
1	5	4
2	1	4
3	2	1
Question 2		
0	6	7
1	8	5
2	0	1
3	1	2
Question 3		
0	1	0
1	7	9
2	5	3
3	2	3

4.4. Intra-group data

The results from groups A and B are compared with respect to the subjective and objective data collected over the five week period.

4.4.1. Subjective data

Table 1: Statistical results of the subjective findings using the Wilcoxon Signed Ranks test to compare visit 1 to visit 8 of the McGill in Group A.

	Group A Visit 1			Group A Visit 8	
	S.D.	**Mean**	**P-value**	**Mean**	**S.D.**
McGill (0-45)	6.22	13.73	0.108	10.13	5.62

There is no significant difference ($p>\alpha/2$) in the values (means) between visits 1 and 8. Thus, the null hypothesis is accepted.

Table 2: Statistical results of the subjective findings using the Wilcoxon Signed Ranks test to compare visit 1 to visit 8 of the McGill in Group B.

	Group B Visit 1			Group B Visit 8	
	S.D.	**Mean**	**P-value**	**Mean**	**S.D.**
McGill (0-45)	6.46	12.33	*0.044*	9.40	7.25

There is no significant difference ($p>\alpha/2$) in the values (means) between visits 1 and 8. Thus, the null hypothesis is accepted. However, at the 90% level of confidence there is a significant difference between the McGill values of the two groups and at this level the alternative hypothesis may be accepted.

Table 3: Statistical results of the subjective findings using the Paired T-test to compare week 1 to week 5 of the headache diary in Group A.

	Group A		
	Week 1	**Week 5**	
Diary	**Mean**		**P-value**
Freq 1 – Freq 5	0.53	0.28	**0.000**
Dur 1 – Dur 5	177.30	111.10	*0.046*
Face 1 – Face 5	5.11	3.67	0.057
Sev 1 – Sev 5	1.82	1.38	0.156

The p-value ($p \leq \alpha/2$) for headache frequency from week 1 to week 5 is significant. Thus, the null hypothesis is rejected. H_1, which states that there is a significant difference between the two readings, is accepted. At the 90% level of confidence the p-value ($p \leq 0.05$) for headache duration is significant. Thus, at this level the alternative hypothesis may be accepted.

Table 4: Statistical results of the subjective findings using the Paired T-test to compare week 1 to week 5 of the headache diary in Group B.

	Group B		
	Week 1	Week 5	
Diary	**Mean**		**P-value**
Freq 1 – Freq 5	0.51	0.33	**0.021**
Dur 1 – Dur 5	185.93	254.11	0.520
Face 1 – Face 5	5.56	4.16	0.060
Sev 1 – Sev 5	2.20	1.69	0.116

The p-value ($p \leq \alpha/2$) for headache frequency from week 1 to week 5 is significant. Thus, the null hypothesis is rejected. H_1, which states that there is a significant difference between the two readings, is accepted.

4.4.2. Objective data

Table 5: Statistical results of the objective findings using the Paired T-test to compare Algometer readings at visits 2, 5 and 8 in Group A.

	Group A			
	Visit 2	**Visit 5**	**Visit 8**	
Algometer	**Mean**			**P-value**
Sup R 2 – Sup R 5	1.93	2.12		**0.018**
Sup L 2 – Sup L 5	1.78	2.01		**0.014**
Sup R 5 – Sup R 8		2.12	2.16	0.567
Sup L 5 – Sup L 8		2.01	2.31	**0.003**
Sup R 2 – Sup R 8	1.93		2.16	0.070
Sup L 2 – Sup L 8	1.78		2.31	**0.001**

The p-value ($p \leq \alpha/2$) for Algometer reading at the superior portion of the sternocleidomastoid muscle on the right from visits 2 to 5 is significant, as are the p-values for readings on the left from visits 2 to 5, visits 5 to 8 and visits 2 to 8. Thus, the null hypothesis is rejected. H_1, which states that there is a significant difference between the readings of these two groups, is accepted.

Table 6: Statistical results of the objective findings using the Paired T-test to compare Algometer readings at visits 2, 5 and 8 in Group B.

	Group B			
	Visit 2	Visit 5	Visit 8	
Algometer	**Mean**			**P-value**
Sup R 2 – Sup R 5	1.83	1.97		0.106
Sup L 2 – Sup L 5	1.77	1.79		0.449
Sup R 5 – Sup R 8		1.97	1.95	0.855
Sup L 5 – Sup L 8		1.79	1.81	0.786
Sup R 2 – Sup R 8	1.83		1.95	0.197
Sup L 2 – Sup L 8	1.77		1.81	0.519

There are no significant differences ($p>\alpha/2$) in the values (means) of the above comparisons. Thus, the null hypothesis is accepted.

Table 7: Statistical results of the objective findings using the Paired T-test to compare Algometer readings at visits 2, 5 and 8 in Group A.

	Group A			
	Visit 2	Visit 5	Visit 8	
Algometer	**Mean**			**P-value**
Mid R 2 – Mid R 5	1.51	1.67		**0.004**
Mid L 2 – Mid L 5	1.46	1.65		**0.006**
Mid R 5 – Mid R 8		1.67	1.71	0.554
Mid L 5 – Mid L 8		1.65	1.77	**0.025**
Mid R 2 – Mid R 8	1.51		1.71	0.052
Mid L 2 – Mid L 8	1.46		1.77	**0.001**

The p-value ($p \leq \alpha/2$) for Algometer reading at the middle portion of the sternocleidomastoid muscle on the right from visits 2 to 5 is significant, as are the p-values for readings on the left from visits 2 to 5, visits 5 to 8 and visits 2 to 8. Thus, the null hypothesis is rejected. H_1, which states that there is a significant difference between the readings of these two groups, is accepted.

Table 8: Statistical results of the objective findings using the Paired T-test to compare Algometer readings at visits 2, 5 and 8 in Group B.

	Group B			
	Visit 2	**Visit 5**	**Visit 8**	
Algometer	**Mean**			**P-value**
Mid R 2 – Mid R 5	1.37	1.34		0.834
Mid L 2 – Mid L 5	1.30	1.32		0.315
Mid R 5 – Mid R 8		1.34	1.39	0.404
Mid L 5 – Mid L 8		1.32	1.33	0.905
Mid R 2 – Mid R 8	1.37		1.39	0.506
Mid L 2 – Mid L 8	1.30		1.33	0.451

There are no significant differences ($p>\alpha/2$) in the values (means) for the above comparisons. Thus, the null hypothesis is accepted.

Table 9: Statistical results of the objective findings using the Paired T-test to compare Algometer readings at visits 2, 5 and 8 in Group A.

	Group A			
	Visit 2	Visit 5	Visit 8	
Algometer	**Mean**			**P-value**
Trap R 2 – Trap R 5	2.27	2.41		0.215
Trap L 2 – Trap L 5	2.16	2.20		0.595
Trap R 5 – Trap R 8		2.41	2.57	0.255
Trap L 5 – Trap L 8		2.20	2.50	**0.011**
Trap R 2 – Trap R 8	2.27		2.57	0.104
Trap L 2 – Trap L 8	2.16		2.50	**0.020**

The p-values ($p \leq \alpha/2$) for Algometer readings at the trapezius muscle insertion on the left from visits 5 to 8 and visits 2 to 8 are significant. Thus, the null hypothesis is rejected. H_1, which states that there is a significant difference between the readings of these two groups, is accepted

Table 10: Statistical results of the objective findings using the Paired T-test to compare Algometer readings at visits 2, 5 and 8 in Group B.

	Group B			
	Visit 2	**Visit 5**	**Visit 8**	
Algometer	**Mean**			**P-value**
Trap R 2 – Trap R 5	1.96	1.94		0.720
Trap L 2 – Trap L 5	1.78	1.83		0.104
Trap R 5 – Trap R 8		1.94	2.01	0.483
Trap L 5 – Trap L 8		1.83	1.99	0.125
Trap R 2 – Trap R 8	1.96		2.01	0.471
Trap L 2 – Trap L 8	1.78		1.99	0.042

There are no significant differences ($p>\alpha/2$) in the values (means) for the above comparisons. Thus, the null hypothesis is accepted. At the 90% level of confidence the p-value ($p\leq 0.05$) for Algometer reading at the trapezius muscle insertion fibres on the left from visits 2 to 8 is significant. Thus, at this level the alternative hypothesis may be accepted.

4.5. Inter-group data

The results from related samples are compared with respect to the subjective and objective data collected within group a and within group B over the five week period.

4.5.1. Subjective data

Table 11: Statistical results of the subjective findings using the Mann-Whitney test to compare visit 1 to visit 8 of both Group A and Group B.

	Group A		**Group B**
	Mean	**P-value**	**Mean**
McGill (0-45) Visit 1	13.73	0.406	12.33
McGill (0-45) Visit 8	10.13	0.575	9.40

There are no significant differences ($p>\alpha/2$) in the values (means) between visits 1 and 8. Thus, the null hypothesis is accepted. For graphic representation of the mean values recorded above refer to graph 1.

Table 12: Statistical results of the subjective findings using the Unpaired T-test to compare week 1 of the headache diary for Group A and Group B.

	Group A Week 1			**Group B Week 1**	
Diary	**S.D.**	**Mean**	**P-value**	**Mean**	**S.D.**
Frequency	0.19	0.53	0.802	0.51	0.24
Duration	183.00	177.30	0.878	185.93	114.08
Face	1.04	5.11	0.225	5.56	0.96
Severity	0.49	1.82	*0.029*	2.20	0.42

There are no significant differences ($p>\alpha/2$) in the values (means) for the above comparisons. Thus, the null hypothesis is accepted. However, at the 90% level of confidence there is a significant difference between the values of the colour coded pain-rating scale of the two groups and at this level the alternative hypothesis may be accepted. Refer to graphs 2, 3, 4 and 5 for graphic representation of the mean values recorded.

Table 13: Statistical results of the subjective findings using the Unpaired T-test to compare week 5 of the headache diary for Group A and Group B.

	Group A Week 5			Group B Week 5	
Diary	**S.D.**	**Mean**	**P-value**	**Mean**	**S.D.**
Frequency	0.27	0.28	0.580	0.33	0.29
Duration	179.80	111.10	0.239	254.12	423.45
Face	2.97	3.67	0.619	4.16	2.41
Severity	1.17	1.38	0.456	1.69	1.05

There are no significant differences ($p>\alpha/2$) in the values (means) for the above comparisons. Thus, the null hypothesis is accepted. Refer to graphs 2, 3, 4 and 5 for graphic representation of the mean values recorded.

4.5.2. Objective data

Table 14: Statistical results of the objective findings using the Unpaired T-test to compare Algometer readings at visit 2 in Group A and Group B.

	Group A Visit 2			Group B Visit 2	
Algometer	**S.D.**	**Mean**	**P-value**	**Mean**	**S.D.**
Sup R	0.71	1.93	0.691	1.83	0.69
Sup L	0.65	1.78	0.970	1.77	0.57
Mid R	0.65	1.51	0.509	1.37	0.41
Mid L	0.53	1.46	0.342	1.30	0.33
Trap R	0.82	2.27	**0.022**	1.96	0.69
Trap L	1.02	2.16	0.296	1.78	0.60

The p-value for the Algometer reading at the trapezius insertion on the right is significant. Thus the null hypothesis is rejected. H_1, which states that there is a significant difference between the two readings, is accepted. Refer to graphs 6, 7 and 8 for graphic representation of the mean values recorded.

Table 15: Statistical results of the objective findings using the Unpaired T-test to compare Algometer readings at visit 5 in Group A and Group B.

	Group A Visit 5			Group B Visit 5	
Algometer	**S.D.**	**Mean**	**P-value**	**Mean**	**S.D.**
Sup R	0.77	2.12	0.658	1.97	0.67
Sup L	0.80	2.01	0.408	1.79	0.98
Mid R	0.65	1.67	0.098	1.34	0.39
Mid L	0.51	1.65	0.059	1.32	0.39
Trap R	0.93	2.41	0.131	1.94	0.65
Trap L	1.31	2.20	0.207	1.83	0.58

There are no significant differences ($p>\alpha/2$) in the values (means) for the above comparisons. Thus, the null hypothesis is accepted. Refer to graphs 6, 7 and 8 for graphic representation of the mean values recorded.

