

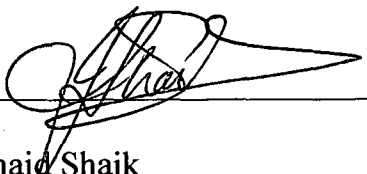
THE RELATIVE EFFECTIVENESS OF CROSS FRICTION
AND MILL'S MANIPULATION AS COMPARED TO CROSS
FRICTION ALONE IN THE TREATMENT OF LATERAL
EPICONDYLITIS ('TENNIS ELBOW')

by

Junaid Shaik

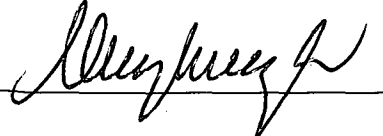
Final submission of a dissertation to the Faculty of Health in partial compliance with
the requirements for a Master's Degree in Technology: Chiropractic at Technikon
Natal.

I, Junaid Shaik do hereby declare that this dissertation represents my own work in
both conception and execution.


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DEDICATION

This dissertation is dedicated to my beloved parents and my ever-loving wife Reyhana.

ACKNOWLEDGEMENTS

I would like to thank my parents for all their support during my academic career.

To my loving wife, Reyhana, I say thank you for being there for me. Thank you for being the best. Without you the writing of this dissertation would not have been possible. Thanks for all the hard work and patience.

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To all the patients who made this study possible: Thank you

Finally to my mentor, Dr. K. Naidu, thank you for inspiring me to be the best I can be.

ABSTRACT

The purpose of this study was to determine the relative effectiveness of cross friction combined with Mill's manipulation compared to cross friction alone in the treatment of lateral epicondylitis. This was a prospective, controlled study. The study involved thirty subjects, fifteen randomly allocated into two groups. These patients were selected from the general population by purposive sampling methods. Group 1 received cross friction and Mill's manipulation while Group 2 received cross friction only. Each subject was treated 6 times over a three-week period. Patients were required to return for a one-month follow-up from the date of their last consultation.

Each subject was assessed subjectively by means of the short-form McGill Pain Questionnaire and the Numerical Pain Rating Scale (NRS 101). Objectively, their pain threshold and grip strength was assessed by means of an algometer and a dynamometer respectively. Assessments were taken at the first, third, sixth and follow-up consultations for all subjective and objective measurements.

The non-parametric Wilcoxon sign-rank test and the Mann-Whitney U-test were used, comparing intra-group and inter-group data respectively, at a 95% confidence level.

Intra-group analysis revealed significant subjective improvement within both groups between treatments 1 and 6 but there was no significant improvement within either group between treatment 6 and the one-month follow-up. There was significant objective improvement within both groups between treatment 1 and treatment 6, with the exception of grip strength with a straight elbow in Group 2. With the exception of the algometer readings, there was no significant objective improvement within both groups between treatment 6 and the one-month follow-up.

Inter-group analysis revealed that there was no significant difference in improvement between the two groups for both the subjective and the objective data between treatments 1, 3, 6 and treatment 6 and the one-month follow-up.

In conclusion, both groups experienced subjective and objective improvements but the difference was not statistically significant. Therefore, the null hypothesis is accepted indicating there was no statistical difference between the two groups (with respect to the variable of comparison at $\alpha = 0.05$ level of significance) and either treatment may be used in the treatment of lateral epicondylitis.

Lateral epicondylitis is a syndrome caused by multiple factors and presents in various ways in different patients. Thus one must take this into consideration when assessing the effect of different treatment modalities on this complicated syndrome.

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Chapter One

1.1 Introduction

Tennis elbow is the common name for lateral epicondylitis. However, it is a misnomer, since it affects quite large number of people who have never played tennis in their lives (Nook 1998). Only one-third of today's regular tennis players suffer from this condition at some point (Saidoff and McDonough 1997). Non traumatic and innocuous-looking activities such as knitting or sewing are more likely to be the culprits in lateral epicondyle pain (Hertling and Kessler 1996). Patients are usually middle-aged and there seems to be an equal sex distribution (Thomson et al. 1991).

The pain of lateral epicondylitis is usually of a gradual onset, is of an aching or sharp quality and may refer from the elbow to the wrist. The power of the forearm muscles is normal at first but gradually decreases as the patient stops using the arm to prevent further damage and pain (Thomson et al. 1991).

The pathological process points to excessive fibrin forming in torn and damaged tissues. This could lead to fibrous adhesions between the tendon and the surrounding tissues. Pain results when these structures are stretched (Thomson et al.

1991). The most common site is the extensor carpi radialis brevis (ECRB) at the teno-periosteal insertion at the lateral epicondyle (Cyriax and Cyriax 1993).

According to Kamien (1990), the therapy for lateral epicondylitis should be “acceptable to the patient, cost effective” and invasive therapy should be wisely selected. He also mentions that conservative therapies such as chiropractic and acupuncture have not been evaluated in the treatment of lateral epicondylitis.

Corticosteroid injections may offer dramatic symptomatic relief but have no beneficial effect on the pathological process and do not influence the aetiological process and therefore have limited value (Hertling and Kessler 1996). This is ironic as it is currently seen as the “mainstay of treating tennis elbow” (Price et al. 1991). Other treatments e.g. laser (Lundeberg et al. 1987 and Krashennikov et al. 1994) and ultrasound (Lundeberg et al. 1988 and Haker and Lundeberg 1991) have been shown to be ineffective for treating lateral epicondylitis. Organ et al. (1997) state that release surgeries which weaken the extensor aponeurosis but fail to address the patho-anatomic changes (see chapter 2) should not be recommended. Surgery should be reserved for those cases that have prolonged symptoms and threaten employment (Rowley and Dent 1997).

Hammer (1991) states that the purpose of Mill’s manipulation is to separate the scar and to create a permanent lengthening while Corrigan and Maitland (1983) states Mill’s manipulation restores normal accessory and physiological movements of the

elbow. However, the articulations were not specified. Zohn (1988) recommends that the painful scar should be torn by manipulation if therapies such as wrist splints, anti-inflammatory medication and physical therapy are unsuccessful.

The intention of transverse friction (cross friction) is to restore mobility of the structure and to increase the extensibility of the structure under conditions of normal loading (Hertling and Kessler 1996) while Prentice (1994) states that transverse friction should be used to “increase inflammation to a point where the inflammatory process is complete and the injury can progress to the later stages of the healing process”.

1.2 Objectives of this study

The first objective is to evaluate the relative effectiveness of cross friction with Mill’s manipulation compared to cross friction alone in terms of the subjective findings in order to determine the impact of cross friction with Mill’s manipulation on the treatment of lateral epicondylitis.

The second objective is to evaluate the relative effectiveness of cross friction with Mill’s manipulation compared to cross friction alone in terms of the objective findings in order to determine the impact of cross friction with Mill’s manipulation on the treatment of lateral epicondylitis.

The effects of Mill's manipulation or cross friction have been theorised by many authors e.g. Cyriax and Cyriax (1993) and these treatments have been used by them in the management of lateral epicondylitis. However, there have not been any randomised, controlled studies to prove their effectiveness. This study aims to establish if Mill's manipulation or cross friction can be genuinely used in the treatment of lateral epicondylitis once their effectiveness has been tested.

Chapter Two

2.1 Definition of lateral epicondylitis

This is a condition characterised by pain and acute tenderness on the lateral side of the elbow usually related to the common extensor tendon (Thomson et al. 1991). Hammer (1991) suggests that 'paraepicondylitis' is perhaps a more suitable name for this lesion as the epicondyle itself is not inflamed. Saidoff and McDonough (1997) classify lateral epicondylitis as a chronic disorder related to the degenerative process.

2.2 The epidemiology of lateral epicondylitis

Lateral epicondylitis normally affects patients aged 30 – 60 years and has an equal sex distribution according to activities (Thomson et al. 1991). Approximately one-third of today's thirty-two million regular tennis players suffer from tennis elbow at some point. Those who play tennis for more than two hours a week have a forty-five percent chance of developing tennis elbow. It occurs in both elbows approximately sixty percent of the time (Saidoff and McDonough 1997). It was not possible to find any studies either on the Internet, journals or CD ROMS indicating the incidences or prevalence of tennis elbow in South Africa.

2.3 *Aetiology of lateral epicondylitis*

Lateral epicondylitis occurs when the wrist extensors are excessively used especially under the following conditions:

- a] The carrying of heavy loads e.g. carrying a heavy suitcase (Nook 1998).
- b] The use of wrong technique in sport e.g. leading with the elbow during the backhand stroke instead of leading with the lower body and shoulder and failure to relax the extensors after the backhand stroke (Hammer 1991).
- c] Doing uncustomary work e.g. pruning plants after a long time (Nook 1998).
- d] Direct trauma to the elbow joint in the area of the lateral epicondyle (D'Ambrosia 1977 and Evans (1994)).
- e] According to Nirschl (1988), intrinsic tendon overuse which results in repetitive microtrauma (especially in the 35-55 year age group), inadequate conditioning of the extremities and constitutional factors (e.g. gout, mesenchymal disorders) are the chief factors which result in injury.

2.4 *Pathology of lateral epicondylitis*

A tear or injury can occur at one or more of the following sites:

- a] Tendon
- b] Teno-muscular junction
- c] Teno-periosteal junction

resulting in inflammation (Thomson *et al.* 1991). Exudate is produced to heal the torn and damaged tissues. However, excessive fibrin may be produced resulting in fibrous tissue forming and this could lead to fibrous adhesions between the tendon and the surrounding tissues. When these structures are stretched during activities, pain results and the function of the elbow is impaired. This is usually a long-term low-grade process and a subperiosteal hematoma is formed (Thomson *et al.* 1991).

Excessive scar tissue can form when the tendon is repeatedly used before adequate healing. The extensor carpi radialis brevis (ECRB) is involved at the teno-periosteal insertion at the lateral epicondyle – this is the most common site (Cyriax and Cyriax 1993). This is probably related to the increased tensile load imposed on the tendon by the radial head when the tendon is stretched e.g. during elbow extension. Rarely the extensor carpi ulnaris may be involved (Hertling and Kessler 1996). A very rare site is the supracondylar ridge of the humerus where the extensor carpi radialis longus originates (Cyriax and Cyriax 1993).

