THE EFFICACY OF DRY NEEDLING IN PATIENTS SUFFERING FROM LATERAL EPICONDYLITIS.

By
Garrick David Haswell

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I, Garrick David Haswell, do hereby declare that this dissertation is representative of my own work.

Approved for examination

Garrick David Haswell   Date: 8/3/02.

Dr H. White B.Sc, B.Ed, M.tech: Chiro, CCFC, MCASA, SCA, SACMA Date: 8/3/02

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Abstract

Lateral epicondylitis is a relatively common disorder affecting approximately one third of the nearly thirty-two million tennis players worldwide. It usually presents as a chronic disorder that follows a remitting relapsing course, and as such represents a challenge to manage. At present the scientific literature does not favour any particular treatment modality and as such well designed placebo studies are required to assess the efficacy of the various modalities of treatment, with a long term view of establishing an effective treatment protocol to manage lateral epicondylitis.

The purpose of this study was to determine the efficacy of dry needling the posterior distal muscles of the upper extremity as a treatment for lateral epicondylitis.

Sixty patients were included in the study. They all under went a case history, physical examination and an elbow regional examination. They were then randomly allocated into the experimental or control groups. The thirty patients in the experimental group received dry needling while the thirty included in the control group received placebo or "sham" needling.

All participants in the study received three treatments over a nine-day period with subjective and objective measurements being taken before the 1st, 2nd, and 3rd treatments, with a 4th being taken after the third treatment.

Examination of the statistical data revealed that a significant improvement in the experimental group versus the control group in terms of both subjective

measurements. Objective data analysis revealed that there was a significant improvement in the algometer readings of the patients in the experimental group but no significant improvement in the dynamometer readings.

One may thus conclude that dry needling may be an effective method of improving the patient's perception of the quantity and quality of the pain associated with lateral epicondylitis. Dry needling may also effectively increase the amount of pressure that is able to be tolerated over the lateral epicondyle. As such the use of dry needling may be a key element in any treatment protocol designed to treat lateral epicondylitis.

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Definitions

Myofascial trigger point (MFTP):

" A hyperirritable spot in skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band". The spot is painful on compression and may give rise to a characteristic pain referral pattern. (Simons 1998:5-7)

Active myofascial trigger point (AMFTP):

A MFTP that causes a clinical pain complaint. It is always tender, prevents lengthening of and weakens the muscle. When compressed it causes tenderness in the pain referral zone. (Simons 1998:5-7)

Latent myofascial trigger point (LMFTP):

A MFTP that is clinical quiescent with respect to spontaneous pain. It is painful only when palpated. (Simons 1998:5-7)

Referred pain:

Pain that arises in a MFTP but is felt at a distance, often entirely removed from its source. (Simons 1998:5-7)

Subjective data:

Information given by the patient. (Bates1995: 635)

Objective data:

Physical findings and laboratory reports. (Bates1995: 635) (In this study; pressure readings taken by means of an algometer, and grip strength measurements taken by means of a dynamometer).

Chapter 1

1.1 Introduction

Chumbley, O'Connor and Nirschl (2000) state that lateral epicondylitis is the most common overuse injury of the elbow. It affects between 1-3% of all adults (Sharat and Maffulli 1997:102). Its peak incidence occurs between the ages of 30 and 55 (Jackson 1997:104), and according to Thomson et al (1991:60) it has an equal gender distribution

Although approximately one third of 32 million regular tennis players suffer from lateral epicondylitis at some point (Saidoff and Mc Donough 1997:71) racket sports are by no means the only aetiological factor. Activities such as carpentry, pruning shrubs or handshaking have been associated with the development of lateral epicondylitis (Hertling and Kessler 1996:229).

Lateral epicondylitis is usually a degenerative disorder that according to (Hertling and Kessler 1996: 229) represents "tissues response to repetitive fatigue stress". The inflammatory disorder is believed to be an attempt to accelerate the rate of tissue production to match the rate of tissue micro damage. If stress continues to be placed on the common extensor tendon the immature scar tissue that is produced continues to break down before it has time to mature adequately.