Table 16: Statistical results of the objective findings using the Unpaired T-test to compare Algometer readings at visit 8 in Group A and Group B.

	Group A Visit 8			Group B Visit 8	
Algometer	**S.D.**	**Mean**	**P-value**	**Mean**	**S.D.**
Sup R	0.76	2.16	0.523	1.95	0.98
Sup L	0.83	2.31	0.092	1.81	0.74
Mid R	0.65	1.71	0.103	1.38	0.37
Mid L	0.61	1.77	**0.022**	1.32	0.35
Trap R	1.31	2.57	0.168	2.01	0.79
Trap L	1.05	2.50	0.145	1.99	0.78

The p-value for the Algometer reading at the middle portion of the sternocleidomastoid muscle on the left is significant. Thus the null hypothesis is rejected. H_1, which states that there is a significant difference between the two readings, is accepted. Refer to graphs 6, 7 and 8 for graphic representation of the mean values recorded.

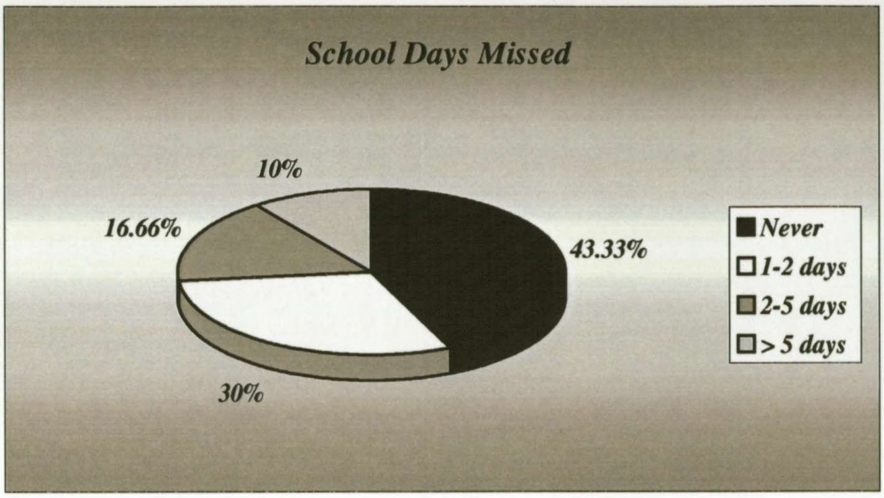
4.6. Graphical presentation

For graphical presentation of the abovementioned results, refer to the pages at the end of this chapter.

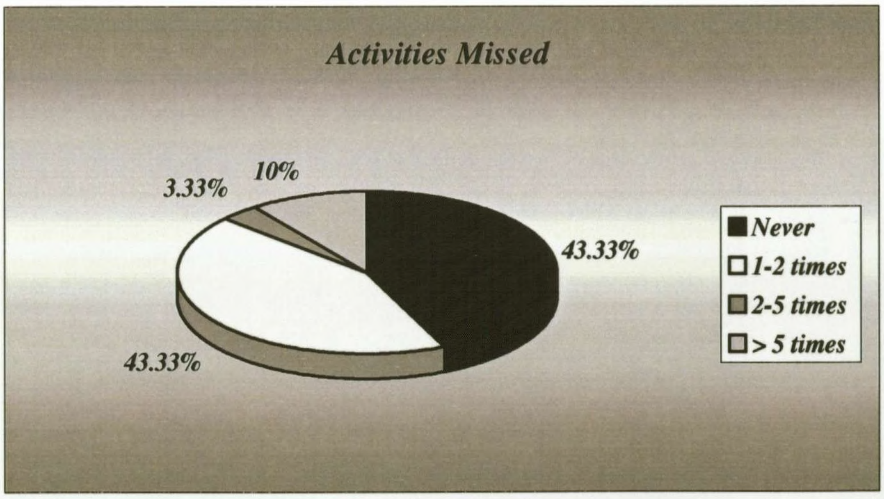
4.7. Conclusion

The data collected in this chapter was collected during the course of the study and represents the subjective and objective measurements for both the intra-group and inter-group comparisons. The data was statistically analysed using the SPSS software package.

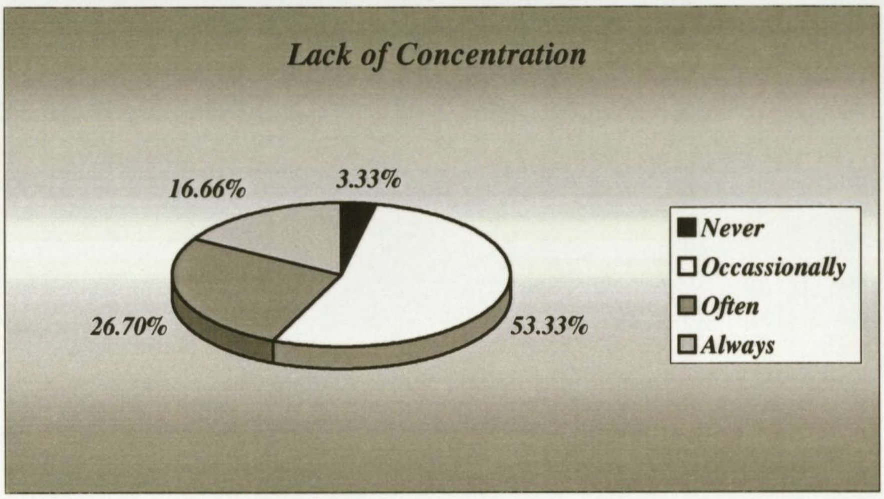
Graphical presentation referred to in 4.6.



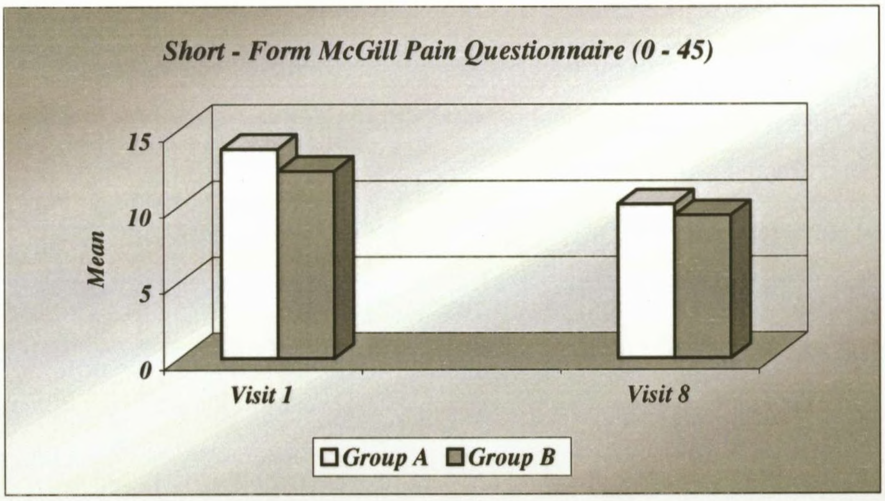
Pie Chart 1: Number of school days missed owing to headache for groups A and B combined



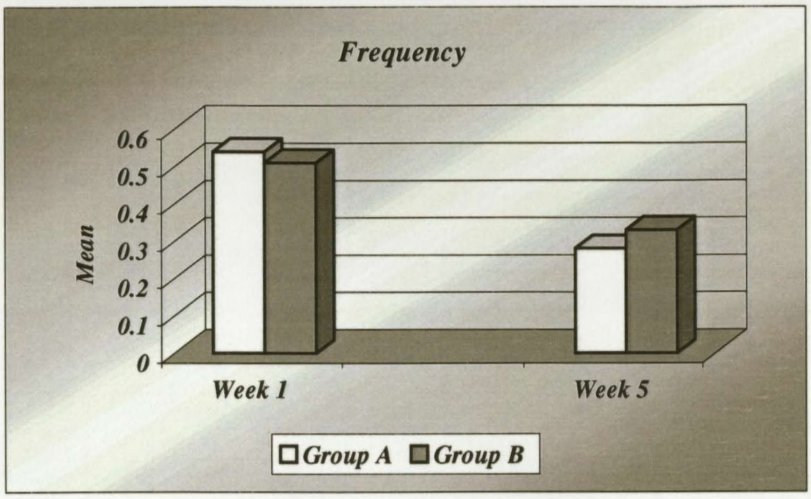
Pie Chart 2: Extra-mural activities or sport missed owing to headache for groups A and B combined



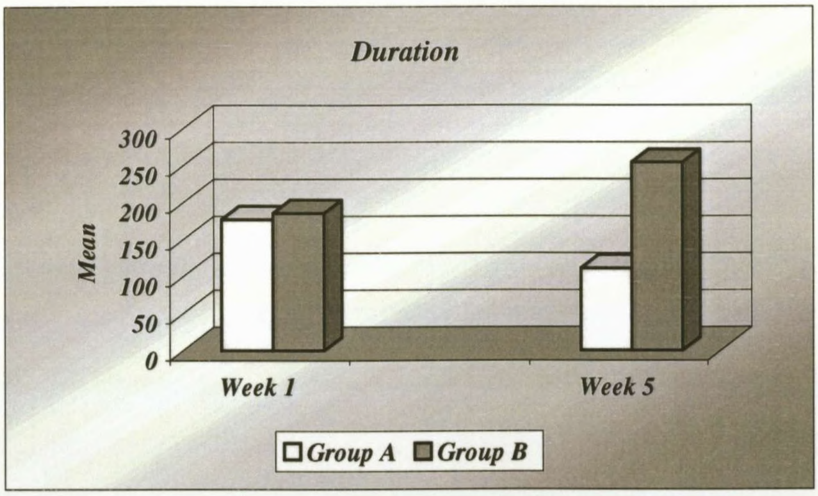
Pie Chart 3: Degree to which concentration was affected during a headache episode for groups A and B combined



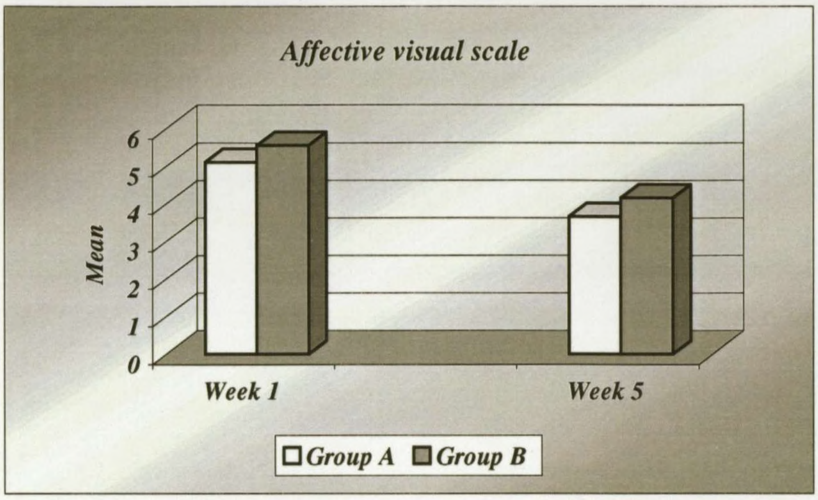
Graph 1: Mean values recorded for the Short-form McGill Pain Questionnaire comparing groups A and B at visits 1 and 8.