Histological studies of the afflicted tendon indicate that there are degenerative changes with angioblastic proliferation and diminished vascularity (Skinner 1995). Morrey and Regan (1994) highlight a single-blind randomised study conducted at the Mayo Clinic (no date given) to determine if there were any consistent microscopic pathological changes characterising lateral epicondylitis. Twelve unembalmed and radiological normal cadavers were the controls and eleven patients with an unequivocal diagnosis of lateral epicondylitis were the experiments.

Macroscopic pathological changes at the origin of the ECRB was observed in all patients. Common microscopic pathological changes were hyaline degeneration, fibroblastic proliferation and calcific changes (statistically higher in the experimental group than the control – $P < 0.001$). Radiographs of affected elbows are normally unremarkable but x-rays may be taken to rule out other pathologies e.g. arthritis. However, one may find dystrophic calcific deposits in the extensor muscle origin and bone spurs indicating traumatic arthritis (Saidoff and McDonough 1997).

2.5 Clinical features of lateral epicondylitis

a) Pain

There is general pain around the lateral aspect of the elbow (Rowley and Dent 1997). The pain is usually of a gradual onset and presents after activity. If the lesion is repeatedly aggravated, the pain is more intense and is of a longer duration. The pain may refer over the wrist extensors from the elbow to the wrist and is of an aching or sharp quality (Thomson *et al.* 1991). The pain may become more intense when the hand grasps something. The patient may complain of objects falling out of his/her hands (Lewit 1991). Prolonged fine finger activities e.g. knitting or sewing may also increase the pain (Hertling and Kessler 1996). If the aggravating activity is continued and the pain is ignored, then arthritic changes may eventually occur in the proximal radio-ulnar joint (Saidoff and McDonough 1997).

b] Movements

Normally the joints of the forearm and hand have full active range of motion. However, active wrist extension is painful but the passive movement is not. The power of the forearm muscles is normal at first but gradually diminishes as the patient stops using the arm to prevent damage and pain (Thomson et al. 1991).

c] Palpation

On palpation of the afflicted tendon, one may find it is thickened and tender. The tenderness is more acute at the site of the lesion. The most tender area is usually on the anterior portion of the lateral epicondyle. In a long-term problem, there may be a reduction in the accessory movement of the elbow and the superior radio-ulnar joints (Thomson et al. 1991).

2.6 Orthopaedic tests for lateral epicondylitis

a] Mill's test

This test is performed as follows: While palpating the lateral epicondyle, the examiner pronates the patient's forearm, flexes the wrist fully and extends the elbow. A positive test is indicated by pain over the lateral epicondyle of the humerus (Magee 1997).

b] Cozen's test

This test is performed as follows: The patient's elbow is stabilised by the examiner's thumb which rests on the patient's lateral epicondyle. The patient is then asked to make a fist, pronate the forearm, radial deviate and extend the wrist while the examiner resists the motion. A positive test is indicated by pain over the lateral epicondyle of the humerus (Magee 1997).

c] Lateral epicondyle test

This test is performed as follows: The examiner resists the extension of the third digit of the hand distal to the proximal interphalangeal joint, stressing the extensor digitorum muscle and tendon. A positive test is indicated by pain over the lateral epicondyle of the humerus (Magee 1997).

2.7 Differential diagnosis of lateral epicondyle pain (other than tennis elbow)

- a] Lateral ligamentous strain – this can be confirmed when an adduction force is applied to the forearm when the elbow is extended and the radio-ulnar joints are supinated (Thomson et al. 1991).
- b] Synovial fringe entrapment between the radial head and the capitulum – pain is elicited when the radio-humeral joint is compressed. Minor movement between the radial head and the capitulum may be decreased (Thomson et al. 1991).

- c] Arthritis of the radio-humeral and radio-ulnar joints – both active and passive movements are painful. Pain is worse when there is a load in the hand and movements of the joints are limited (Thomson et al. 1991).
- d] Strain of the teno-periosteal attachment of the extensor carpi radialis longus – tenderness on the lateral supracondylar ridge on palpation (Thomson et al. 1991).
- e] Radial nerve entrapment – the nerve or its branch may be trapped within the brachioradialis or the supinator muscles. The pain may be sharp or of a stabbing quality and the muscles may also be sore. The wrist extensors may also be weak (Thomson et al. 1991).
- f] Nerve root pressure in the neck – the neck may be painful and the movements may be limited. Lateral flexion towards the affected side may reproduce the pain in the elbow joint (Thomson et al. 1991).

2.8 *Treatment of lateral epicondylitis*

Kamien (1990) recommends that “therapy should start with the simple and conservative before progressing to the more complex and invasive therapies. The therapy should be acceptable to the patient, cost-effective and where invasive

therapy is recommended, the potential benefits should clearly outweigh the risks". He also mentions that therapies such as chiropractic and acupuncture have not been evaluated in the treatment of lateral epicondylitis. He does not give any reasons for this but it is probably due to medical practitioners not being fully aware of the full scope of chiropractic.

Rowley and Dent (1997) recommend a minimum six-week period of rest. Although rest allows new tissue to be produced, it is not of normal extensibility because there is no proper orientation of the structural elements. Therefore, abnormal adherence of structural elements to one another and to adjacent tissues occurs. Because of this lack of extensibility during the healing process, the structure becomes more susceptible to internal strain when stresses are applied to it. Thus a low-grade inflammatory process occurs each time the affected part is used. This is true for tendinitis of the origin of the extensor carpi radialis brevis (i.e. lateral epicondylitis).

Transverse frictions promote increased extensibility and mobility of the structure and allow healing to take place (Hertling and Kessler 1996).

Lundeberg et al. (1987) compared the effects of laser versus placebo in the treatment of lateral epicondylitis. The results indicated that laser was not significantly better than placebo in the treatment of lateral epicondylitis. This was probably because the conduction velocity in the sensory nerves is not affected by laser radiation nor is there a thermal effect on the subcutaneous tissues even after sixty seconds of laser

application. Krasheninnikof et al. (1994), in a double blind, randomised study investigated the effects of low power laser and placebo in the treatment of lateral epicondylitis. They concluded that low power laser offered no advantage over placebo in the treatment of lateral epicondylitis.

Lundeberg et al. (1988) investigated the effects of continuous ultrasound, placebo ultrasound and rest in the treatment of lateral epicondylitis. They found that continuous ultrasound was significantly better than rest but not significantly better than placebo ultrasound. Another study by Haker and Lundeberg (1991) investigated the effects of pulsed ultrasound compared to placebo in the treatment of lateral epicondylitis. The patients were followed up after 3 and 12 months. They found no significant statistical difference in the subjective and objective outcomes between the groups after the treatments or the follow-ups.

Price et al. (1991) have stated that corticosteroids are “the mainstay of treating tennis elbow even though their effectiveness has not been well established by controlled studies”. They say that doctors use corticosteroids based on “experience of practice and less on the evidence of clinical trials”. There is no specific choice or dose of corticosteroids and there have been no comprehensive comparison of commonly used agents. They further state that inflammatory changes provide the rationale for corticosteroid injections.

In a double blind clinical trial, Price et al. (1991), compared local injections of 2ml lignocaine with either 10mg triamcinolone or 25mg hydrocortisone made up to 2ml with 1% lignocaine. The results indicated that within 2 weeks, pain relief was greater for triamcinolone than for hydrocortisone but the difference was not statistically significant. The response to steroid injections was better than lignocaine but at 24 weeks, the degree of improvement was similar for all three groups. However, patients still had pain and relapses were common.

Symptomatic relief is often dramatic after a local injection of corticosteroid, but the injection itself has no permanent beneficial effect on the pathological process (mentioned earlier) and does not influence the aetiological factors. Therefore, such treatment has temporary value (Kessler and Hertling 1996).

Organ et al. (1997) reported that in a retrospective study of 34 patients (35 elbows) who had prior failed surgery for lateral epicondylitis that 34 of the 35 elbows had residual tendinosis of the extensor carpi radialis brevis tendon; 27 elbows had pathologic changes in the extensor carpi radialis brevis tendon which were not addressed at all in the surgery; 7 elbows had damaged tissue which was not completely excised during surgery. According to the above authors, release operations which weaken the extensor aponeurosis but fail to address the patho-anatomic changes should not be recommended.

Surgery should be reserved for those cases that have prolonged symptoms and threaten employment (Rowley and Dent 1997). Dandy (1993) recommends release surgery if 3 injections of hydrocortisone acetate and an anesthetic e.g. lignocaine are unsuccessful in relieving the symptoms of lateral epicondylitis. He does, however, mention that it is an uncomfortable and unpredictable operation.

2.9 *Mill's manipulation*

Mill performed this manipulative technique in 1928. Corrigan and Maitland (1983) states that the reason for its success is that the extensor origin at the lateral epicondyle is stretched and separation of the scar tissue occurs. It could also be that the manipulation restores normal accessory and physiological movements of the elbow. Corrigan and Maitland (1983) also mentions that after the manipulation, proper exercises, rehabilitation program and changes of the grip and support of the forearm should be administered.

According to Zohn (1988), if wrist splints, anti-inflammatory medication (steroidal or non-steroidal) and physical therapy modalities are unsuccessful in the treatment of chronic lateral epicondylitis, then the painful scar should be torn by manipulation. Hammer (1991) recommends that Mill's manipulation may be used as long as there is full elbow extension. It is important for the examiner to maintain the wrist in full flexion with the elbow flexed at about 45 degrees. This is because the extensor carpi radialis muscles span two joints. While the wrist flexion is maintained, a

thrust is directed at the elbow joint so that it is extended. The purpose of the manipulation according to Hammer (1991) is to separate the scar and a permanent lengthening is created.

The technique of Mill's manipulation according to Cyriax and Cyriax (1993) is as follows: The patient is seated and the examiner stands behind him/her. The arm is lifted to a right angle, the shoulder internally rotated while the forearm is pronated. The wrist of the patient is clamped in full flexion while the other hand is rested on the patient's flexed elbow. The elbow is then snapped in full extension. The manipulation is performed only once on each visit. The manipulation may be momentarily painful. The above authors also claim that the painful scar would be torn by the manipulation with a fresh tear being replaced by new fibrous tissue under no tension. This is probably the main effect of Mill's manipulation. There is no information available in the literature to indicate that Mill's manipulation has any effect on the inflammatory response.