Simons, D.S. (1998:734-5), is of the opinion that the literature on lateral epicondylitis fails to supply a convincing explanation for the symptoms associated with the condition, and feels that a major cause may have been overlooked. Recognition of the role played by myofascial trigger points may provide the missing explanation. Schneider and Rachlin are two authors who echo Simon's sentiment. Rachlin (1994:344) states that myofascial trigger points in the brachioradialis, and the extensor muscles of the forearm may be responsible for the symptoms of lateral epicondylitis and Schneider (1994:120) explains that tendonitis at the lateral epicondyle may be secondary to chronic muscle hypertonicity, which repeatedly overloads the tendinous attachment.

1.2 STATEMENT OF THE PROBLEM

The aim of this study is to investigate the efficacy of dry needling myofascial trigger points in the posterior distal muscles of the upper extremity as a treatment for lateral epicondylitis, in terms of subjective and objective clinical findings.

1.3 Objectives of the Study

Objective 1: To investigate the efficacy of dry needling myofascial trigger points in the posterior distal muscles of the upper extremity as a treatment for lateral epicondylitis, in terms of objective clinical findings.

Objective2: To investigate the efficacy of dry needling myofascial trigger points in the posterior distal muscles of the upper extremity as a treatment for lateral epicondylitis, in terms of subjective clinical findings.

1.4 Hypotheses

1.4.1 Hypothesis One

It was hypothesised that dry needling myofascial trigger points in the posterior distal muscles of the upper extremity would be effective in reducing pain and disability in patients with lateral epicondylitis

1.4.2. Hypothesis Two

It was hypothesised that dry needling myofascial trigger points in the posterior distal muscles of the upper extremity would be more effective than placebo dry needling in the management of lateral epicondylitis.

1.5. Benefits of the Study

According to Ernst (1992:55) most authors seem to agree upon a conservative approach to the treatment of lateral epicondylitis before progressing to more complex and invasive therapies. There is not however any scientific evidence in current literature to favour the use of any particular treatment protocol (Sharat and Maffulli 1997). Labelle et al. (1992) reviewed 185 articles pertaining to the treatment of lateral epicondylitis and concluded that due to the poor quality and contradictory results of the randomised controlled trials reported thus far there is insufficient evidence to support any particular treatment modality. This led them to further conclude that there is a need to evaluate all forms of therapy currently utilized in the treatment of lateral epicondylitis with properly controlled trials.

Simons, D.S. (1998:734-5), is of the opinion that the literature on lateral epicondylitis fails to supply a convincing explanation for the symptoms associated with the condition, and feels that a major cause may have been overlooked. Recognition of the role played by myofascial trigger points may provide the missing explanation. Simons also explains that while the symptoms associated with lateral epicondylitis are generally accepted to be the result of repetitive micro trauma to the common extensor origin, they may also be the result of an enthesopathy of the common extensor origin due to chronic tension associated with taut bands of myofascial trigger points. Schneider (1994: 120) is also of the opinion that any tendonitis may be secondary to chronic muscle hypertonicity, which repeatedly overloads the tendinous attachment.

The aim of this study is to determine the efficacy of dry needling the posterior distal muscles of the upper extremity as a treatment for patients suffering from lateral epicondylitis. It is hypothesised that by effectively treating the associated myofascial trigger points in the extensor muscles of the forearm, the brachioradialis, the supinator, and the triceps there will be a reduction in the pain felt, firstly as result of diminished referred pain and secondly by effectively reducing the tension on the common extensor tendon.

Chapter 2

2.1 Introduction.

Chumbley, O'Connor and Nirschl (2000) state that lateral epicondylitis is the most common overuse injury of the elbow. They further state that lateral epicondylitis is an overuse injury of the elbow that occurs as a result of degenerative tendonosis of the extensor muscles of the forearm, particularly the extensor carpi radialis brevis.