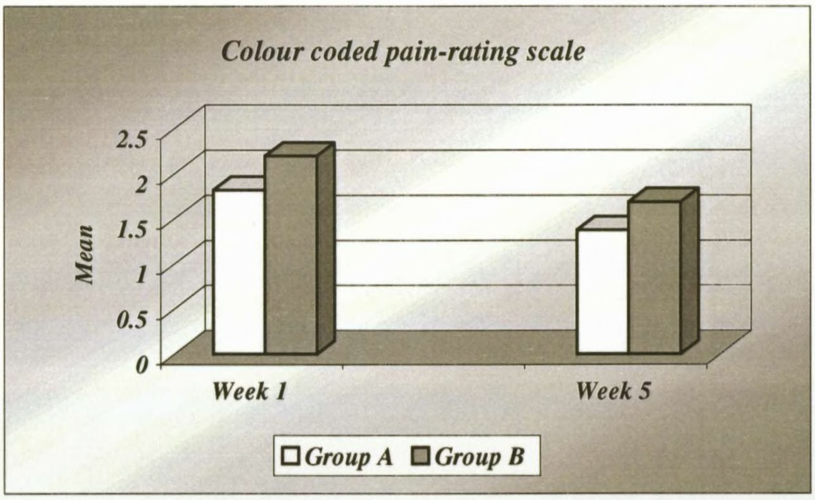
Graph 2: Mean headache frequency values comparing groups A and B at weeks 1 and 5.



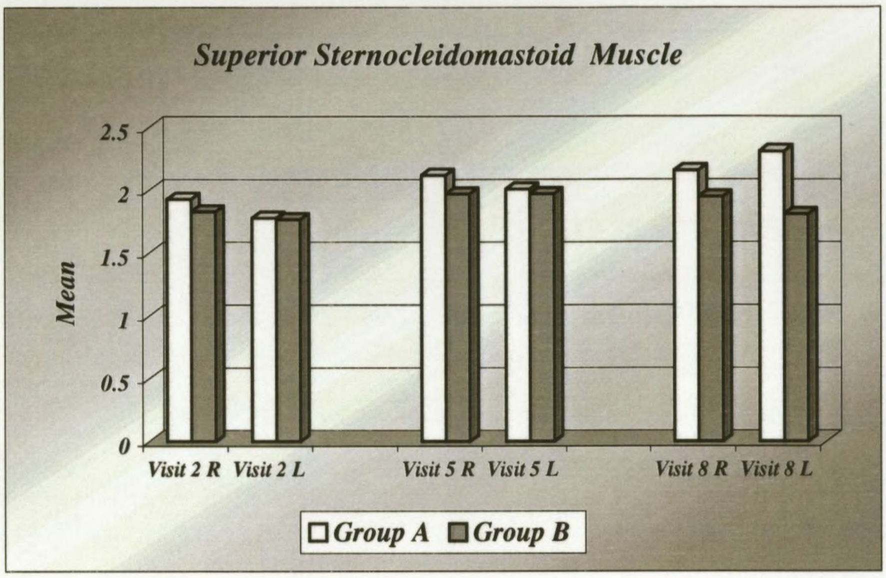
Graph 3: Mean headache duration values per episode in minutes comparing groups A and B at weeks 1 and 5



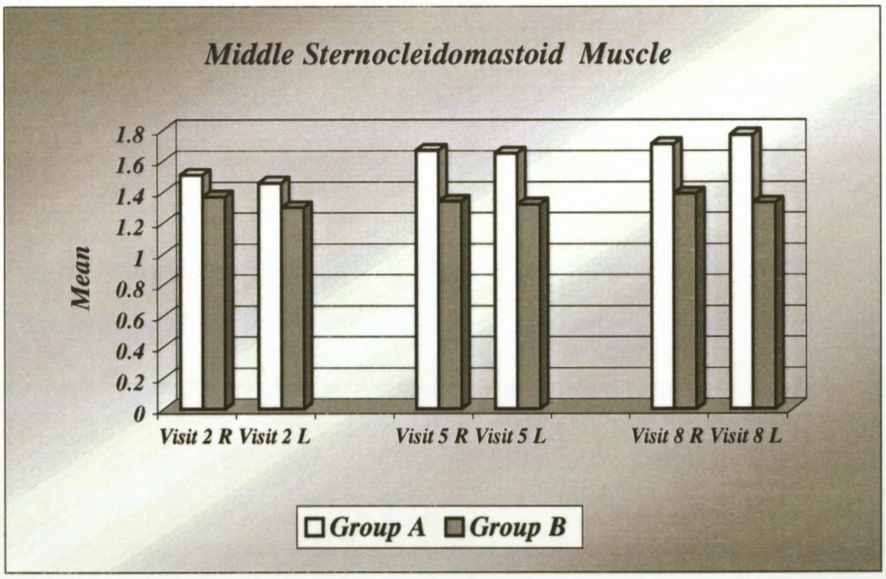
Graph 4: Mean values recorded for the affective visual scale comparing groups A and B at weeks 1 and 5



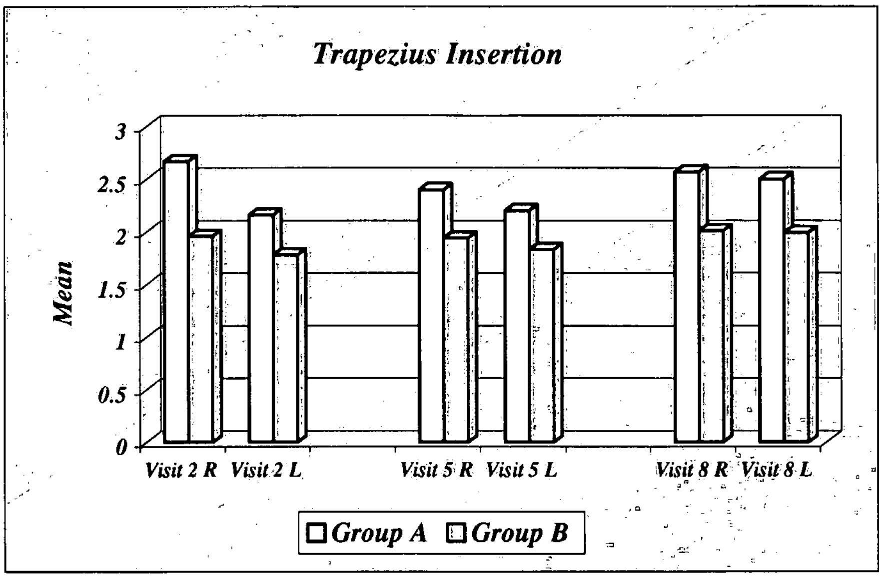
Graph 5: Mean values recorded for the colour coded pain-rating scale comparing groups A and B at weeks1 and 5



Graph 6: Mean Algometer values recorded for the superior portion the sternocleidomastoid muscle comparing groups A and B at visits 2, 5 and 8



Graph 7: Mean Algometer values recorded for the middle portion o the sternocleidomastoid muscle comparing groups A and B at visits 2, 5 and 8



Graph 8: Mean Algometer values recorded for the trapezius muscle insertion comparing groups A and B at visits 2, 5 and 8

CHAPTER FIVE

5. Discussion

5.1. Introduction

This chapter focuses on three main areas of analysis, namely demographic data analysis, subjective data analysis and objective data analysis. Analysis of both the subjective and objective data includes intra-group comparisons as well as inter-group comparisons. Results from this study were then compared with published research on the topic to determine whether this study compares favourably or not with documented trends.

5.2. Demographic data

Thirty-nine children and adolescents applied to be part of the study of whom thirty were accepted to participate. Patients were excluded for the following reasons:

1. Four subjects had sustained trauma to the cervical spine,
2. One subject had a positive Wallenberg's test bilaterally and
3. Two subjects were diagnosed with having both migraine and tension-type headache.

During the study two subjects were excluded because of taking medication for their headache.

The age range of group A was from eleven to eighteen years of age with a mean age of 15.07 years whilst the range of group B was from eight to seventeen years of age with a mean age of 13.66 years. The difference in ages between the groups may affect the inter-group analysis to a certain extent. The age range and mean age corresponded with other studies in which it was indicated that the onset of Episodic tension-type headache was greater in the second decade of life than in the first (Raskin 1988; Rasmussen 1993).

The male to female ratio was 6:9 (2:3) for group A and 7:8 for group B. In this study more males were accepted than females, however, in other studies the ratio was shown to be closer to 1:1. Despite the difference in ratios this study illustrates that unlike in adults, females are not more prone to suffering from headache than males (Bille 1981; Rasmussen 1993).

Headache location was similar between the groups, with the majority of patients complaining of frontal headache. Most of these locations were in combination, patients often stating that they had pain over the both the temporal and frontal regions.

In both groups A and B the most common level of fixation was C1, followed by C2 and then C4 in group A and C3 in group B. In the thoracic spine, T4 was commonly fixated and then T3 for both groups. Ng (1980) and Bogduk (1992) noted dysfunction of the upper cervical spine in adult headache sufferers and the results of the current study confirm the role of the upper cervical spine in the mechanism of Episodic tension-type headache. Vernon and McDermaid (1998) found upper and mid-cervical manipulation to receive the highest level of endorsement from chiropractors in the field. The large number of thoracic fixations recorded in this study correlated with similar findings by Viti and Paris (2000). In their review they revealed manipulation of the thoracic spine to have a positive effect on headache and postulated that the fixations were often a result of a sustained 'slouch' type posture. They concluded that manipulation resulted in improved thoracic extension, decreased forward head posture and decreased subcranial backward bending, thus resulting in reduced compression of the suboccipital muscles. Vernon and McDermaid (1998) indicated that although not endorsed at the highest level, adjustment of the thoracic spine is a common form of treatment by practising chiropractors.

In group A, twelve children complained of associated neck or shoulder pain and/or "tightness" and eight children from the group had a positive Kemp's test. Nine children in group B also complained of neck or shoulder pain and/or "tightness" and nine children from the group had a positive Kemp's test. Hypertonicity and tenderness most commonly occurred in the trapezius and upper posterior cervical musculature in both groups of children. These findings correspond with Kunkel (1991) and Davies' (2000) findings that patients with Episodic tension-type headache concurrently experience neck "tightness" or stiffness and "tightness" of the trapezius and suboccipital muscles. Edmeads (1988) suggested more evidence be required in order to classify cervicogenic headache as a separate entity from other headache, especially tension-type headache. It is cautiously suggested that many patients who sufferer from Episodic tension-type headache may also have a cervicogenic problem, owing to the large number of patients who had fixations and positive Kemps test of the cervical spine.

The headache questionnaire included three questions. The first question revealed that 46.7% of group A and 40% of group B had not missed a day of school in the past six months as a result of headache. 33.3% of group A and 26.75% of group B had taken one or two days off school, 6.7% of group A and 26.7% of group B had taken between two and five days off school and 13.3% of group A and 6.7% of group B had taken more than five days off school in the last six months (Refer to Pie Chart 1 for graphic representation of the combined percentages of groups A and B). Linet et al. (1989) and Klerman et al. (1987) demonstrated similar results in their studies, indicating that headache contributes significantly to school absenteeism. Owing to the small sample size of this study these results may be somewhat exaggerated. Question two related to sport or extra-mural activities missed as a result of headache. 40% of group A and 46.7% of group B had not missed any such activities in the past six months. 53.3% of group A and 33.3% of group B had missed such activities once or twice, none of group A and 6.7% of group B had missed such activities between two and five times and 6.7% of group A and 13.3% of group B had missed sport or extra-mural activities more than five times in the past six months (Refer to Pie Chart 2 for graphic representation of the combined percentages of groups A and B). Lack of concentration was a common complaint during headache episodes as revealed by question three, with only one child never experiencing this problem. By far the majority of children stated that they occasionally suffered from affected levels of concentration (46.7% of group A and 60% of group B). 33.3%of group A and 20% of group B often experienced this problem and 13.3% of group A and 20% of group B always found that headache interfered with their ability to concentrate (Refer to Pie Chart 3 for graphic representation of the combined percentages of groups A and B). The results from this questionnaire seem to support Schwartz et al. (1998) view that Episodic tension-type headache has a significant functional and societal impact at school and home.

5.3. Intra-group analysis

5.3.1. Subjective data

Short-form McGill Pain Questionnaire

Comparing visit one to visit eight of the McGill Pain Questionnaire (Table 1) for group A the p-value was greater than $\alpha = 0.025$, thus the null hypothesis (H_0), which states that there is no significant improvement between the visits, was accepted. The mean values of the data appear to indicate a slight improvement in the quality of pain during the aforementioned interval.