According to Maitland (1977), when Mill's manipulation is effectively used, a good result is produced because the joint is manipulated and not because the teno-muscular junction at the lateral epicondyle has been stretched. Lewit (1991) mentions that manipulation is effective for treating lateral epicondylitis.

2.10 Cross friction

Cross friction is also known by the terms “deep massage” and transverse frictions. There are many different ways to apply deep massage and these often produce different physiologic results (Cyriax 1960).

Generally there are two types of cross frictions according to Thomson et al. (1991):

- a] Transverse frictions – these are applied at right angles to the long axis of the structure that is being treated.
- b] Circular frictions – these are used to produce localised effects on muscle which has been in a prolonged state of tension.

The intention of transverse frictions is to restore mobility of the structure and to increase the extensibility of the structure under conditions of normal loading (Hertling and Kessler 1996). According to Prentice (1994), the purpose of transverse frictions is to “increase inflammation to a point where the inflammatory process is complete and the injury can progress to the later stages of the healing process”.

Initially, the tenderness or pain experienced by the patient may increase. However, after one or two minutes of treatment with light pressure, the tenderness or pain should decrease. If this does not occur or if the pain or tenderness increases, the

treatment should be discontinued (Hertling and Kessler 1996). No lubricant should be used for friction massage (Zohn 1988).

2.10.1 Indications for deep massage

- a] Muscle: Deep massage mobilises the muscle and separates adhesions between individual fibres, thus increasing movement and decreasing pain. “Deep transverse frictions restore mobility in the same way that a forced passive movement frees a joint” (Cyriax 1960).
- b] Ligament: Deep friction should be applied to a site of minor tears in the ligament. The duration of the massage should be for a few minutes. Deep massage can also be given in preparation “for the manipulative rupture of the restricting adhesion”. The deep friction causes numbness and thinning of the affected tendon, thus allowing easier movement when manipulated (Cyriax 1960).
- c] Tendon: Deep massage causes the tendon sheath to roll to and fro against the tendon thus smoothening the gliding surfaces. Successful massage probably breaks the scarring at the enthesis (site of tendon insertion) (Cyriax 1960).

2.10.2 *Technique of deep massage*

The following technique is according to Cyriax (1960):

- a] The area of the lesion must be accurately localised to within one centimeter or the width of the therapist's finger.
- b] The patient's skin must be moved so that the underlying lesion is properly massaged.
- c] The therapist should have a knowledge of the way the fibres of the underlying structures run. The friction must be applied at 90° to this direction.
- d] The area of the lesion must be sufficiently swept by the therapist's finger.
- e] The therapist must press very hard over the lesion.
- f] The patient must be properly positioned so that the therapist has best access to the site of the lesion. Muscles should be relaxed while tendons should be taut.

Chapter Three

3.1 The objective

This study investigated the relative effectiveness of cross friction and Mill's manipulation compared to cross friction alone in the treatment of lateral epicondylitis in terms of the patient's subjective response to the treatment as well as the measurable physical findings in order to establish which is more effective in the treatment of lateral epicondylitis.

3.2 The Research Methodology

3.2.1 Subjects

Non probability, purposive sampling was used to identify candidates. As only casual inferences were drawn from this pilot study, a sample of thirty patients diagnosed with lateral epicondylitis was accepted into the study. Demographically the profile of the patients was as follows: age ten to seventy, of any sex, race or occupation from the province of Kwazulu Natal. The sample group was obtained by advertising in local newspapers and on the local radio station. Pamphlets and flyers were used at local tennis clubs, gyms and sports clubs. Patients were also obtained via word-of-mouth from other patients. Patients with lateral epicondylitis

who presented at the Chiropractic Day Clinic were also considered for the study. All thirty patients completed the research protocol satisfactorily.

3.2.2 Allocation of Subjects

The subjects admitted to the study were randomly assigned to one of two groups. The randomisation took place by placing thirty small pieces of paper in a box, fifteen marked "A" and fifteen marked "B". Patients were then asked to pick one piece of paper and were then grouped according to the piece of paper chosen. Those in group A received cross friction and Mill's manipulation while those in group B received cross friction only.

3.2.3 Standards of Acceptance

At the initial consultation, all the patients underwent a detailed case history (Appendix A), a general physical examination (Appendix B) and an elbow regional examination (Appendix C). The exclusion criteria for this study were as follows:

- Fracture of any of the bones of the involved extremity.
- Tumors, either primary or secondary, benign or malignant, of any of the structures of the involved extremity
- Bleeding disorders e.g. Hemophilia
- Connective tissue disorders e.g. Marfan's syndrome

- Osteogenesis imperfecta
- Severe ligamentous sprain of the involved elbow region
- Severe hypermobility of the involved elbow region
- Arthritis of the elbow

The diagnosis of lateral epicondylitis was based on the following: Pain at or around the lateral epicondyle, aggravated by active wrist extension and a positive finding of at least one of the following orthopaedic tests: Mills, Cozen's and the Lateral epicondyle test (Magee 1997).

Mill's test was performed as follows: While palpating the lateral epicondyle, the examiner pronated the patient's forearm, flexed the wrist fully and extended the elbow. A positive test was indicated by pain over the lateral epicondyle of the humerus (Magee 1997).

Cozen's test was performed as follows: The patient's elbow was stabilised by the examiner's thumb which rested on the patient's lateral epicondyle. The patient was then asked to make a fist, pronate the forearm, and radially deviate and extend the wrist while the examiner resisted the motion. A positive finding was indicated by pain in the area of the lateral epicondyle of the humerus (Magee 1997).

The lateral epicondyle test was performed as follows: The examiner resisted extension of the third digit of the hand distal to the proximal interphalangeal joint,

stressing the extensor digitorum muscle and tendon. A positive test was indicated by pain over the lateral epicondyle of the humerus (Magee 1997).

The patients were accepted into the study once the diagnosis of lateral epicondylitis was confirmed. The nature of the study and the treatment period (i.e. six treatments in a three-week period and a one-month follow up consultation) was then outlined to the patient. The patients were also made aware that for the duration of the study, they were not to receive any other treatment for lateral epicondylitis. The subjects then signed a written consent form (Appendix D) before taking part in the study.

3.2.4 *Interventions*

The subjects accepted into the study completed the Numerical Pain Rating Scale (NRS 101) (Appendix E) and the McGill Short Form Pain Questionnaire (Appendix F) under the researcher's supervision before the first, third, sixth and one-month follow up consultations. The NRS 101 questionnaire was used to determine the subjective pain intensity experienced by the patient. The questionnaire instructed the patient to rate their pain at its worst and at its least on a numerical scale of zero to hundred, with zero indicating "no pain at all" and one hundred indicating "pain as bad as it could be". The average intensity was calculated by adding the values representing the worst and least pain and then dividing this value by two (Jenson et al. 1986). The patient's response was noted at the initial visit, the third treatment,

the sixth treatment and at the one-month follow up consultation. The NRS 101 has been shown to be simple, effective and the recommended choice in a study comparing six methods of measuring clinical pain intensity (Jenson et al. 1986).

The McGill questionnaire is one of the most widely used tests for the measurements of pain, the patient's perception and its treatment. It provides information on the sensory, affective and evaluative dimensions of the pain together with a brief description of the overall intensity (Melzack 1987). This questionnaire allows the patient to describe the nature of their pain and then rate the relative intensity associated with each pain description. It consists of fifteen options each with a minimum score of 0 (zero) and a maximum of 3, giving each patient a raw score out of 45.

Grip strength readings (Appendix G) with the involved elbow in two positions viz. straight (180°) and bent in the ninety-degree flexion position were also taken on the first, third, sixth and one-month follow up consultations. Grip strength readings were taken because according to De Smet and Fabry (1997), grip force was greatly reduced at the pathologic side especially when the grip force was measured with a straight elbow compared with the elbow flexed at ninety degrees. A portable dynamometer was used to measure grip strength with the elbow in the straight (180°) and ninety-degree flexion positions. According to Agre et al. (1987), in study to determine the reliability of a portable dynamometer for testing upper and

lower extremity strength, the results indicate that the dynamometer is reliable for testing upper extremity strength but not lower extremity strength.

In order to measure the tenderness at the lateral epicondyle or its surrounding area, a pressure algometer was used (Appendix H). The algometer was used to quantify palpatory pain findings over bone and muscle and consists of a force dial which reads in pounds and a one centimetre diameter rubber-tipped stylus. Pain threshold was determined by the amount of force per square centimetre required for the person to first perceive pain (Fischer 1987). The procedure of taking a pressure reading was as follows: The algometer was set to zero and then pressed over the tender area (either the lateral epicondyle or its surrounding area) up to the pressure threshold of that patient. This reading, obtained in pounds per square centimetre, indicated the sensitivity of the tender area to pain.

The treatment for group A consisted of a ten minute cross friction applied to the site of pain followed by Mill's manipulation of the elbow. Mill's manipulation was performed as follows: The patient was seated and the researcher stood behind him/her. The arm was lifted to a right angle, the shoulder internally rotated while the forearm was pronated. The wrist of the patient was clamped in full flexion while the other hand was lightly rested on the patient's flexed elbow. The elbow was then snapped into full extension. The manipulation was repeated only once on each visit. The above technique was according to Cyriax and Cyriax (1993).

The treatment for group B consisted only of a ten minute cross friction applied to the site of pain. Patients in both groups received six treatments followed by a one-month consultation. The patients were not treated during this consultation

3.3 *Measurement and Observations*

3.3.1 *The Data*

The data was in two forms, primary data and secondary data.

3.3.1.1 *The Primary Data*

Five clinical experiments were done: Algometer (ALG), Dynamometer reading (i.e. grip strength) at 90° (GS 1), Dynamometer reading at 180° (GS 2), McGill Short Form Questionnaire and the NRS 101. For each clinical experiment, readings were taken 4 times (before the first treatment, before the third treatment, before the sixth treatment and at the one-month follow up consultation). ALG, GS 1, GS 2 and NRS were continuous variables while the McGill was a categorical variable.

3.3.1.2 *The Secondary Data*

The published documentation and accepted theories on lateral epicondylitis, cross friction and Mill's manipulation.

3.4 Statistical Analysis

3.4.1 Treatment of the Data

3.4.1.1 Treatment of the Subjective Data

The questionnaires were examined to assess whether they had been correctly completed and then the results were transferred to a spreadsheet. These results then underwent statistical analysis.

3.4.1.2 Treatment of the Objective Data

The algometer and the dynamometer readings were transferred to a spreadsheet and then underwent statistical analysis.

3.4.2 Statistical Analysis of the Data

The data was analysed statistically using the SPSS (Statistical Package for the Social Sciences) package (Version 9). Due to the small sample size ($n = 15$ in each group) both the continuous and categorical variables were analysed using non-parametric methods. The following tests were used:

- The Mann-Whitney U-tests between group A and group B.
- The Wilcoxon's signed rank test within group A and within group B.
- Summary statistics and bar charts.

3.4.2.1 Comparison between groups 1 and 2 with respect to the categorical variable

The Mann-Whitney U-test was used to compare Groups 1 and 2 with respect to the categorical variable. The null hypothesis states that there is no significant difference between Groups 1 and 2 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 $p \leq \alpha/2$ where p is the observed significance level or probability value. Otherwise, the null hypothesis is accepted at the same level.

3.4.2.2 Comparison between Groups 1 and 2 with respect to continuous variables

The Mann-Whitney U-test was used to compare Groups 1 and 2 with respect to each continuous variable. The null hypothesis states that there is no significant difference between Groups 1 and 2 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 $p \leq \alpha/2$ where p is the observed significance level or probability value. Otherwise, the null hypothesis is accepted at the same level.

3.4.2.3 Comparison between related samples within Group 1 with respect to the categorical variable

Wilcoxon's signed rank test was used to compare results from related samples. 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.

Decision rule:

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

3.4.2.4 Comparison between related samples within Group 1 with respect to continuous variables

Wilcoxon's signed rank test was used to compare results from related samples. 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 no significant improvement.

Decision rule:

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

3.4.2.5 Comparison between related samples within Group 2 with respect to the categorical variable

Procedure 3.4.2.3 was repeated within group 2 with the same decision rule.

3.4.2.6 Comparison between related samples within Group 2 with respect to continuous variables

Procedure 3.4.2.4 was repeated within group 2 with the same decision rule.

3.4.2.7 Comparison using bar charts

Visual summaries of analytic findings were given by use of bar charts to compare Groups 1 and 2 with respect to the continuous variables of the study only. Average readings were used to make bar charts.

3.4.2.8 Power analysis for continuous variables

Power analysis was done for continuous variables only.

Chapter Four

4.1 *Introduction*

This chapter concerns itself with the results obtained after statistical analysis of the data from the measurement criteria as discussed in Chapter 3. The data is presented in table form with relevant comments and interpretation in order to accept or reject the null hypothesis.

4.2 *The Hypotheses*

Wilcoxon signed rank test was used to compare results within related samples within Group1 and within Group 2 with respect to both continuous and categorical variables. In each test, the null hypothesis (H_0) states that there is no significant improvement between the 2 related samples being compared. The alternative hypothesis (H_a) states that there is a significant improvement.

The Mann-Whitney U-test was used to compare between Group 1 and Group 2 with respect to the categorical and continuous variables. The null hypothesis (H_0) states that there is no significant difference between Group1 and Group 2 with respect to the variable of comparison at the $\alpha = 0.05$ level of significance. The alternate hypothesis (H_a) states that there is a significant difference at the same level.

4.3 *The Analysed data*

The data was analysed at the $\alpha = 0.05$ level of significance. The decision rule was applied and states:

Reject the null hypothesis (H_0) if $p \leq \alpha/2$ or accept the null hypothesis (H_0) if

$p > \alpha/2$. Now $\alpha = 0.05$, therefore $\alpha/2 = 0.025$. Therefore, the p-value would have to be below or equal to 0.025 to reject the null hypothesis and conclude that there is a statistically significant improvement at the $\alpha = 5\%$ level of significance.

4.4 The Demographic Data

Table 1 *Age, Gender and Race distribution*

	Group 1 (15)	Group 2 (15)	Total (30)
<i>A] Age distribution</i>			
20 – 30	4	5	9
31 – 40	2	2	4
41 – 50	3	4	7
51 – 60	5	4	9
61 – 70	1	-	1
Average age	42.5 Min. age: 21 Max. age: 62	39.1 Min. age: 23 Max. age: 57	40.8 Min. age: 21 Max. age: 62
<i>B] Gender distribution</i>			
Males	6	7	13
Females	9	8	17
<i>C] Racial distribution</i>			
Black	-	-	-
Indian	3	4	7
Coloured	-	1	1
White	12	10	22
Other	-	-	-

D] Geographical distribution

Table 2 *Geographic distribution*

Suburb of the City of Durban	No. of patients
Amanzimtoti	1
Berea	5
Bluff	2
Carrington Heights	2
Chatsworth	2
Durban Central	2
Durban North	6
Glenwood	1
Kloof	1
Morningside	1
Newlands West	2
Pinetown	1
Queensburgh	1
Westville	3

E/ Occupation

Table 3 Occupation

Occupation	No. of patients
Accountant	1
Brick layer	1
Cashier	1
Chiropractor	1
Consultant	1
Hairstylist	1
Housewife	4
Lecturer	1
Locksmith	1
Manager	7
Nurse	1
Receptionist	2
Roof contractor	1
Sales Rep	1
Student	6

F] Sporting or exercise activities that aggravate lateral epicondylitis

Table 4 *Sporting or exercise activities that aggravate lateral epicondylitis*

Sporting/exercise activity	No. of patients	Total number of hours per week*
Badminton	1	2
Biceps curls	4	13
Golf	2	7
Tennis	3	11

*Refers to the combined activity total of all patients in that sporting/exercise category

G] Non – sporting activities that aggravate lateral epicondylitis

Table 5 *Non – sporting activities that aggravate lateral epicondylitis*

Activity	No. of patients	Total no. of hours per week*
Carrying heavy bags/tool boxes	5	107
Cashing i.e. using a cash register	1	25
Chiropractic adjustments	3	3
Hairstyling	1	48
Knitting	1	16
Massage	1	14
Typing	4	71
Use of computer mouse	3	50

*Refers to the combined activity total of all patients in that activity category

4.5 The non-parametric Wilcoxon signed rank tests:

4.5.1 Results of the Wilcoxon signed rank test for continuous variables:

Table 6 Results of the Wilcoxon signed rank test for Grip strength 1 (elbow at 90° flexion) for both Group 1 and Group 2

GS 1	Assessment 1 (Treatment 1 and 3)	Assessment 2 (Treatment 3 and 6)	Assessment 3 (Treatment 1 and 6)	Assessment 4 (Treatment 6 and one-month follow up)
Group 1 p value	0.057	0.179	0.007	0.246
Group 2 p value	0.719	0.003	0.004	0.209

The results indicate that at the 95% level of significance, Group 1 showed a significant improvement between treatments 1 and 6 but no significant improvement between treatments 1 and 3, treatments 3 and 6 and treatment 6 and one month follow up. Group 2 showed significant improvements between treatments 3 and 6 and treatments 1 and 6. There was no significant improvement between treatments 1 and 3 and treatment 6 and the one month follow up consultation.

Table 7 Results of the Wilcoxon Signed Rank test for Grip Strength 2 (elbow at 180°) for both Group 1 and Group 2

GS 2	Assessment 1 (Treatment 1 and 3)	Assessment 2 (Treatment 3 and 6)	Assessment 3 (Treatment 1 and 6)	Assessment 4 (Treatment 6 and one- month follow up)
Group 1 p value	0.107	0.035	0.005	0.634
Group 2 p value	0.783	0.164	0.726	0.169

The results indicate that at the 95% level of significance, Group 1 showed a

significant improvement between treatments 1 and 6 but group 2 did not do so. Both groups showed no significant improvements between treatments 1 and 3, treatments 3 and 6 and treatment 6 and the one-month follow up consultation.

Table 8 *Results of the Wilcoxon Signed Rank test for the Algometer readings for both Group 1 and Group 2*

ALG	Assessment 1 (Treatment 1 and 3)	Assessment 2 (Treatment 3 and 6)	Assessment 3 (Treatment 1 and 6)	Assessment 4 (Treatment 6 and one-month follow up)
Group 1 p value	0.020	0.002	0.002	0.018
Group 2 p value	0.067	0.004	0.001	0.009

The results indicate that at the 95% level of significance, Group 1 showed a slight improvement between treatments 1 and 3, while Group 2 shows no significant improvement between the same period. Both groups showed significant improvements between treatments 3 and 6, treatments 1 and 6 and between treatment 6 and the one-month follow up consultation.

Table 9 *Results of the Wilcoxon Signed Rank test for the NRS for both Group 1 and Group 2*

NRS	Assessment 1 (Treatment 1 and 3)	Assessment 2 (Treatment 3 and 6)	Assessment 3 (Treatment 1 and 6)	Assessment 4 (Treatment 6 and one-month follow up)
Group 1 p value	0.002	0.047	0.001	0.280
Group 2 p value	0.231	0.001	0.003	0.634

The results indicate that at the 95% level of significance, Group 1 showed significant improvements between treatments 1 and 3 and treatment 1 and 6. Group 2 showed significant improvements between treatment 3 and 6 and treatment 1 and 6. There was no significant improvement between treatment 6 and one month follow up for both groups.

4.6 Results of the Wilcoxon Signed Rank test for the categorical variable for both Group 1 and Group 2

Table 10 Results of the Wilcoxon Signed Rank test for the McGill for both Group 1 and Group 2

McGill	Assessment 1 (Treatment 1 and 3)	Assessment 2 (Treatment 3 and 6)	Assessment 3 (Treatment 1 and 6)	Assessment 4 (Treatment 6 and one-month follow up)
Group 1 p value	0.013	0.026	0.001	0.334
Group 2 p value	0.126	0.001	0.003	0.796

The results indicate that at the 95% level of significance, Group 1 showed a significant improvement between treatments 1 and 3 and treatments 1 and 6. Group 2 showed a significant improvement between treatments 3 and 6 and treatments 1 and 6. There was no significant improvement between treatment 6 and the one month follow up for both groups.

4.7 The non-parametric Mann-Whitney Unpaired tests:

4.7.1 Results of Mann-Whitney test comparing the categorical variable between Group 1 and Group 2 for McGill

Table 11 Results of Mann-Whitney test comparing the categorical variable between Group 1 and Group 2 for McGill

McGill		Mean rank	p-value
Treatment 1	Group 1	15.57	0.966
	Group 2	15.43	
Treatment 3	Group 1	15.30	0.900
	Group 2	15.70	
Treatment 6	Group 1	14.90	0.699
	Group 2	16.10	
One-month follow-up	Group 1	13.77	0.247
	Group 2	17.23	

The results indicate that at the 95% level of significance no statistically significant difference in improvements were noted between Group 1 and Group 2 at treatments 1, 3, 6 and the one-month follow up consultation. Therefore, the null hypothesis is accepted, indicating that both treatment groups were equally effective.