The McGill (Table 2) for group B did not show statistically significant results at the 95% confidence level when comparing visit one to visit eight. At this level H_0 is accepted. However, at the 90% level of confidence the p-value was less than $\alpha/2 = 0.05$, indicating a statistically significant result, in other words a significant improvement in the quality of pain during the interval. This reveals that the treatment was thus able to reduce the headache symptoms, at a 90% level of confidence.

Summary (McGill)

There were no statistically significant differences recorded for the McGill scores of either group A or B, however at a 90% level of confidence group B showed a significant benefit. Thus, chiropractic manipulation in conjunction with soft tissue treatment, resulted in no carryover or lasting effect from visit one to eight although the mean values of the data appear to indicate a slight improvement in headache symptoms. Soft tissue treatment alone was able to reduce headache symptoms, but was only significant at a lower level of confidence (90% level).

Headache diary

For group A (Table 3), a statistically significant reduction in headache frequency was recorded when comparing the headache diary of week one with week five, thus H_0 was rejected and the alternative hypothesis (H_1) was accepted. Subjects experienced considerably fewer headaches in week five than in week one with a mean number of 1.96 (0.28 multiplied by 7) headache days a week for week five, as compared with 3.71 (0.53 multiplied by 7) headache days a week for week one. At a 95% confidence level, H_0 was accepted and H_1 rejected for the headache duration data. However at a 90% level of confidence, the results were seen to be statistically significant. From week one to week five there was a reduction in the mean duration of headache episodes by a value of 66.2 minutes (1hour 6minutes and 12seconds). Thus although not statistically significant at $\alpha/2=0.025$ level, there was a trend towards a decrease in headache duration.

The affective visual and colour coded pain-rating scales for group A (Table 3), did not show significant improvement over the same interval and thus H_0 was accepted and H_1 rejected for these variables. Subjects tended towards a reduction in the affective visual scale, with a 1.44 point reduction out of a total possible score of nine from week one to week five indicating that some degree of relief from pain and distress was achieved, this however not being statistically significant. A slight reduction in the colour coded pain-rating scale was also noted.

For group B (Table 4), there was a statistically significant improvement in headache frequency when comparing week one with week five, with a decline in frequency from 3.57 (0.51 multiplied by 7) to 2.31 (0.33 multiplied by 7) headache days a week across the interval. No statistically significant reduction in duration was achieved across the same interval and thus H_0 was accepted and H_1 rejected. There was in fact a slight increase in mean headache duration per episode of 68.18 minutes (1hour 8minutes and 11seconds) when comparing week one with week five in this group.

Data recorded from the affective visual and colour coded pain-rating scales in group B (Table 4), revealed no statistically significant differences. Thus H_0 was rejected for both these measurements. A trend towards reduction in pain and distress was established though, since the affective visual scale recorded a 1.40 point reduction out of a total possible score of nine from week one to week five. A slight reduction in the colour coded pain-rating scale was also noted.

Summary (Headache diary)

Analysis of the data indicated that both groups A and B showed statistically significant improvements in headache frequency. Group A had a p-value of 0.000 as compared with 0.021 for group B, thus demonstrating that manipulation in conjunction with soft tissue treatment caused a greater reduction in frequency than soft tissue treatment alone for Episodic tension-type headache.

No statistically significant improvement was recorded for either group in terms of headache duration. However, group A demonstrated a trend towards reduction in duration and the results were significant at a 90% confidence level. Group B actually demonstrated a slight increase in headache duration over the same time interval.

The affective visual and colour coded pain-rating scales did not show statistically significant improvements when comparing week one with week five for either group A or B. Both forms of treatment resulted in a trend towards decreased pain and distress associated with headache, as recorded by the affective visual scale. Only a minor reduction in the colour coded pain-rating scale was evidenced in both groups.

5.3.2 Objective data

Algometer

Superior portion of the Sternocleidomastoid muscle.

Comparisons of visit two with visit five in group A (Table 5) indicated a significant improvement for readings taken on both the right and left. Therefore H_0 was rejected and H_1 accepted. Comparisons of visit five with visit eight showed statistically significant improvements for readings taken on the left, but not on the right. Therefore H_0 was rejected on the right, but accepted on the left. The benefits recorded on the left for visit five to visit eight, were greater than those recorded for visit two to visit five, with the mean pressure difference recorded between visit two to visit five and visit five to visit eight, being 0.19kg/cm^2 and 0.30kg/cm^2 respectively. Only a minor difference was recorded on the right for these same intervals. Comparison of visit two with visit eight revealed a statistically significant improvement for readings taken on the left only and not on the right. The difference in mean pressure readings taken across this interval was 0.53kg/cm^2. Recordings on the right, although not statistically significant, showed a tendency toward improvement in pain pressure sensitivity. Thus for group A, a lasting effect was established, especially on the left side with respect to muscle pain pressure sensitivity.

Comparisons of visit two with visit five, visit five with visit eight and visit two with visit eight in group B (Table 6), revealed no statistically significant improvements for readings taken on either the right or the left. H_0 was accepted and H_1 rejected for each of the above comparisons. Thus indicating that no lasting benefit in terms of pain pressure sensitivity occurred as a result of the treatment received by group B.

Middle portion of the Sternocleidomastoid muscle.

A similar trend to that recorded for the superior portion of this muscle was recorded in this set of data for group A (Table 7). Comparisons of visit two with visit five on the left and on the right, visit five with visit eight and visit two with visit eight on the left all showed statistically significant improvements in terms of pain pressure sensitivity. The most significant improvement being recorded from visit two to visit eight on the left, thus H_0 was rejected for all the above results. H_0 was accepted for the comparison of visit five with visit eight and of visit two with visit eight on the right, in that no significant differences were noted. There seems to be a trend, however, towards improved pain pressure sensitivity for these sets of data. A lasting effect appears to be established over the aforementioned intervals on the left side and initially on the right. The effect seems to strengthen when comparing the results of visit two with visit five on the left, with the results of visit two with visit eight on the left, revealing an increase in the difference between mean pressure readings over these time intervals of $0.16kg/cm^2$ and $0.31kg/cm^2$ respectively.

As with the superior portion of this muscle, data collected at the middle portion of the sternocleidomastoid in group B (Table 8) did not reveal any statistically significant improvement across any of the visit intervals. Thus, H_0 was accepted and H_1 rejected for each of the sets of data, indicating that no lasting benefit resulted.

Trapezius insertion.

The statistical results of the comparison of visit two with visit five on the left and on the right in group A (Table 9) revealed that no statistically significant improvements occurred, as did the comparison of visit five with eight and of visit two with eight on the right. The p-values were all greater than $\alpha=0.025$ and the mean values only increased slightly as the treatments progressed, thus H_0 was accepted for these sets of data. H_0 was rejected for the comparison of visit five with visit eight and of visit two with visit eight on the left, since statistically significant improvements in Algometer readings were recorded. The mean values of the Algometer readings at visits two, five and eight confirm that a reduction in pain pressure sensitivity occurred. There was an increase in the mean pressure readings recorded between visits two and five of $0.04 kg/cm^2$, between visits five and eight of $0.30 kg/cm^2$ and between visits two and eight of $0.34 kg/cm^2$.

The statistical results when comparing Algometer readings in group B (Table 10), revealed no significant differences between the data obtained from each of the visit intervals on the left or on the right. All p-values were greater than $\alpha=0.025$. Although the mean pressure values were fairly similar at each visit, a trend was noted on the left toward a reduction in pain pressure sensitivity, especially across the interval from visit two to visit eight. When comparing visit two with visit eight the p-value was significant at a 90% level of confidence (α=0.05), thus H_0 was rejected for the trapezius insertion at this confidence level.

Summary

Similar findings were recorded for all three muscle regions tested. In group A, statistically significant results were recorded when comparing visit two with five on the left and on the right for the sternocleidomastoid muscle portions, and when comparing visits five with eight on the left and visits two with eight on the left for the sternocleidomastoid muscle portions and the trapezius insertion. These results indicate a carryover effect or lasting benefit in terms of pericranial muscle sensitivity to pressure when treated by manipulation in conjunction with soft tissue treatment.

For group B, no statistically significant results were recorded when comparing any of the visit intervals, both on the left and on the right. A trend towards reduction in pain pressure sensitivity was noted at the left trapezius insertion across the visit intervals. No lasting benefits were evidenced however in terms of pericranial muscle pressure sensitivity in this group, which received soft tissue treatment.

When comparing the subjective and objective findings, both groups demonstrated a reduction in headache frequency per week, group A having a more significant p-value than group B for this reading. Only group A recorded significant improvement in pericranial tenderness of the muscles tested over the visit intervals.

5.4. Inter-group data

5.4.1. Subjective data

Short-form McGill Pain Questionnaire

Comparing the data obtained from the McGills completed at the first visit for both groups A and B (Table 11) produced a p-value greater than α=0.025 and hence H_0 was accepted. Therefore, no statistically significant difference was observed.

The mean values of both groups were similar in terms of the quality of pain experienced and the groups were thus comparable. This assists in the analysis of any changes that may arise as a result of either form of treatment. Any reduction in the quality of pain would be indicative of the success of the treatment. Analysis of the statistical results comparing visit eight of groups A and B revealed a p-value greater than α=0.025. H_0 was therefore accepted and H_1 rejected.

Summary (McGill)

Overall, the mean values of the two groups at visit two and eight were very similar, indicating that neither treatment was statistically more beneficial than the other in reducing the quality of pain experienced by these headache sufferers.

Headache diary

When comparing week one of the headache diary for groups A and B (Table 12), a statistically significant difference was noted at the 90% level of confidence for headache severity as recorded by the colour coded pain-rating scale. In terms of headache severity, subjects in group B appear to have suffered more severe headache prior to the commencement of treatment than group A. All other data recorded, including frequency, duration, and headache pain and distress as recorded by the affective visual scale, revealed no such statistically significant differences at either the 90% or 95% confidence level.

In week five no statistically significant changes were noted when comparing the groups (Table 13) and thus H_0 was accepted and H_1 rejected. It would appear that both forms of treatment were equally beneficial, however with regard to mean headache duration, group A's value decreased from 177.30 to 111.10 minutes per episode, while group B's value actually increased from 185.93 to 254.12 minutes per episode. The standard deviation between the groups was fairly similar during week one, however, in week five group B showed a very large standard deviation indicating that the mean may not be totally representative of the data for that group. All other mean values recorded appear to be totally representative of the groups, with smaller standard deviations. Both groups showed an improvement in terms of headache frequency, with a change in the mean number of headache days per week from 3.71 and 3.57 to 1.96 and 2.31 for groups A and B respectively.

The severity of headache experienced by both groups was statistically significant at a 90% confidence level during week one, but not during week five. It would appear that the two groups became more comparable by week five. Group A showing a reduction in severity as recorded by the colour coded pain-rating scale of 0.44 out of a possible score of four between weeks one and five, and group B a reduction of 0.5 over the same period, thus this group's (group B) headache became less severe with the progression of treatment.

<u>Summary (Headache diary)</u>

The two groups were comparable for all measurements at week one, apart from pain severity. Aside from this, the groups were similar and thus any changes in the p-value to an alpha value less than 0.025 would indicate the one treatment to be more effective than the other.

Comparisons of the groups at week five illustrated no statistically significant differences in terms of reduction in frequency, duration, pain and distress or severity of pain experienced, thus H_0 was accepted and H_1 rejected for this set of data. Thus neither form of treatment was more effective than the other.

5.4.2. Objective data

<u>Algometer</u>

When comparing Algometer readings at visit two for groups A and B (Table 14) no statistically significant differences were evidenced and thus H_0 was accepted for all tests, except for the readings taken at the right trapezius insertion. These readings demonstrated a p-value of 0.022 (i.e. less than $\alpha/2=0.025$) indicating a significant difference between the groups, with subjects in group B having markedly higher pain pressure sensitivity than those in group A at this muscle insertion.