4.7.2 Results of Mann-Whitney test comparing the continuous variables between

Group 1 and Group 2

Table 12 *Results of Mann-Whitney test comparing the continuous variables between Group 1 and Group 2 for Grip strength (90°)*

Grip strength (90°)		Mean rank	p-value
Treatment 1	Group 1	15.13	0.819
	Group 2	15.87	
Treatment 3	Group 1	15.60	0.950
	Group 2	15.40	
Treatment 6	Group 1	14.93	0.724
	Group 2	16.07	
One-month follow-up	Group 1	15.57	0.967
	Group 2	15.43	

The results indicate that at the 95% level of significance no statistically significant difference in improvements were noted between Group 1 and Group 2 at treatments 1, 3, 6 and the one-month follow up consultation. Therefore, the null hypothesis is accepted, indicating that both treatment groups were equally effective.

Table 13 *Results of Mann-Whitney test comparing the continuous variables
between Group 1 and Group 2 for Grip strength (180°)*

Grip strength (180°)		Mean rank	p-value
Treatment 1	Group 1	15.93	0.787
	Group 2	15.07	
Treatment 3	Group 1	16.63	0.480
	Group 2	14.37	
Treatment 6	Group 1	17.37	0.244
	Group 2	13.63	
One-month follow-up	Group 1	16.30	0.618
	Group 2	14.70	

The results indicate that at the 95% level of significance no statistically significant difference in improvements were noted between Group 1 and Group 2 at treatments 1, 3, 6 and the one-month follow up consultation. Therefore, the null hypothesis is accepted, indicating that both treatment groups were equally effective.

Table 14 *Results of Mann-Whitney test comparing the continuous variables
between Group 1 and Group 2 for Algometer*

Algometer		Mean rank	p-value
Treatment 1	Group 1	17.17	0.299
	Group 2	13.83	
Treatment 3	Group 1	17.83	0.146
	Group 2	13.17	
Treatment 6	Group 1	17.77	0.158
	Group 2	13.23	
One-month follow-up	Group 1	18.43	0.068
	Group 2	12.57	

The results indicate that at the 95% level of significance no statistically significant difference in improvements were noted between Group 1 and Group 2 at treatments 1, 3, 6 and the one-month follow up consultation. Therefore, the null hypothesis is accepted, indicating that both treatment groups were equally effective.

Table 15 *Results of Mann-Whitney test comparing the continuous variables between Group 1 and Group 2 for Numerical Pain Rating Scale (NRS)*

NRS		Mean rank	p-value
Treatment 1	Group 1	18.43	0.067
	Group 2	12.57	
Treatment 3	Group 1	14.27	0.441
	Group 2	16.73	
Treatment 6	Group 1	16.13	0.692
	Group 2	14.87	
One-month follow-up	Group 1	14.27	0.435
	Group 2	16.73	

The results indicate that at the 95% level of significance no statistically significant difference in improvements were noted between Group 1 and Group 2 at treatments 1, 3, 6 and the one-month follow up consultation. Therefore, the null hypothesis is accepted, indicating that both treatment groups were equally effective.

4.8 The power-value

The power value assesses the sensitivity of the statistical tests by assessing the probability of a particular test to detect a difference between the groups. The probability of accepting a type II error is β , therefore the power of a statistical test is $(1 - \beta)$ (Daniel 1999). This power value is then converted to a percentage. Therefore, the closer the power value is to 100, the smaller the probability of accepting a type II error and the greater the sensitivity of the test (Worku 1998).

Table 16 Power values

	GS 1	%	GS 2	%	Algometer	%	NRS 101	%
Treatment 1	0.0533	5.3	0.0918	9.1	0.1417	14.1	0.3745	37.4
Treatment 3	0.0788	7.8	0.1689	16.8	0.2974	29.7	0.1335	13.3
Treatment 6	0.0549	5.4	0.2438	24.3	0.3471	34.7	0.0609	6.0
One-month follow up	0.0638	6.3	0.1349	13.4	0.5717	57.1	0.1172	11.7

4.9 Selected bar charts for continuous variables

The following graphs are a visual representation of the mean value changes as found within the first, third, sixth and one-month follow up consultations. These values were taken from the summary statistics and are not intended as a comparison between the two study groups as this could not be done from the mean values. However, they serve to augment the discussion of the results in chapter 5 and serve to indicate possible trends between the two groups.

Graph

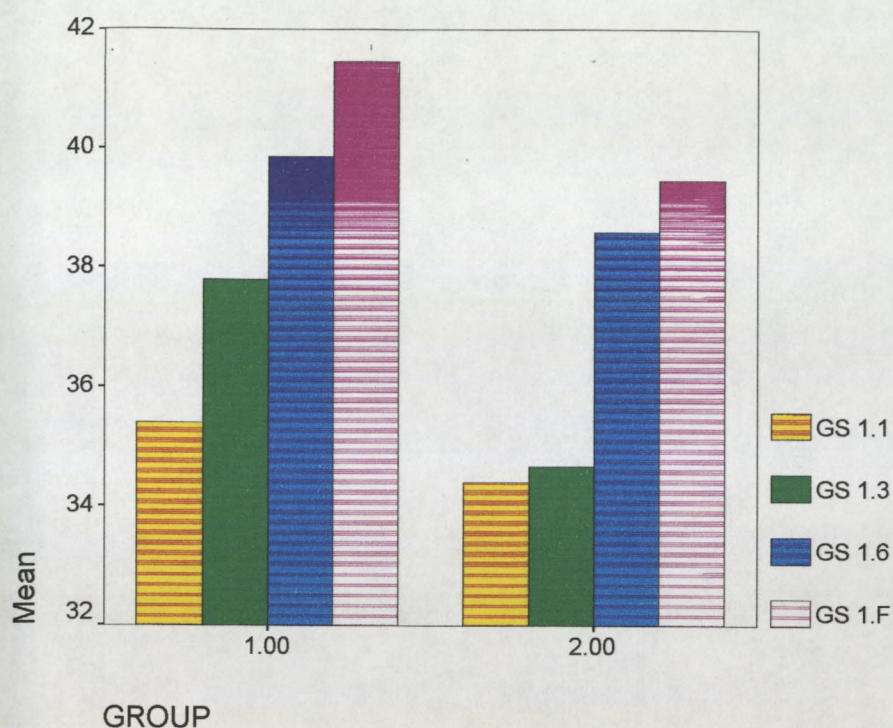


Figure 1 *Grip strength 90°*

This figure indicates the changes in the mean grip strength (elbow at 90°) values over the period evaluation.

GS 1.1 – Grip strength evaluation at treatment 1

GS 1.3 – Grip strength evaluation at treatment 3

GS 1.6 – Grip strength evaluation at treatment 6

GS 1.F – Grip strength evaluation at the one-month follow up consultation

Graph

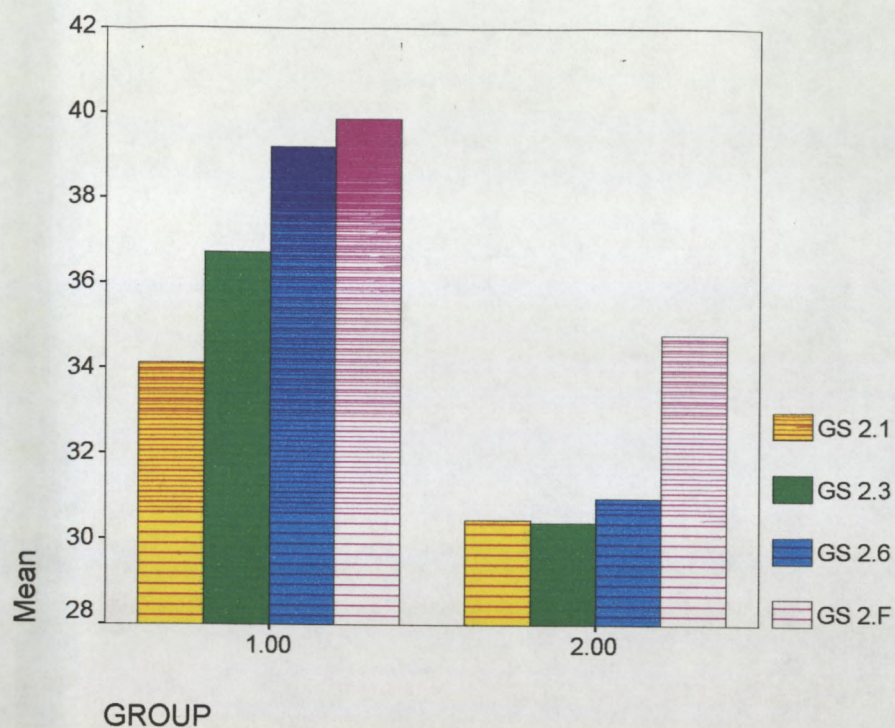


Figure 2 *Grip strength 180°*

This figure indicates the changes in the mean grip strength (elbow at 180°) values over the period evaluation.