Comparisons of groups A and B (Table 15) for visit five revealed no statistically significant differences for any of the readings taken, thus H_0 was accepted and H_1 rejected. Overall there was a slight increase in the mean readings from visit two to visit five. However, at the middle portion of the sternocleidomastoid muscle and trapezius insertion on the right, subjects in group B showed a slight increase in pain pressure sensitivity. Readings taken at the middle portion of the sternocleidomastoid on the left tended towards a significant difference, with an improvement in the mean pain pressure sensitivity from visit two to five of $0.19kg/cm^2$ in group A and only $0.02kg/cm^2$ in group B (Tables 14 & 15). No significant difference was noted at the trapezius insertion on the right at week five because of a $0.02kg/cm^2$ decrease in readings for group B, and a $0.14kg/cm^2$ increase in readings for group A from visit two to visit five (Tables 14 & 15).

Comparison of the groups (Table 16) for visit eight showed a statistically significant improvement ($p<\alpha$) in the readings taken at the middle portion of the sternocleidomastoid muscle on the left, with an improvement of $0.12kg/cm^2$ from visit five to visit eight for group A and no improvement for group B (Tables 15 & 16). All other readings revealed no statistically significant differences between the groups. Thus for all other readings H_0 was accepted and H_1 rejected.

<u>Summary</u>

Statistically significant differences between the groups were only noted for the trapezius insertion on the right at visit two and the middle portion of the sternocleidomastoid muscle on the left at visit eight. This is in keeping with data generated from the subjective analysis, which showed no statistically significant differences between the groups, apart from headache intensity in week one. Algometer readings improved from visit two to visit five and from visit five to visit eight, with group A recording lower pain pressure sensitivity for all readings taken, especially as the treatment progressed. This improvement however was not statistically significant.

5.5. Problems encountered with the demographic, subjective and objective data

In this study homogeneity was a problem. This author randomly allocated the patients into either treatment group in order to safeguard against selection bias. However, ideally matched pairs should be used where the subject is matched with someone of the same or similar age, sex, race and history (Fitz-Gibbon & Morris 1987:109). In this particular study owing to the clinical setting and time constraints, it was not possible to achieve this ideal. The demographic data in 4.3, revealed that the two groups were not similar with respect to mean age and age range. It is possible that the heterogeneity of the two groups may have affected the outcome.

The problems experienced in recording the subjective data occurred in the completion of the Short-form McGill Pain Questionnaire. It is the author's opinion that some children tended to underplay the quality of the pain experienced due to their headache at visit one and exaggerate the quality of pain experienced at visit eight. The headache diary was generally successfully completed by all patients and no problems arose from the actual recording of this data. However, when school exams coincided with week one or week five of the study, these children's headache tended to be of greater frequency, duration and intensity than those not writing exams, possibly owing to the added stress. The reverse was noted when the children were on holiday. All patients successfully completed the headache questionnaire.

For the objective data, no problems arose when taking readings at the superior portion of the sternocleidomastoid muscle and trapezius insertion. However, although readings were successfully taken at the middle portion of the sternocleidomastoid muscle, this was a particularly awkward and often tender region to apply pressure to, especially in younger children were the sternocleidomastoid muscle mass is not particularly bulky.

5.6. Comparison of the results of this study with past research

There have been few studies to date specific to the chiropractic management of Episodic tension-type headache in children and thus most comparisons have been made with adults studies related to the topic.

Vernon (1982) in a prospective study of chiropractic treatment for adult tension-type headache sufferers recorded a reduction in frequency from twelve to two headaches per month. Mootz et al. (1994) found that after eight treatments of manipulation, myofascial trigger point therapy and moist heat packs, subjects in the study went from suffering 6.4 to 3.1 headaches per two weeks. Similarly Boline et al.'s (1995) study comparing spinal manipulation with anti-depressive medication, indicated a 42% decrease in frequency for the group receiving manipulation and no improvement for the medication group. In the current study, group A showed a similar reduction in headache frequency, with the mean average of recorded headache decreasing from 3.71 to 1.96 headache days per week. Group B however also showed a significant, though not as substantial drop in frequency from 3.57 to 2.31 headache days per week. Hence, this study revealed that although manipulation in conjunction with soft tissue treatment was successful in reducing headache frequency, soft tissue alone also resulted in long term benefits and is in keeping with the above mentioned studies' results for the manipulation group.

The duration of headache experienced in the current study decreased significantly (at a 90% confidence level) in group A from 177.30 to 111.10 minutes per headache episode (a 62% reduction) and actually increased, though not significantly, in group B from 185.93 to 254.11 minutes per headache episode (a 36% increase). Thus, group A's results were likened to findings by Vernon (1982) who recorded a decrease in headache duration from thirteen to three hours per episode, Mootz et al. (1994) where subjects headache duration decreased from 6.4 to 3.1 hours per episode and Bove and Nilsson's (1998) study in which spinal manipulation in conjunction with soft tissue treatment reduced the patients' duration in mean daily headache hours from 2.8 to 1.5 hours. It was also found however in their study, that the comparison group which received soft tissue treatment alone, experienced a reduction in mean daily headache hours from 3.4 to 1.9 hours, thus contradicting the findings recorded for group B which had also received soft tissue treatment.

This study recorded the intensity of pain by using both an affective visual scale, which recorded the level of distress caused as a result of headache, and a colour coded pain-rating scale, which recorded pain severity. In both groups there was a trend towards decreased levels of distress, which was not statistically significant. No such changes resulted in terms of severity of headache recorded. This compared favourably with Bove and Nilsson's (1998) study in which headache intensity remained unchanged for the duration of the trial, as well as the study by Mootz et al. (1994) where a trend towards reduction in severity was recorded but was not found to be statistically significant. Contradictory findings were recorded by Hoyt et al. (1979) who indicated a decrease by 50% in headache severity and Boline et al. (1995) who indicated a 32% decrease in headache intensity. Possible reasons for this disparity in the literature are that Hoyt et al.'s (1976) study compared manipulation with two placebo control groups and Boline et al.'s (1995) study did not compare two forms of manual therapy and was conducted in chronic tension-type headache sufferers.

Table 17: Comparison of recent studies into tension-type headache with the current study.

Study	Treatment	Size & Age	Frequency	Duration	Intensity
Current (2000)	SMT & STT vs. STT in ETTH	n=30 8-18	3.71-1.96 3.57-2.31	2.96-1.85 hrs 3.1-4.24 hrs	1.82-1.38/ 4 2.2-1.69/ 4
Bove & Nilsson (1998)	SMT & STT vs. STT & placebo laser in ETTH	n=75 20-59	- -	2.8-1.5 hrs/day 3.4-1.9hrs/day	0.66-0.38 0.82-0.59
Boline et al. (1995)	SMT vs. Amitryptaline in CTTH	n=150 18-70	12.4-8.6 10.8-6.8	- -	5.6-4.3/ 20 5.0-3.2/ 20
Mootz et al. (1994)	SMT in ETTH & CTTH	n=11 18-40	6.4-3.1	6.7-3.88 hrs	5.05-3.37

Study	Treatment	Size & Age	Frequency	Duration	Intensity
Vernon (1982)	SMT	n=18 20-47	12.05-2.19	13-2.8 hrs	3.5-1.44/ 5

SMT = Spinal manipulative therapy CTTH = Chronic tension-type headache

STT = Soft tissue treatment ETTH = Episodic tension-type headache

Pericranial muscles have long been considered to play an important role in the mechanism/pathophysiology of Episodic tension-type headache. This study demonstrated significant changes in pain pressure sensitivity over the course of treatment and for the week following treatment in the group receiving manipulation, at both the middle and superior portion of the sternocleidomastoid muscle and the trapezius insertion on the left and initially on the right. No significant differences apart from at visit eight for the trapezius insertion on the right were recorded in the soft tissue group. Apart from these objective findings, results from the demographic data indicated tenderness and hypertonicity of the pericranial muscles especially the posterior cervical, sternocleidomastoid and trapezius muscles to be common findings in each group. These sets of data appear to reflect Kim et al. (1995) and Jensen et al.'s (1998) studies in which both concluded that increased sensitivity of muscles of the head and especially the neck region may be included in the pathogenetic mechanism of Episodic tension-type headache.

Vernon et al. (1990) demonstrated that manipulation produced significantly higher increases in pain pressure sensitivity of tender points than did mobilisation for the treatment of tension-type headache. He recorded an increase in the pain pressure threshold of 40-50%, with an average increase of 45% in the group receiving manipulation, which also seems to be reflected in the results of this current study. In a later study, Vernon et al. (1992) reiterated that the neck plays an important and largely ignored role in the manifestation of adult headache, which appears to be a fitting statement with regards to the children in this study. Fitz-Ritson (1990), Curl (1994) and Green (1997) all indicated that cervical spine manipulation reduced muscle hypertonicity, as muscle spasm is reflexly relieved when facet mechanoreceptors are stimulated by manipulation. Viti and Paris (2000) in discussing the effect of thoracic manipulation came to the same conclusions. Both the above statements concur with the current findings of increased pain pressure threshold for all three muscles tested, of between $0.20 kg/cm^2$ and $0.53 kg/cm^2$ for readings taken from visits two to eight in group A as compared with a range of between $0.02\ kg/cm^2$ and $0.21 kg/cm^2$ in group B. Unlike in Nilsson et al.'s (1997) study of cervicogenic headache sufferers in which manipulation when compared with soft tissue treatment was found to have significant benefits in terms of the intensity and duration of headache, this study showed very little difference between the groups. Therefore these results indicate that in Episodic tension-type headache, as compared with cervicogenic headache, cervical dysfunction is only one of the mechanisms and not the mechanism of headache.

The possibility that Episodic tension-type headache arises from psychological stress cannot be refuted by this study. Although not recorded in the demographic data, it was interesting to note that stress was commonly indicated by children to trigger a headache. Three subjects in this study had experienced the death of a parent, four subjects were writing matric exams, while numerous others were writing mid and end of year exams and two subjects fell into the category of over-pressured, high achievers. Other stresses mentioned included family tension and a dislike of school. In keeping with the findings of this study, Passchier and Orlebeke (1985) reported that of all headache triggers in their study, stress was mentioned most frequently for both elementary and secondary school pupils. Smith (1995) indicated that psychosocial factors might precipitate or augment paediatric headache. Bove and Nilsson (1998) added that treatment by manual therapy allows for greater levels of personal attention to be given, as compared with prescribing medication. It is cautiously suggested by the author that although not measurable, the effects of personal interaction and interest would to a certain degree have benefited both groups, especially owing to the psychological dimension related to Episodic tension-type headache.

To echo Bove and Nilsson (1998), as an isolated intervention, when not combined with a separate form of treatment including medication, biofeedback or relaxation technique, spinal manipulation seems to have no significant positive effect on Episodic tension-type headache.

CHAPTER SIX

6. Conclusions and recommendations

6.1. Conclusions

6.1.1. Subjective data

Analysis of the results indicates statistically significant improvements in both groups with regard to headache frequency. Group A showed a strong trend toward a reduction in headache duration and both groups showed a tendency toward reduction of pain and distress caused by headache. No significant improvement in headache severity was established by this study.

Inter-group analysis did not demonstrate any significant differences between groups A or B and thus neither form of treatment was seen to be more effective than the other in the management of Episodic tension-type headache, with regards to the children's perception of headache.

6.1.2. Objective data

The group receiving manipulation evidenced statistically significant improvements in terms of pericranial pain pressure sensitivity of all muscles tested on the left, and initially at muscles tested on the right. Few such changes were recorded for the group receiving soft tissue alone, with the most substantial difference occurring at the trapezius muscle on the left.

Objective findings from the inter-group analysis revealed a statistically significant reduction in pain pressure sensitivity of the middle portion of the sternocleidomastoid muscle on the left. All other recordings were similar between the groups, indicating that apart from one muscle, neither of the two forms of treatment given were significantly more effective than the other in reducing overall pericranial pain pressure sensitivity associated with Episodic tension-type headache. The results from this study seem to demonstrate that manipulation of the cervical and thoracic spine may cause reflex inhibition of spasm and hypertonicity of the pericranial muscles or by some other mechanism cause pain relief and hypoalgesia of these muscles. It appears that both forms of manual therapy had some effect in decreasing pericranial tenderness associated with Episodic tension-type headache in children.