GS 2.1 – Grip strength evaluation at treatment 1

GS 2.3 – Grip strength evaluation at treatment 3

GS 2.6 – Grip strength evaluation at treatment 6

GS 2.F – Grip strength evaluation at the one-month follow up consultation

Graph

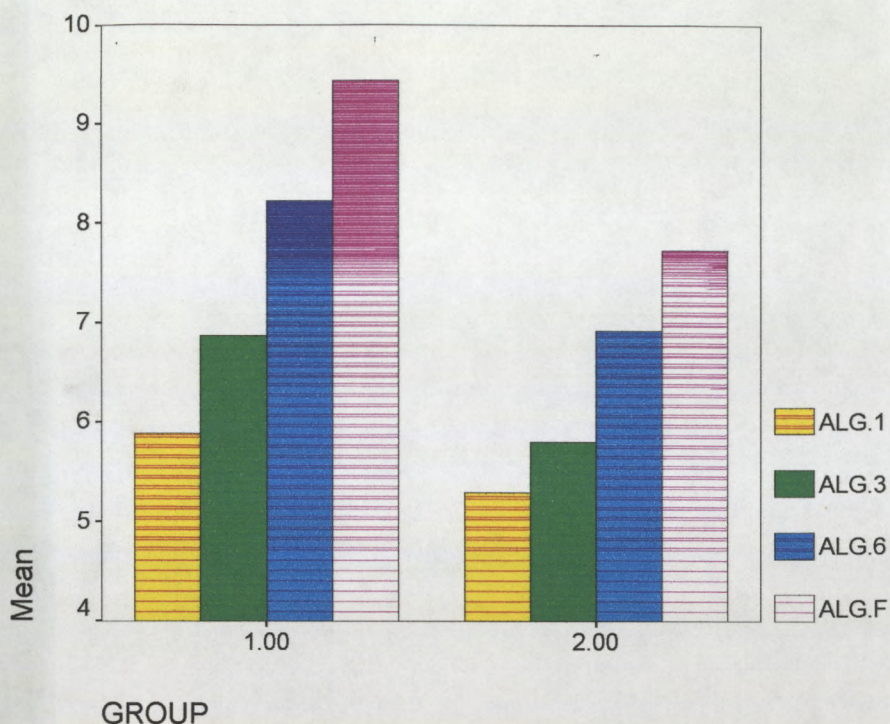


Figure 3 *Algometer*

This figure indicates the changes in the mean algometer values over the period evaluation.

ALG 1 – Algometer evaluation at treatment 1

ALG 3 – Algometer evaluation at treatment 3

ALG 6 – Algometer evaluation at treatment 6

ALG F – Algometer evaluation at the one-month follow up consultation

Graph

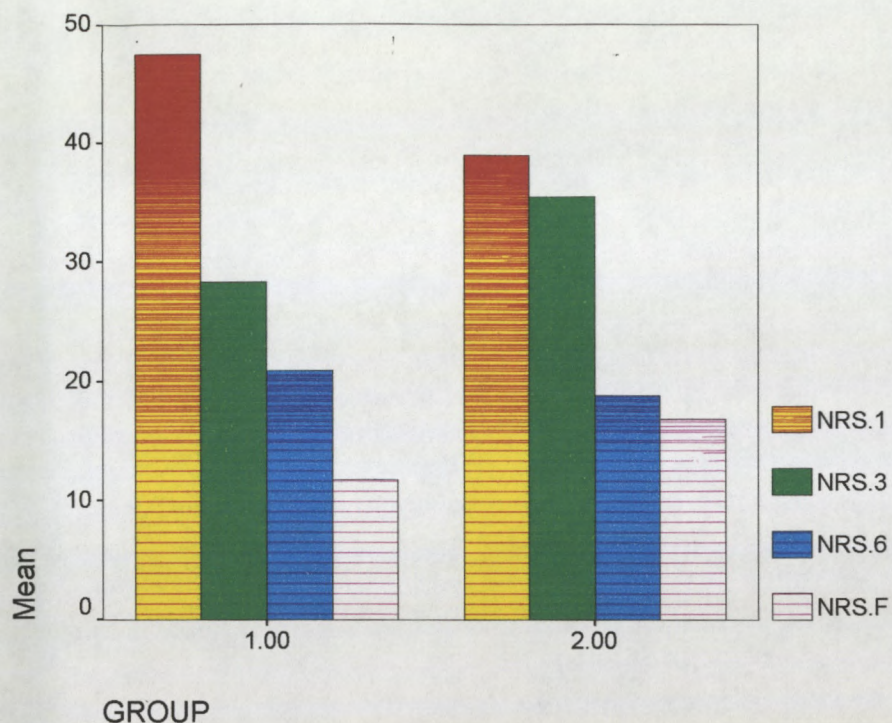


Figure 4 *NRS 101*

This figure indicates the changes in the mean NRS 101 values over the period evaluation.

NRS 1 – NRS evaluation at treatment 1

NRS 3 – NRS evaluation at treatment 3

NRS 6 – NRS evaluation at treatment 6

NRS F – NRS evaluation at the one-month follow up consultation

Chapter Five

This chapter will discuss the results of the objective and subjective findings as gathered from the dynamometer measurements, the algometer measurements, the Numerical Pain Rating Scale (NRS 101) and the McGill questionnaire.

5.1 The Demographic data

The average age of the symptomatic patient in group 1 of this study was 42.5 years of age, in group 2 it was 39.1 years of age and overall it was 40.8 years of age (Table 1). These findings were comparable to those of Thomson *et al.* (1991) who stated that lateral epicondylitis normally affects patients aged 30 – 60 years.

Of the thirty patients participating in this study, 13 (43%) were males and 17 (57%) were females (table 1). These findings indicate a slight female preponderance as opposed to Thomson *et al.* (1991), who stated that lateral epicondylitis has an equal sex distribution.

Table 1 also indicates that of the 30 patients who participated in this study, 22 (73%) were White, 7 (23%) were Indian and 1 (4%) was coloured. No Blacks participated in this study. This is probably an unrealistic sample, as most of the Black, Coloured and Indian communities are not aware of the exact nature of the chiropractic

profession. It is also likely that the pamphlets and newspapers which carried the advertisements for the research did not reach the black population in the previously "black areas". The geographic distribution (table 2) indicates that most of the patients were from the previously White suburbs of Durban. One could speculate that only a proportion of the wealthier suburbs surrounding the Technikon Natal Berea campus are aware of the nature and benefits of chiropractic care. Twenty percent of the patients were from the wealthy suburb of Durban North while only 4 (13%) patients came from the previously disadvantaged suburbs of Chatsworth and Newlands West.

The occupations of the patients who participated in this study varied widely. Most of these patients had never played tennis in their lives and could not understand why they were suffering from tennis elbow. Twenty three percent of the patients were managers and twenty percent were students. Table 3 indicates that almost anyone could be afflicted with tennis elbow and it is not possible to isolate a specific occupation that could cause lateral epicondylitis.

Ten patients (33%) engaged in sporting activities or exercises that aggravated lateral epicondylitis as indicated in Table 4. Four patients (13%) stated that biceps curls aggravated the elbow pain while 3 (10%) patients said that playing tennis aggravated the elbow pain. Other sporting activities that aggravated lateral epicondylitis were golf (2 patients) and badminton (1 patient).

The non-sporting activities (table 5) that aggravated lateral epicondylitis were those that involved manual labour e.g. carrying heavy boxes (5 patients [17%]) and those that involved fine finger activity e.g. hairstyling, knitting, typing, cashing, massage and use of the computer mouse (11 patients [37%]) as indicated by table 5. This finding is in keeping with the view of Nook (1998) who stated that the carrying of heavy loads aggravated or caused lateral epicondylitis and the view of Hertling and Kessler (1996) who stated that prolonged fine finger activities e.g. knitting or sewing also aggravated lateral epicondylitis.

5.2 *The first objective*

The first objective was to evaluate the relative effectiveness of cross friction with Mill's manipulation compared to cross friction alone in terms of the subjective findings in order to determine the impact of cross friction with Mill's manipulation on the treatment of lateral epicondylitis. The subjective data was collected via the NRS 101 and McGill pain questionnaire.

5.2.1 *Intra-group analysis*

The statistical data can be found in tables 9 and 10. The results from the analysis of the NRS 101 revealed that at the 95% level of significance, Group 1 showed a significant improvement between treatments 1 and 3 and treatments 1 and 6. Group

2 showed significant improvements between treatments 3 and 6 and treatments 1 and 6. Although there was no significant improvement between treatments 3 and 6 for Group 1, treatment 3 contributed to the overall improvement of the patient. There was no significant improvement between treatment 6 and the one-month follow-up for both groups.

The results from the analysis of the McGill pain questionnaire revealed that at the 95% level of significance, Group 1 showed a significant improvement between treatments 1 and 3 and treatments 1 and 6. Group 2, however, showed significant improvements between treatments 3 and 6 and treatments 1 and 6. There was no significant improvement between treatment 6 and the one-month follow-up for both groups. To conclude, it must be noted that no patients were treated between treatment 6 and the one-month follow-up and both groups showed no subjective improvements during this period. This probably indicates that once treatment has stopped, the degree of subjective improvement is not statistically significant – this was true for both Group 1 and Group 2.

5.2.2 Inter-group analysis

The statistical data can be found in tables 11 and 15. The Mann-Whitney test was used to compare the results of the McGill pain questionnaire. The results indicate that at the 95% level of significance, no statistical significant difference in

improvements were noted between Group 1 and Group 2 at treatments 1, 3, 6 and the one-month follow-up consultation. Therefore, the null hypothesis is accepted indicating that subjectively both treatments were equally effective.

The Mann-Whitney test was also used to compare the results of the NRS 101. The results indicate that at the 95% level of significance, no statistical significant difference in improvements were noted between Group 1 and Group 2 at treatments 1, 3, 6 and the on-month follow-up consultation. Therefore, the null hypothesis is accepted indicating that subjectively both treatments were equally effective.

5.3 The second objective

The second objective was to evaluate the relative effectiveness of cross friction with Mill's manipulation compared to cross friction alone in terms of the objective findings in order to determine the impact of cross friction with Mill's manipulation on the treatment of lateral epicondylitis. Objective data was collected via an algometer and dynamometer (grip strength) readings at 90° and 180°.

5.3.1 Intra-group analysis

Statistical data can be found in tables 6, 7 and 8. The results from the analysis of grip strength with the elbow bent at 90° indicate that at the 95% level of significance, Group 1 showed a significant improvement between treatments 1 and 6

but no significant improvements between treatments 1 and 3, treatments 3 and 6 and treatment 6 and the one-month follow-up. However, treatment 3 did contribute to the overall objective improvement between treatments 1 and 6 in Group 1. Group 2 showed significant improvements between treatments 3 and 6 and treatments 1 and 6 but no significant improvements between treatments 1 and 3 and treatment 6 and the one-month follow-up.

The results from the analysis of grip strength with the elbow straight indicate that at the 95% level of significance, Group 1 showed a significant improvement between treatments 1 and 6 but group 2 did not do so. Both groups showed no significant difference in improvements between treatments 1 and 3, treatments 3 and 6 and treatment 6 and the one-month follow-up. It must be noted that no patients were treated between treatment 6 and the one-month follow-up and both groups showed no grip strength (both readings) improvements during this period. This probably indicates that once treatment has stopped, the degree of grip strength improvement is not statistically significant – this was true for both Group 1 and Group 2.

The results from the analysis of the algometer readings revealed that at the 95% level of significance, Group 1 showed a slight improvement between treatments 1 and 3 while Group 2 did not show any significant improvement between the same period. However, both groups showed significant improvements between treatments 3 and 6, treatments 1 and 6 and between treatment 6 and the one-month follow-up. This is the only objective data that showed significant improvement between

treatment 6 and the one-month follow-up. This indicates that a patient's tenderness "levels" declined even after treatment was stopped at treatment 6.

5.3.2 *Inter-group analysis*

Statistical data can be found in tables 12, 13 and 14. The Mann-Whitney test was used to compare the results of the grip strength readings with elbow bent at 90°. The results indicate that at the 95% level of significance, no statistical significant difference in improvements were noted between Group 1 and Group 2 at treatments 1, 3, 6 and the one-month follow-up consultation. Therefore, the null hypothesis is accepted indicating that objectively both treatments were equally effective.

The Mann-Whitney test was also used to compare the results of the grip strength readings with elbow straight. The results indicate that at the 95% level of significance, no statistical significant difference in improvements were noted between Group 1 and Group 2 at treatments 1, 3, 6 and the one-month follow-up consultation. Therefore, the null hypothesis is accepted indicating that objectively both treatments were equally effective.

The Mann-Whitney test was also used to compare the results of the algometer readings. The results indicate that at the 95% level of significance, no statistical significant difference in improvements were noted between Group 1 and Group 2 at

treatments 1, 3, 6 and the one-month follow-up consultation. Therefore, the null hypothesis is accepted indicating that objectively both treatments were equally effective. It is most likely that cross friction is the main therapeutic intervention and that any scar is probably torn or broken down by successful friction rather than Mill's manipulation. This probably accounts for the lack of any significant statistical difference between the two groups.

5.4 Power values

The power values were calculated for all the Mann-Whitney tests and converted to percentages. It was assumed for this study that there was a greater chance of accepting a type II error when the power analysis was lower than 50% (Daniel 1999). The low power values (table 16) in this study may well be due to the small sample size as Worku (1998) says that low power values can be expected with small sizes.

5.5 Problems with the subjective data

As this study was not blinded in any way, it was possible that the subjects tried to please the researcher by subjectively reporting improvement at successive consultations – the “Hawthorne” effect (Mouton 1996). This phenomenon would however, not have been isolated to one group only and therefore did not prejudice one group more than the other.

The lack of statistically significant differences between the 2 groups queries the sensitivity of the questionnaires and perhaps subtle changes in patient disability and pain intensity were undetected. Some patients expressed a degree of difficulty as they attempted to describe and quantify their pain and disability within the parameters of the questionnaires.

5.6 *Problems with the objective data*

Some patients involuntarily squeezed the dynamometer as they attempted to comfortably grip it. They then tried to squeeze the dynamometer as hard as they could but the readings in such an instance would not be accurate. To get an accurate reading from a dynamometer, the subject needs to apply a constant pressure till he/she cannot squeeze anymore. The researcher had to watch for this and make sure that the dial was set to zero before the patient was instructed to squeeze the dynamometer.

Minor variations in algometer placement due to human error may have influenced the pain threshold readings. A few patients (2) found that the pressure required for the pressure threshold readings bruised them. The problem with this is that these patients, on subsequent readings may have responded to lower pressure to prevent further bruising.

5.7 Comparison of the results to previous studies

No randomised controlled study involving Mill's manipulation or cross friction as a treatment for lateral epicondylitis could be found in journals, CD-ROMS, textbooks or the Internet, thus it was impossible to make direct comparisons to other research studies.

Chapter Six

6.1 *Conclusions*

This study consisted of thirty patients diagnosed with lateral epicondylitis, all of whom underwent a medical history, general physical examination and a regional elbow examination. They were randomly assigned into two groups: Group 1 received cross friction and Mill's manipulation while Group 2 received cross friction only.

The maximum number of treatments each patient received was six over a 3-week period, they all returned for their follow-up consultation one month after their last treatment.

Intra-group statistical analysis revealed significant subjective improvement within both groups between treatments 1 and 6 but there was no significant improvement between treatment 6 and the one-month follow-up. There was also significant objective improvement within both groups between treatment 1 and treatment 6, with the exception of grip strength with a straight elbow in Group 2. With the exception of the algometer readings (tenderness levels), there was no significant objective improvement within both groups between treatment 6 and the one-month follow-up.

The inter-group statistical analysis revealed that there was no significant difference in improvement between the two groups for both the subjective and objective data between treatments 1, 3, 6 and treatment 6 and the one-month follow-up.

Lateral epicondylitis is a syndrome caused by multiple factors and presents in various ways in different patients. Thus one must take this into consideration when assessing the effect of different treatment modalities on this complicated syndrome.

6.2 *Recommendations*

This study should be repeated using a larger sample size, so that accurate conclusions can be drawn from the derived information. A follow-up study at 3 months, 6 months and 1 year might help establish how effective the treatment is over a long period.

Perhaps a more sensitive pain questionnaire pertaining more to the patient who suffers from lateral epicondylitis would help identify subtle changes during subjective evaluation.

The blinding of the algometer and dynamometer readings by utilising an unbiased colleague to take the readings might result in more reliable data.

In the author's opinion it would be of interest to ascertain the effectiveness of either Mill's manipulation or cross friction versus placebo in the treatment of lateral epicondylitis. It would also be of interest to ascertain the effectiveness of chiropractic manipulation based on motion palpation findings of the elbow versus placebo in the treatment of lateral epicondylitis

REFERENCES

Agre, J.C., Magness, J.L. , Hull, S.Z. , Wright, K.C. , Baxter, T.L. , Patterson, R. , Stradel, L. 1987. Strength testing with a portable dynamometer: reliability for upper and lower extremities. Archive of Physical Medicine Rehabilitation. 68(7):454-458.

Corrigan, B. and Maitland, G.D. 1983. Practical Orthopaedic Medicine. pp 73. London. England. Butterworth & Co. 295p. ISBN 0-407-00440-8.

Cyriax, J.H. and Cyriax, P.J. 1993. Cyriax's illustrated manual of orthopedic medicine. 2nd edition. pp 58-59. Oxford. England. Butterworth-Heinemann Ltd. 268p. ISBN 0 7506 1483 8.

* Cyriax, J.H. 1960. Massage, Manipulation and Traction. pp 122-139. Connecticut. U.S.A. Elizabeth Licht. 531p. *No ISBN available.

D'Ambrosia, R.D. 1977. Musculoskeletal Disorders – Regional Examination and Differential Diagnosis. pp 384. Philadelphia. U.S.A. J.B. Lippincott and Company. 542p. ISBN 0-397-50373-3.

Dandy, D.J. 1993. Essential Orthopedics and Trauma. 2nd edition. pp 361. New York. U.S.A. Churchill Livingstone. 475p. ISBN 0-443-04722-7.

Daniel, W.W. 1999. Biostatistics: A Foundation For Analysis In The Health Sciences. 7th edition. pp 262-267. New York. U.S.A. John Wiley & Sons, Inc. 755p. ISBN 0471 16386-4.

Delee, J.C. and Drez, D. Jnr. 1994. Orthopaedic Sports Medium: Principles and Practice. pp 861. Philadelphia. U.S.A. W.B. Saunders Company. 1017p. ISBN 0-7216-2836-2.

De Smet, L. and Fabry, G. 1997. Grip force reduction in patients with tennis elbow: influence of elbow position. Journal of Hand Therapy. 10(3):229-231.

Evans, R.C. 1994. Illustrated Essentials in Orthopedic Physical Assessment. pp 156. St. Louis. U.S.A. Mosby-Year Book Inc. 613p. ISBN 0-8016-6612-0.

Fischer, A.A. 1987. Pressure Threshold Measurement for Diagnosis of Myofascial Pain and Evaluation of Treatment Results. The Clinical Journal of Pain. 2:207-214.

- Haker, E. and Lundeberg, T. 1991. Pulsed ultrasound treatment in lateral epicondylalgia. Scandinavian Journal of Rehabilitation Medicine. 23(3):115-118.
- Hammer, W.I. 1991. Functional Soft Tissue Examination and Treatment by Manual Methods. pp. 63-72. Maryland. U.S.A. Aspen Publishers, Inc. 300p. ISBN 0-8342-0185-2.
- Hertling, D. and Kessler, R.M. 1996. Management of Common Musculoskeletal Disorders: Physical Therapy Principles and Methods. 3rd edition. pp 135-566. Philadelphia. U.S.A. Lippincott-Raven Publishers. 795p. ISBN 0-397-55150-9.
- Jenson, M.P., Karoly, R.K., Bravor, S. 1986. The Measurements of Clinical Pain Intensity; a comparison of six methods. Pain. 27:117-126.
- Kamien, M., 1990. A rational management of tennis elbow. Sports Medicine. 9(3):173-191.
- Krashennikoff, M., Ellitsgaard, N., Rogvi-Hansen, B., Zeuthen, A., Harder, K., Larsen, R., Gaardbo, H. 1994. No effect of low power laser in lateral epicondylitis. Scandinavian Journal of Rheumatology. 23(5):260-263.
- Lewit, K. 1991. Manipulative Therapy in Rehabilitation of the Locomotor System. 2nd edition. pp 243. Oxford. England. Butterworth-Heinemann. 308p. ISBN 0 7506 1123 5.
- Lundeberg, T., Abrahamsson, P., Haker, E. 1988. A comparative study of continuous ultrasound, placebo ultrasound and rest in epicondylalgia. Scandinavian Journal of Rehabilitation Medicine. 20(3):99-101.
- Lundeberg, T., Haker, E., Thomas, M. 1987. Effect laser versus placebo in tennis elbow. Scandinavian Journal of Rehabilitation Medicine. 19(3):135-138.
- Magee, D. J. 1997. Orthopedic Physical Assessment. 3rd edition. pp 258. Philadelphia. U.S.A. W.B. Saunders Company. 805p. ISBN 0-7216-6290-0
- Maitland, G.D. 1977. Peripheral manipulation. 2nd edition. pp 149. London. England. Butterworth & Co. 501p. ISBN 0-407-35671-1.
- Melzack, R. 1987. The short-form McGill Pain Questionnaire. Pain. 30:191-197.
- Mouton, J. 1996. Understanding social research. pp 152. Pretoria. South Africa. J.L. van Schaik Publishers. 272p. ISBN 0 627 02163 8.
- Nirschl, R. P. 1988. Prevention and treatment of elbow and shoulder injuries in the tennis player. Clinical Sports Medicine, 7:289-308.