6.1.3. Final conclusion

In conclusion, in comparing the two different forms of treatment, manipulation in conjunction with soft tissue with soft tissue alone, manipulation was not found to be more effective than soft tissue treatment in the management of Episodic tension-type headache in children and adolescents. However due to the small sample size, there is a high probability of type 2 error having occurred. It is therefore possible that statistically significant differences existed that were not detected by the statistical analysis.

6.2. Recommendations

A larger sample size is recommended in order that a trend in the results may be more apparent and sensitive to subtle changes in data. This study with a sample size of thirty and treatment groups of fifteen cannot carry the weight that a larger sample size could.

Careful consideration should also be given to the use of medication by patients. In this study, no medication was allowed and this excluded patients who were unable to be without the pain relief afforded by analgesic medication. It is recommended that in future studies, the amount of medication taken should be recorded in order to determine the effect that treatment has with regard to the amount and potency of medication taken. It would also prevent any rebound headache from occurring due to the sudden cessation of analgesic medication intake and would provide an additional objective measure..

A two week pre- and post-treatment headache diary is suggested in order to document an accurate baseline and provide a more accurate measure of any changes arising in headache behaviour following treatment.

It is suggested that different age ranges be researched. The current study included both children and adolescents, however it may make the study groups more homogeneous if these two age groups be kept separate. Suitable age groups for study may include pre-pubertal children, post-pubertal children, children in their first decade of life and those in their second decade of life.

For the affective visual scale different methods are used in allocating values to each face. This study group consisted mostly of adolescents, the majority of whom indicated that they would have allocated a score of one to nine for the faces. McGrath (1990) however, states that in younger children it may be beneficial to allow them to allocate values to each face and then use an average of these scores for each face when analysing the results. This may increase the validity of the results, especially in younger children.

It is recommended that manipulation in future studies be compared with a separate form of intervention such as analgesic medication, in order to determine the effectiveness of manual therapy in the management of this condition.

REFERENCES

Andrasik, F. 1992. Assessment of patients with headache. In Turk. D.K. and Melzack, R. (eds.) Handbook on Pain Assessment. pp. 344 – 361. New York: The Guildford Press. 455p. ISBN 0 – 89862 – 883 – 0.

Anrig, C. 1995. Pediatric Headaches. [online]. California. Available from: http://www.chiroweb.com/archives/16/17/04.html [Accessed 12 March 1999].

Anrig, C. and Plaugher, G. 1998. Pediatric Chiropractic. Williams and Wilkins. Baltimore, Maryland. USA. 787 p. ISBN 0 – 683 – 00136 – 1.

Bergmann, T.F., Peterson, D.H. and Lawrence, D.J. 1993. Chiropractic Technique: Principles and Practices. New York: Churchill Livingstone. 803p. ISBN 0 – 443 – 08752 – 0.

Bille, B. Migraine in childhood and its prognosis. Cephalalgia. 1981. 1: 71 – 75.

Blanchard, E.B., Andrasik, F., Neff, D.F., Jurish, S.E. and O'Keefe, D.M. 1981. Social validation of the headache diary. Behavior Therapy. 12: 711 – 715.

Bogduk, N. 1992. The Anatomical Basis for Cervicogenic Headache. Journal of Manipulative and Physiological Therapeutics. 15 (1): 67 – 70.

Boline, P.D., Kassak, K., Bronfort, G., Nelson, C. and Anderson, A.V. 1995. Spinal manipulation vs. amitryptaline for the treatment of Chronic tension-type headaches. Journal of Manipulative and Physiological Therapeutics. 18 (3): 148 – 154.

Bove, G. and Nilsson, N. 1998. Spinal manipulation in the treatment of Episodic tension-type headache. Journal of the American Medical Association. 280 (18): 1576 – 1579.

Bove, G.M. and Nilsson, N. 1999. Pressure pain threshold and pain tolerance in Episodic tension – type headache do not depend on the presence of headache. Cephalalgia. 19: 174 – 178.

Cassidy, J.D., Quon, J.A., Lafrance, L.J. and Yong-Hing, K. 1992. The effect of manipulation on pain and range of motion in the cervical spine: A pilot study. Journal of Manipulative and Physiological Therapeutics. 15 (8): 195 – 500.

Chesney, M.A., Shelton, J.L. 1976. A comparison of muscle relaxation and electromyogram biofeedback treatments for muscle contraction headache. Journal of Behaviour Therapy and Experimental Psychiatry. 7: 221 – 225.

Curl, D.D. 1994. Chiropractic Approach to Head Pain. Baltimore: Williams and Wilkins. 358 p. ISBN 0 – 683 – 02250 – 4.

Dabbs, V. and Lauretti, W.J. 1995. A risk assessment of cervical manipulation vs. NSAIDS for the treatment of neck pain. Journal of Manipulative and Physiological Therapeutics. 18 (8): 530 – 536.

Davies, N.J. 2000. Chiropractic Pediatrics. A Clinical Handbook. London, Churchill Livingstone. 500 p. ISBN 0 – 443 – 06253 – 6.

Diamond, S. 1987. Muscle Contraction Headache. In Dalessio, D.J. (ed.). Wolff's Headache and other Head Pain. 5th ed. pp. 171 – 189. New York: Oxford University Press. 434p. ISBN 0 – 19 – 504356 – 1.

Diamond, S. 1998. Diagnosing and Managing Headaches. [online] Chicago, Illinois. Available from:http://www.medscape.com/PCT/headaches/headaches.ch06/headaces.ch06-01html [Accessed 30 September 2000].

Donkin, R.D. 1998. The Relative Effectiveness of Adjustments and Traction in the Treatment of Tension-type Headaches. Unpublished. M.Tech: Chiro. Dissertation. Technikon Natal Library, Durban. 112 p.

Dorland's Pocket Medical Dictionary. 23rd ed. 1982. Philadelphia: W.B. Saunders Company. 754p. ISBN 0 – 7216 – 3166 – 3.

Edmeads, J. 1988. The cervical spine and headache. Neurology. 38: 1874 – 1878.

Fischer, A.A. 1986. Pressure threshold for diagnosis of myofascial pain and evaluation of treatment results. The Clinical Journal of Pain. 2: 207 - 214.

Fitz-Gibbon, C.T. and Morris, L.L. 1987. How to Analyse Data. 1st ed. California: Sage Publications. 162p. ISBN 0 – 8039 – 3133 – 6.

Fitz–Ritson, D. 1990. The chiropractic management and rehabilitation of cervical trauma. Journal of Manipulative and Physiological Therapeutics. 13: 17 - 25.

Gatterman, M. I. 1990. Chiropractic Management of Spine related disorders. Williams and Wilkins. Baltimore: USA. 437 p. ISBN 0 – 683 – 03468 – 3.

Gatterman, M. I. 1995. Foundations of Chiropractic Subluxation.. St Louis: Mosby – Year Book Inc. 487 p. ISBN 0 – 8151 – 3543 – 2.

Geiringer, S.T., Kincaid, C.B. and Rechtien, J.R. 1993. Traction, manipulation, and massage. In De Lisa, J.A. (ed.) Rehabilitation Medicine: Principle and Practice. 2nd ed. Philadelphia: J.B. Lippincott. 1238p. ISBN 0 – 397 – 51262 – 7.

Green, J. 1997. Cervicogenic headache: a case study. European Journal of Chiropractic. 45: 43 – 47.

Haldeman, S. 2000. Neurologic effects of the adjustment. Journal of Manipulative and Physiological Therapeutics. 23(2): 112 – 114.

Haynes, S.N., Griffin, P., Mooney, D. and Parise, M. 1976. Electromyographic Biofeedback and Relaxation Instructions in the Treatment of Muscle Contraction Headaches. Behaviour Therapy. 6: 672 – 678.

Hoyt, W.F., Shaffer, F. and Bard, D.A. 1979. Osteopathic manipulation in the treatment of muscle contraction headache. Journal of the American Osteopathic Association. 78: 322 – 325.

International Headache Society. 1988. Classification and diagnostic criteria for headache disorders, cranial neuralgias and facial pain. Cephalgia. 8 (suppl 7).

Jansen, C. 1998. The Prevalence and type of Headache in Afrikaans Speaking High School Children in the Greater Durban Area. Unpublished. M.Tech: Chiro. Dissertation, Technikon Natal Library, Natal, South Africa. 137 p.

Jensen, R. and Olesen, J. 1996. Initiating mechanisms of experimentally induced tension-type headache. Cephalgia. 16: 97 – 103.

Jensen, R., Bendstsen, L. and Olesen, J. 1998. Muscular factors are of importance in tension-type headache. Headache. 38: 10 – 17.

Jensen, R. 1999. Pathophysiological mechanisms of tension-type headache: a review of epidemiological and experimental studies. Cephalgia. 19: 602 – 621.

Jones, B.D. 1999. Delmar's Comprehensive Medical Terminology: A Competency Approach. USA, New York: Delmar Publishers. 968p. ISBN 0 – 7668 – 0493 – 3.

Kabe, N., Tezuka, H., Nagazumi, A. and Terashi, A. 1991. Thermographic investigation of tension-type headache. Cephalalgia. 11(11): 63.

Kim, H.S., Chung, S.C., Kim, Y.K. and Lee, S.W. 1995. Pain pressure threshold in the head and neck region of Episodic tension-type headache patients. Journal of Orofacial Pain. 9: 357 – 364.

King, N.J. and Sharpley, C.F. 1990. Headache activity in children and adolescents. Journal of Paediatric Child Health. 26: 50 – 54.

Klerman, L.V; Weitzman, M., Alpert, J.J. Lamb, G.A., Kayne, H., Gerominini, K.R., Rose, L. and Cohen, L. 1987. Why adolescents do not attend school. The views of students and parents. Journal of Adolescent Health Care. 8: 425 – 430.

Kunkel, R.S. 1991. Diagnosis and treatment of muscle contraction (tension-type) headache. Medical Clinics of North America. 75(3): 595 – 603.

Langemark, M., Olesen, J., Poulsen, D. L. and Bech, P. 1998. Clinical characterization of patients with chronic tension headache. Headache. 28: 590 – 596.

Leviton, A., Slack, W.V., Bana, D. and Graham, J.R. 1984. Age-related headache characteristics. Archives of Neurology. 41: 762 – 764.

Lewis, D.W., Middlebrook, M.T. Mehallick, L., Rauch, T.M. Deline, C. and Thomas, E.F. 1996. Pediatric headaches: What do the children want? Headache. 36: 224 – 230.

Lewit, K. 1991. Manipulative Therapy in Rehabilitation of the Locomotor system. 2nd ed. Oxford: Butterworth - Heinemann. 308p. ISBN 0 – 7506 – 1123 – 5.

Linet, M.S., Stewart, W.F., Celentano, D.D., Ziegler, D. and Sprecher, M. 1989. An epidemiologic study of headaches among adolescents and young adults. Journal of the American Medical Association. 261 (15): 2211-2216.

McGrath, P.A. 1990. Pain in Children. Nature, Assessment and Treatment. New York: Guilford Publications. 466p. ISBN 0-89862-390-1.

Melzack, R. 1987. The Short-form McGill Pain Questionnaire. Pain. 30: 191 – 197.

Melzack, R. and Katz, J. 1992. The McGill Questionnaire: Appraisal and current status. In Melzack, R. and Turk, D.C. (eds.) Handbook of Pain Assessment. pp. 152 – 168. New York: The Guilford Press. 419p. ISBN 0 – 89862 – 0.

Moore, K.L. 1992. Clinically Oriented Anatomy. 3rd ed. Baltimore: Williams and Wilkins. 917 p. ISBN 0 – 683 – 06133 – x.