Nook, B. C. 1998. Personal communication. 17 August 1998.

Organ, S.W., Nirschl, R.P., Kraushaar, B.S., Guidi, E.J. 1997. Salvage surgery for lateral tennis elbow. American Journal of Sports Medicine. 25(6):746-750.

Prentice, W. E. 1994. Therapeutic Modalities in Sports Medicine. 3rd edition. pp 351-352. St. Louis. U.S.A. Mosby-Year Book Inc. 409p. ISBN 0-8016-7922-2.

Price, R., Sinclair, H., Heinrich, I., Gibson, T. 1991. Local injection treatment of tennis elbow – hydrocortisone, triamcinolone and lignocaine compared. British Journal of Rheumatology. 30(1):39-44.

Rowley, I. D. and Dent, J. A. 1997. The Musculoskeletal System: Core topics in the new curriculum. pp 176-177. New York. Oxford University Press, Inc. 347p. ISBN 0 412 62700 0.

Saidoff, D.C. and McDonough, A.L. 1997. Critical Pathways in Therapeutic Intervention: Upper Extremity. pp 69-78. St. Louis. U.S.A. Mosby-Year Book Inc. 352p. ISBN 0-8151-4486-5.

Skinner, H.B. 1995. Current Diagnosis and Treatment in Orthopedics. pp 161. Connecticut. U.S.A. Appleton & Lange. 645p. ISBN 0-8385-1009-4.

Thomson, A., Skinner, A., Piercy, J. 1991. Tidy's Physiotherapy. 12th edition. pp 60-444. Oxford. England. Butterworth-Heinemann Ltd. 501p. ISBN 7506 1346 7.

Worku, Z. 1998. Personal communication. 8 September 1998.

Zohn, D.A. 1988. Musculoskeletal Pain: Diagnosis and Physical Treatment. 2nd edition. pp 195-196. Boston. U.S.A. Little, Brown and Company (Inc.). 261p. ISBN 0-316-98897-9.

APPENDIX A

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient: _____ Date: _____
file #: _____ X-Ray#: _____
Age: _____ Sex: _____ Occupation: _____
Intern: _____ Signature: _____

FOR CLINICIAN'S USE ONLY

Initial visit clinician: _____ Signature: _____

Case History:

Examination:

Previous:

Current:

X-Ray Studies:

Previous:

Current:

Clinical Path. lab:

Previous:

Current:

Case Status:

PTT: Conditional: Signed Off: Final Sign out:

Recommendations:

Intern's Case History

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

3. Present Illness:

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

4. Other Complaints:

5. Past Medical History:

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

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

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

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient: _____ File#: _____ Date: _____
Clinician: _____ Signature: _____
Intern: _____ Signature: _____

1. VITALS

Pulse rate:

Respiratory rate:

Blood pressure: R L

Temperature:

Height:

Weight:

2. GENERAL EXAMINATION

General Impression:

Skin:

Jaundice:

Pallor:

Clubbing:

Cyanosis (Central/Peripheral):

Oedema:

Lymph nodes - Head and neck:
- Axillary:
- Epitrochlear:
- Inguinal:

Urinalysis:

3. CARDIOVASCULAR EXAMINATION

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

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

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

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

Percussion: - borders of heart

Auscultation:

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

4. RESPIRATORY EXAMINATION

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

Inspection

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

Palpation

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

Percussion

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

Auscultation

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

5. ABDOMINAL EXAMINATION

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

Inspection

- Shape:
- Scars:
- Hernias:

Palpation

- Superficial:
- Deep = Organomegally:

- Masses (intra- or extramural)
- Aorta:

Percussion - Rebound tenderness:

- Ascites:
- Masses:

Auscultation - Bowel sounds:

- Arteries (aortic, renal, iliac, femoral, hepatic)

Rectal Examination

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

6. G.U.T EXAMINATION

External genitalia:

Hernias:

Masses:

Discharges:

7. NEUROLOGICAL EXAMINATION

Gait and Posture

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

Higher Mental Function

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

G.C.S.:

- Eyes:
- Motor:
- Verbal:

Evidence of head trauma:

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

- Kernigs sign:

Cranial Nerves:

I Any loss of smell/taste:
Nose examination:

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

- Pupillary light reflexes = Direct:
 = Consensual:
- Fundoscopy findings:
- III Ocular Muscles:
 Eye opening strength:
- IV Inferior and Medial movement of eye:
- V a. Sensory - Ophthalmic:
 - Maxillary:
 - Mandibular:
 b. Motor - Masseter:
 - Jaw lateral movement:
 c. Reflexes - Corneal reflex
 - Jaw jerk
- VI Lateral movement of eyes
- VII a. Motor - Raise eyebrows:
 - Frown:
 - Close eyes against resistance:
 - Show teeth:
 - Blow out cheeks:
 b. Taste - Anterior two-thirds of tongue:
- VIII General Hearing:
 Rinnes = L: R:
 Webers lateralisation:
 Vestibular function - Nystagmus:
 - Rombergs:
 - Wallenbergs:
 Otoscope examination:
- IX & Gag reflex:
- X Uvula deviation:
 Speech quality:
- XI Shoulder lift:
 S.C.M. strength:
- XII Inspection of tongue (deviation):

Motor System:

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

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

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

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

Sensory System:

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

- b. Joint position sense
- Finger:
 - Toe:

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

Cerebellar function:

Obvious signs of cerebellar dysfunction:

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

Finger-nose test (Dysmetria):

Rapid alternating movements (Dysdiadochokinesia):

Heel-shin test:

Heel-toe gait:

Reflexes:

Signs of Parkinsons:

8. SPINAL EXAMINATION:(See Regional examination)

Obvious Abnormalities:

Spinous Percussion:

R.O.M:

Other:

9. BREAST EXAMINATION:

Summon female chaperon.

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

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

APPENDIX C ELBOW REGIONAL EXAMINATION

Patient: _____
Intern / Resident: _____
Clinician: _____

File No.: _____ Date: _____
Signature: _____
Signature: _____

OBSERVATION:

- Posture and willingness to move _____
- Carrying angle (anatomical position) _____
- Colour and texture of skin _____
- Bony and soft tissue contours _____
- Swelling _____
- Position of function (triangle sign) _____

PALPATION:

Anterior :

- Cubital fossa _____
- Bicep tendon _____
- Brachial artery _____
- Coronoid process _____
- Radial head _____
- Bicep and Brachialis _____

Medial:

- Medial epicondyle _____
- Medial collateral ligament _____
- Ulnar nerve _____

Lateral:

- Lateral epicondyle _____
- Supracondylar ridge (ECRL) _____
- Lateral collateral ligament _____
- Radial head and annular ligament _____

Posterior:

- Olecranon process _____

ACTIVE MOVEMENTS:

- Flexion (140 – 150°) _____
- Extension (0-10°) _____
- Supination (90°) _____
- Pronation (80-90°) _____

PASSIVE MOVEMENTS:

- Flexion (tissue approximation) _____
- Extension (bone to bone) _____
- Supination (tissue stretch) _____
- Pronation (tissue stretch) _____

RESISTED ISOMETRIC MOVEMENTS: (elbow at 90° flexion and supinated)

- Flexion _____
- Extension _____
- Supination _____
- Pronation _____
- Elbow flexion _____
- Elbow extension _____

JOINT PLAY MOVEMENTS:

- Upward glide of radial head on ulna _____
- Downward glide of radial head on ulna _____
- Rotation of radial head _____
- Medial to lateral side tilt _____
- Lateral to medial side tilt _____
- Distraction of olecranon process on the humerus (90° flexion) _____

SPECIAL TESTS:

- Ligamentous Instability Test:
 - valgus / adduction stress (MCL) _____
 - varus / abduction stress (LCL) _____
- Lateral epicondylitis:
 - Cozen's Test _____
 - Mill's Test _____
 - Lateral epicondyle test (extensor digitorum) _____
- Medial epicondyle test _____
- Tinel's Sign (ulnar nerve) _____
- Wartenberg's Sign (ulnar neuritis) _____
- Elbow flexion test (ulnar nerve - cubital tunnel syndrome) _____
- Pronator teres syndrome test (median nerve) _____
- Pinch Grip test (ant. interosseous branch of median nerve) _____

NEUROLOGICAL:

- Reflexes
 - Biceps (C5/6) R _____ L _____
 - Brachioradialis (C5/6) R _____ L _____
 - Triceps (C7/8) R _____ L _____
- Dermatomes
 - C4 _____ C5 _____ C6 _____ C7 _____ C8 _____
 - T1 _____ T2 _____
- Cutaneous distribution
 - median nerve _____
 - ulnar nerve _____
 - radial nerve _____

RADIOLOGICAL EXAMINATION:

DIAGNOSIS:

MANAGEMENT PLAN:

Appendix D

INFORMED CONSENT FORM

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

TITLE OF THE RESEARCH PROJECT

NAME OF SUPERVISOR

NAME OF RESEARCH STUDENT

PLEASE CIRCLE THE APPROPRIATE ANSWER

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

PATIENT/SUBJECT* Name _____
(in block letters)

Signature _____

PARENT/GUARDIAN* Name _____
(in block letters)

Signature _____

WITNESS Name _____

Signature _____

RESEARCH STUDENT

Name _____

Signature _____

Appendix E

NUMERICAL PAIN RATING SCALE - 101 QUESTIONNAIRE

Patient name:

Group number:

Treatment number: _____

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

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

Appendix F

SHORT-FORM MCGILL PAIN QUESTIONNAIRE

Patient name:

Group number:

Treatment number: _____

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

Appendix G

Patient name:

Group no.: _____

Grip strength 1 (elbow bent 90°) readings:

Treatment 1	Treatment 3	Treatment 6	One-month follow up

Grip strength 2 (elbow straight) readings:

Treatment 1	Treatment 3	Treatment 6	One-month follow up

Appendix H

Patient name:

Group no.:

Algometer readings:

Treatment 1	Treatment 3	Treatment 6	One-month follow up