Mootz, R.D, Dhami, M.S.I., Hess, J.A., Cook, R.D. and Schorr, D.B. 1994. Chiropractic treatment of chronic episodic tension-type headaches in male subjects: a case series analysis. Journal of the Canadian Chiropractic Association. 38 (3): 152 – 159.

Nagasawa, A., Sakakibara, T. and Takahashi, A. 1993. Roentgenographic findings of the cervical spine in tension-type headache. Headache. 33 (2): 90 – 95.

Nelson, G.F. 1994. The tension headache, migraine headache continuum: A hypothesis. Journal of Manipulative and Physiological Therapeutic. 17 (4): 156 – 157.

Ng, S.Y. 1980. Upper cervical vertebrae and occipital headache. Journal of Manipulative and Physiological Therapeutics. 3 (3): 137 – 141.

Nilsson, N. 1997. Spinal manipulation in the treatment of headaches: The clinical trials. Proceedings of the Scientific World Chiropractic Congress. Tokyo. Japan. June 6-8, 1997. Toronto. Ontario. World Federation of Chiropractic. 274 p.

Nilsson, N., Christensen, H.W. and Hartvigsen, J. 1997. The effect of spinal manipulation in the treatment of cervicogenic headache. Journal of Manipulative and Physiological Therapeutics. 20 (5): 326-330.

Onel, Y., Friedman, A.P. and Grossman, J. 1961. Muscle blood flow studies in muscle contraction headaches. Neurology. 11 (11): 935 – 939.

Passchier, J. and Orlebeke, J.F. 1985. Headache and Stress in Schoolchildren: An epidemiological study. Cephalalgia. 5: 167 – 176.

Penter, C.S. 1994. Determining the Role Chiropractic Plays in the Management of Tension-type Headache. Unpublished. M.Tech: Chiro. Dissertation, Technikon Natal Library, Durban. 98 p.

Prax, J.C. 1999. Upper Cervical Chiropractic Care of the Pediatric Patient: A review of the literature. Journal of Clinical Chiropractic Pediatrics. 4 (1): 257 – 263.

Raskin, N.H. 1988. Headache. 2nd ed. New York: Churchill Livingstone. 96 p. ISBN 0 – 443 – 08547 – 1.

Rasmussen, B. K. 1993. Migraine and tension-type headache in a general population: precipitating factors, female hormones, sleep pattern and relation to lifestyle. Pain. 53: 65 – 72.

Rasmussen, B. K. 1995. Epidemiology of Headache. Cephalalgia. 15: 45 – 68.

Schachtel, B.P., Furey, S.A. and Thoden, W.R. 1996. Non-prescription ibuprofen and acetaminophen in the treatment of tension-type headache. Journal of Clinical Pharmacology. 36: 1120 – 1125.

Schafer, R.C. and Faye, L.J. 1989. Motion Palpation and Chiropractic Technique. California: The Motion Palpation Institute. 426p. ISBN 0 – 9244889 – 00 – 4.

Schnider, P., Aull, S., Feucht, M., Mraz, M., Travniczek, A., Zeiler, K. and Wessely, P. 1994. Use and abuse of analgesics in tension-type headache. Cephalgia. 14: 162 – 167.

Schwartz, B S., Stewart, W.F., Simon, D. and Lipton, R. 1998. Epidemiology of tension-type headache. Journal of the American Medical Association. 279: 381-383.

Sherk, H.H., Dunn, E.J., Eismont, F.J., Fielding, J.W., Long, D.M., Ono, K., Penning, L. and Raynor, R. (eds.). 1989. The Cervical Spine. 2nd ed. Philadelphia: J B Lippincott Company. 881 p. ISBN 0 – 397 – 0827 – 1.

Shillito, P. and Stephenson, J. 1994. Headaches in children: action or reassurance. The Practitioner. 238: 761 – 765.

Sillanpaa, M. 1982. Prevalence of headache in puberty. Headache. 23: 10 – 14.

Smith, M.S. 1995. Comprehensive evaluation and treatment of recurrent pediatric headache. Pediatric Annals. 24 (9): 450 – 457.

Stano, M. 1993. A comparison of health care costs for chiropractic and medical patients. Journal of Manipulative and Physiological Therapeutics. 16 (5): 291 – 299.

Travell, J.G. and Simons D.G. 1983. Myofascial pain and dysfunction. Baltimore: Williams and Wilkins. Vol. 1 713 p. ISBN 0 – 683 – 08366 – x.

Ukestad, L.K. and Wittrock, D.A. 1996. Pain and perception and coping in female tension headache sufferers and headache–free controls. Health Psychology. 15 (1): 65 – 68.

Varni, J.W., Thompsom, K.L. and Hanson, V. 1987. The Varni/Thompson Pediatric Pain Questionnaire. Chronic musculoskeletal pain in juvenile rheumatoid arthritis. Pain. 28: 27-38.

Vernon, H.T. 1982. Chiropractic manipulative therapy in the chiropractic treatment of headaches: A retrospective and prospective study. Journal of Manipulative and Physiological Therapeutics. 5 (3): 109 – 112.

Vernon, H.T. (ed.) 1988. Upper Cervical Syndrome. Baltimore: Williams and Wilkins. 253p. ISBN 0 – 683 – 08591 – 3.

Vernon, H.T., Aker, P., Viljakaanen, S. and Short, L. 1990. Pressure pain threshold evaluation of the effect of spinal manipulation in the treatment of chronic headache pain: A pilot study. Journal of Manipulative and Physiological Therapeutics. 13 (1): 13 – 16.

Vernon, H. T., Steiman, I. and Hagino, C. 1992. Cervicogenic dysfunction in muscle contraction headache and migraine. A descriptive study. Journal of Manipulative and Physiological Therapeutics. 15 (7): 418 – 429.

Vernon, H.T. 1995. The effectiveness of chiropractic manipulation in the treatment of headache: an exploration of the literature. Journal of Manipulative and Physiological Therapeutics. 18 (9): 611 - 617.

Vernon, H. and McDermaid, C. 1998. Chiropractic management of Episodic tension-type headache: A survey of clinical specialists. Journal of the Canadian Chiropractic Association. 42 (4): 209 – 215.

Viti, J.A. and Paris, S.V. 2000. The use of upper thoracic manipulation in a patient with headache. The Journal of Manual and Manipulative Therapy. 8 (1): 25 – 28.

Williams, P.L., Dyson, M., Warwick, R. and Bannister, L. 1989. Grays Anatomy. 37th ed. London: Churchill Livingstone. 1598 p. ISBN 0 – 443 – 04177 – 6.

Zar, J.H. 1996. Biostatistical Analysis. 3rd ed. New Jersey: Prentice-Hall International Incorporated. 662p. ISBN 0 – 13 – 086398 – x.

APPENDIX 1

TECHNIKON NATAL CHIROPRACTIC CLINIC

Chiropractic Research on Tension-type Headaches in Children

Dear Parent and Patient

Thank you for considering enrolling in this research programme. Outlined below is a brief explanation of what the research programme entails as well as what would be expected of you, the patient.

This research programme aims to evaluate the effectiveness of chiropractic manipulation in the treatment of tension-type headache in children. If you choose to participate in this research programme you will undergo a full case history, physical and regional examination on your consultation. This will enable us to determine whether or not the headache you are experiencing is a tension-type headache and therefore your eligibility for the programme. Should you be accepted on to the study all treatment will be free of charge. A full time clinician is permanently on duty and will be there to assist should any problems arise.

Once it is determined that you are a candidate for this research programme, you will be randomly assigned to one of two groups. Both groups will receive soft tissue treatment i.e. massage, while only one of the groups will receive chiropractic treatment. There is a 50/50 chance of receiving chiropractic treatment. The programme will consist of six treatment sessions over a period of three weeks. You are expected to be present at all these sessions. You will be required to fill out a headache diary every day for a week prior to the start of treatment and for a week following the completion of the treatment.

For the duration of the study no pain medication may be taken for a headache, please inform me if you do take any medication. If you should become headache free during the programme, you will still be expected to complete the programme to facilitate the collection of data.

Parental consent is a prerequisite for this study. You are free to withdraw from the study at any stage. Please feel free to ask about any other concerns.

Nikki de Busser
(Chiropractic Intern)

APPENDIX 2

INFORMED CONSENT FORM
(To be completed by parent/guardian)

Date : ______________

Title of research project : The relative effectiveness of chiropractic manipulation in conjunction with soft tissue treatment, as compared with soft tissue treatment alone, in the management of tension-type headaches in children.

Name of supervisor : Dr. C. Penter

Name of research student : Nikki de Busser

Please circle the appropriate answer

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

If you have answered no to any of the above, please obtain the information before signing

Please Print in block letters:

Patient /Subject Name:____________________ Signature:____________________

Parent /Guardian Name:____________________ Signature:____________________

Witness Name:____________________ Signature:____________________

Research Student Name:____________________ Signature:____________________

APPENDIX 3

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient:______________________________ Date: ________________
file #:______ X-Ray#:________________
Age:_______ Sex:_______ Occupation:__________________
Intern:________________________ Signature:__________________

FOR CLINICIAN'S USE ONLY
Initial visit clinician:__________________Signature:__________________

Case History:

Examination:
Previous: Current:

X-Ray Studies:
Previous: Current:

Clinical Path. lab:
Previous: Current:

Case Status:

PTT: Conditional: Signed Off: Final Sign out:

Recommendations:

Intern's Case History

1. Source of History:

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

3. Present Illness:

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

4. Other Complaints:

5. Past Medical History:

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

6. Current health status and life-style:

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

7. Immediate Family Medical History:

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

8. Psychosocial history:

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

9. Review of Systems:

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

APPENDIX 4

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient:______________________ File#: _______________________ Date:__________
Clinician:______________________ Signature:____________________
Intern:________________________ Signature:____________________

1. VITALS

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

2. GENERAL EXAMINATION

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

Urinalysis:

3. CARDIOVASCULAR EXAMINATION

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

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

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

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

Percussion: - borders of heart

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

4. <u>RESPIRATORY EXAMINATION</u>

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. <u>ABDOMINAL EXAMINATION</u>

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

Inspection - Shape:
- Scars:
- Hernias:

Palpation - Superficial:
- Deep = Organomegally:

- Masses (intra- or extramural)
- Aorta:

Percussion
- Rebound tenderness:
- Ascites:
- Masses:

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

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

6. G.U.T EXAMINATION

External genitalia:
Hernias:
Masses:
Discharges:

7. NEUROLOGICAL EXAMINATION

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

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

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

Evidence of head trauma:

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

Cranial Nerves:

I Any loss of smell/taste:
Nose examination:

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

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

III Ocular Muscles:
Eye opening strength:

IV Inferior and Medial movement of eye:

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

VI Lateral movement of eyes

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

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

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

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

XII Inspection of tongue (deviation):

Motor System:

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

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

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

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

Sensory System:

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

b. Joint position sense
- Finger:
- Toe:

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

Cerebellar function:

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

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

8. <u>SPINAL EXAMINATION:</u>(See Regional examination)

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

9. <u>BREAST EXAMINATION:</u>

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:

APPENDIX 5

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

Patient: ____ File: ______________

Date: _________________ Intern/Resident: __________________________________

Clinician: __________________________________ Sign: ___________________

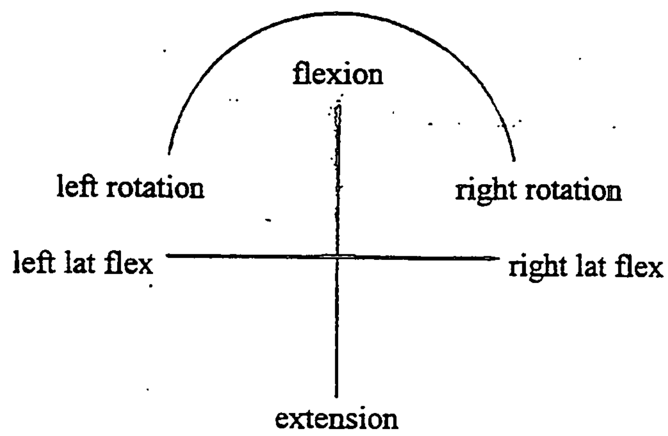
OBSERVATION:

Posture
Swellings
Scars
Discolouration
Hair Line
Bony & Soft Tissue Contours

Shoulder position:
Left:
Right:
Muscle spasm
Facial expression

RANGE OF MOTION:

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



PALPATION:

Lymph Nodes
Thyroid Gland
Trachea

ORTHOPAEDIC EXAMINATION:

Tenderness
Trigger Points: SCM
Scalenii
Post Cervicals
Trapezius
Lev Scap

Doorbell sign
Kemp's test
Cervical distraction
Halstead's test
Hyperabduction test
Shoulder abduction test
Cervical compression
Lateral compression
Adson's test
Costoclavicular test
Eden's test
Shoulder depression test

Dizziness rotation test
Brachial plexus tension

Lhermitte's sign

NEUROLOGICAL EXAMINATION:

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

VASCULAR:

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

MOTION PALPATION & JOINT PLAY:

Left: Motion Palpation:
Joint Play:

Right: Motion palpation:
Joint Play:

Basic Exam: Shoulder:
Case History:

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

Upper T horacics:
Motion Palpation:
Joint Play:

Basic Exam: Thoracic Spine:
Case History:

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

APPENDIX 6

Short-form McGill Pain Questionnaire (SF-MPQ)

Ronald Melzack (1984)

Date:______________ File no.:________________ Visit no:____

Patient name:____

	NONE 0	MILD 1	MODERATE 2	SEVERE 3
THROBBING				
SHOOTING				
STABBING				
SHARP				
CRAMPING				
GNAWING				
HOT-BURNING				
ACHING				
HEAVY				
TENDER				
SPLITTING				
TIRING-EXHAUSTING				
SICKENING				
FEARFUL				
PUNISHING-CRUEL				

APPENDIX 7

HEADACHE DIARY

Name: ____

Please complete the following questions every day for the next 7 days.

Day____________________ Date________________________

1. The graphs below show one full day from 6am to 6am the next day. Each block represents half an hour, if you get a headache make a mark in the time slot in which you get the headache.

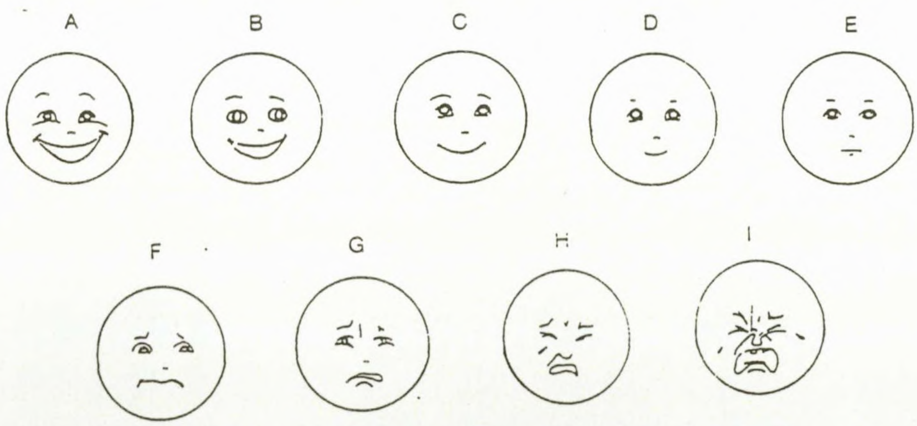
Day

6am	6:30	7am	7:30	8am	8:30	9am	9:30	10am	10:30	11am	11:30	12am	12:30	1pm	1:30	2pm	2:30	3pm	3:30	4pm	4:30	5pm	5:30

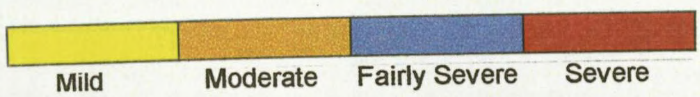
Night

6pm	6:30	7pm	7:30	8pm	8:30	9pm	9:30	10pm	10:30	11pm	11:30	12pm	12:30	1am	1:30	2am	2:30	3am	3:30	4am	4:30	5am	5:30

2. Tick which face describes the way you felt inside when you had the pain.



3. How strong was your pain? That is, how much did it hurt? Choose the colour



APPENDIX 8

HEADACHE QUESTIONNAIRE
(To be filled in with the assistance of the researcher)

1. Total number of days absent from school in the last 6 months because of a headache:
   - None
   - 1 – 2 days
   - 2 – 5 days
   - More than 5 days

2. Total number of times that you missed taking part in sport, or in other extra-mural activities in the last 6 months because of a headache:
   - Never
   - 1 – 2 times
   - 2 – 5 times
   - More than 5 times

3. Is your ability to concentrate either at school or at home effected because of your headache:
   - My ability to concentrate is never effected when I have a headache
   - My ability to concentrate is occasionally effected when I have a headache
   - My ability to concentrate is often effected when I have a headache
   - My ability to concentrate is always effected when I have a headache

FORCE DIAL

CERTIFICATE OF CALIBRATION

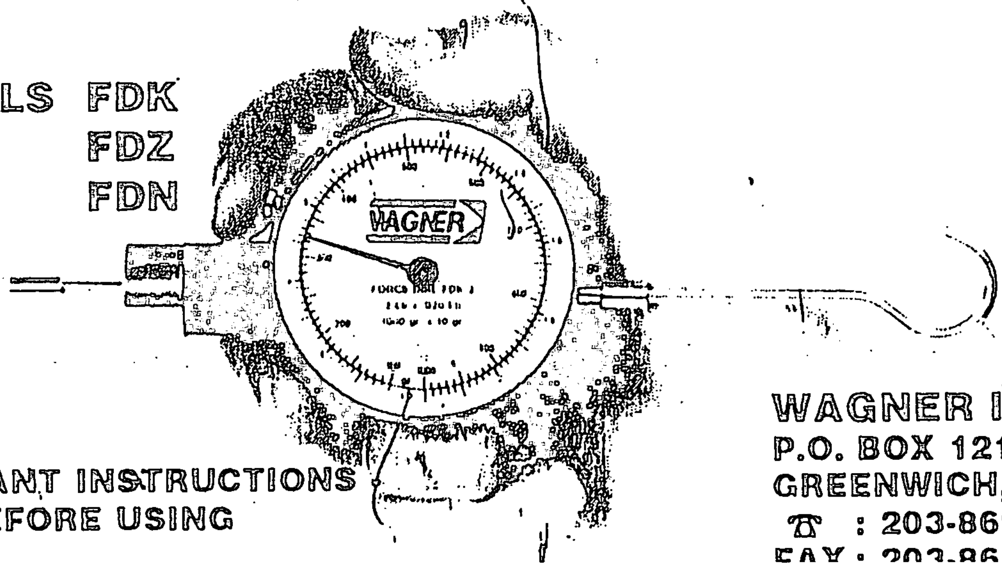
WAGNER INSTRUMENTS certifies that all **FORCE DIALS** are calibrated at the factory to meet the specified accuracy of ± 1% of full scale, advertised in our current catalog.

QUALITY CONTROL DIRECTOR

FORCE DIAL™

PUSH - PULL FORCE GAGE

MODELS FDK
FDZ
FDN



IMPORTANT INSTRUCTIONS
READ BEFORE USING

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

Complete list of available FORCE DIALS

FDK

DECIMAL POUND / GRAM GRADUATIONS

Model	Capacity/Graduations			
FDK 025	.25 LB x	.002 LB/	100 G x	1 G
FDK 050	.50 LB x	.005 LB/	200 G x	2 G
FDK 1	1 LB x	.010 LB/	500 G x	5 G
FDK 2	2 LB x	.020 LB/	1000 G x	10 G
FDK 5	5 LB x	.050 LB/	2500 G x	25 G
FDK 10	10 LB x	.100 LB/	5 KG x	50 G
FDK 20	20 LB x	.250 LB/	10 KG x	100 G
FDK 40	40 LB x	.500 LB/	20 KG x	200 G
FDK 60	60 LB x	.500 LB/	28 KG x	250 G

OUNCE / GRAM GRADUATIONS

Model	Capacity/Graduation			
FDK 4	4 OZ x	1/32 OZ/	100 G x	1 G
FDK 8	8 OZ x	1/16 OZ/	200 G x	2 G
FDK 16	16 OZ x	1/8 OZ/	500 G x	5 G
FDK 32	32 OZ x	1/4 OZ/	1000 G x	10 G
FDK 80	5 LB x	1 OZ/	2500 G x	25 G
FDK 160	10 LB x	2 OZ/	5 KG x	50 G

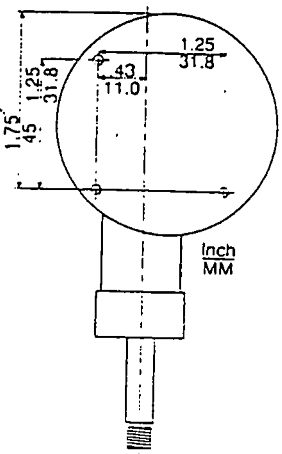
FDN

NEWTON / GRAM GRADUATIONS

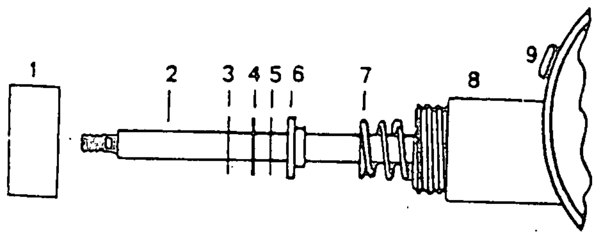
Model	Capacity/Graduation			
FDN1	1N x	.01N/	100G x	1G
FDN2	2N x	.02N/	200G x	2G
FDN5	5N x	.05N/	500G x	5G
FDN10	10N x	.1N/	1000G x	10G
FDN20	20N x	.2N/	2000G x	20G
FDN50	50N x	.5N/	5KG x	50G
FDN100	100N x	1N/	10KG x	100G
FDN200	200N x	2N/	20KG x	200G
FDN300	300N x	2.5N/	30KG x	250G

MOUNTING

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



PARTS



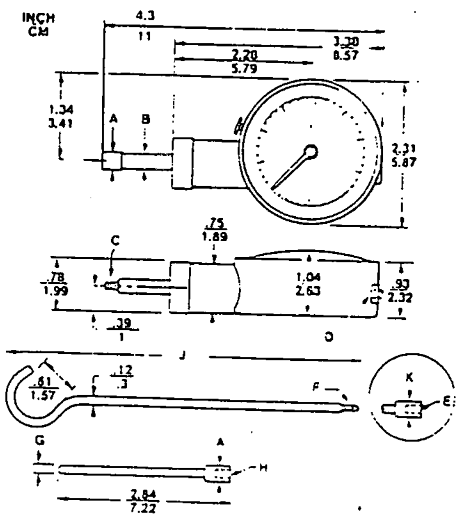
(1) Retainer
(2) Plunger
(3) Disc
(4) Clip
(5) Calibration Washers
(6) Plate
(7) Spring
(8) Case
(9) Push Button
(10) Crystal *
(11) Pointer *

ACCESSORIES: *

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

* Not shown in diagram.

DIMENSIONS



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

All dimensions are approximate.

Low Capacity (thru 2 LB / 1000 G)

A	.19"	.45 cm
B	.12"	.3 cm
C	M 3	male
D	M 3	male
E	M 3	female
G	.12"	.3 cm
H	M 3	female
J	2.8"	7.1 cm
K	.19"	.45 cm

High Capacity (5 LB / 2500 G & up)

A	.26"	.65 cm
B	.24"	.6 cm
C	M 4	male
D	M 3	female
F	M 3	male
G	.14"	.35 cm
H	M 4	female
J	3.4"	8.6 cm

GENERAL

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

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

Lubrication of the FORCE DIAL is not recommended.

IMPORTANT

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

CALIBRATION

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

IMPLEMENT WEIGHT ADJUSTMENT

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

WEIGHT OF IMPLEMENTS:

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

ADJUSTMENT:

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