2.2 Epidemiology

Lateral epicondylitis affects between 1-3% of all adults (Sharat and Maffulli 1997:102). Its peak incidence occurs between the ages of 30 and 55 (Jackson 1997:104), and according to Thomson et al (1991:60) it has an equal gender distribution. No statistics could be found documenting the prevalence of this condition in the South African population. Shaik (2000) and Roodt (2001) both found lateral epicondylitis to be far more prevalent in the white racial group. They also reported that no black patients participated in their research studies. This may lead one to conclude that this condition does not occur in the black population of South Africa. Shaik (2000) does mention, however, that the racial demographics may have been biased by the method of advertising, the location of the Chiropractic day clinic and the lack of awareness of the role of chiropractic in the management of the condition in the previously disadvantaged communities of South Africa.

2.3 Aetiology

Although approximately one third of 32 million regular tennis players suffer from lateral epicondylitis at some point (Saidoff and Mc Donough 1997:71) racket sports are by no means the only aetiological factor. Activities such as carpentry, pruning shrubs or handshaking have been associated with the development of lateral epicondylitis (Hertling and Kessler 1996:229). Shaik (2000:52) divides aetiological factors into sporting activities (e.g. tennis, badminton, golf, gym) and non-sporting activities (e.g. carrying heavy parcels, fine finger activities such as typing or using a computer mouse). In fact any repetitive task that involves radial deviation, wrist extension, or forearm pronation may lead to the development of the disorder as a result of the excessive tensile stress placed on the extensor-supinator muscle mass and on the common extensor origin at the lateral epicondyle. (Hertling and Kessler 1996: 229).

2.4 Pathology

Lateral epicondylitis is usually a degenerative disorder that according to (Hertling and Kessler 1996: 229) represents "tissues response to repetitive fatigue stress". The inflammatory disorder is believed to be an attempt to accelerate the rate of tissue production to match the rate of tissue micro damage. If stress continues to be placed on the common extensor tendon the immature scar tissue that is produced continues to break down before it has time to mature adequately. Saidoff and Mc Donough (1998: 68) describe this process as a viscious cycle of "irritation, inflammation, inadequate healing, pain, and weakness". Chumbley, O'Connor and Nirschl (2000) state that lateral epicondylitis is an overuse injury of the elbow that occurs as a result of degenerative tendonosis of the extensor muscles of the forearm, particularly the extensor carpi radialis brevis. Cyriax and Cyriax (1993) explain the extensor carpi radialis brevis is more frequently involved as a result of increased tensile loads placed its tendon by the radial head when the tendon is stretched, for example during extension of the elbow.

Wiesel (1993:218) reports that gross histological findings reveal " an oedematous, gritty degeneration" of the tendinous origin of the muscle. Macroscopically it appears that the normal linear pattern of the collagen and fibrous tissue is replaced by " a disorganised array of fibroblasts and vascular elements". Chard et al. (1989) provide one explanation for the lack of a clearly defined pathophysiology attributable to lateral epicondylitis when they mention that as a result of most cases of tennis elbow never coming to surgery pathological material for study is relatively rare.

As alluded to in the introduction and discussed further in the section on differential diagnosis, Simons is of the opinion that the literature fails to supply a convincing explanation for the symptoms associated with lateral epicondylitis. Recognition of the role played by myofascial trigger points is another factor to be considered. Simons (1998:734-5) explains that while the symptoms associated with lateral epicondylitis are generally accepted to be the result of repetitive micro trauma to the common extensor origin, they may also be the result of an enthesopathy of the common extensor origin due to chronic tension associated with taut bands of myofascial trigger points. Schneider (1994) agrees with this opinion and feels that epicondylitis may be secondary to chronic muscle hypertonicity, which repeatedly overloads the tendinous attachment at the common extensor origin. Rachlin (1994) states that myofascial trigger points in the brachioradialis and the extensor muscles of the forearm may be responsible for the symptoms of lateral epicondylitis. He is also explains that the presence of trigger points may lead to the tightening of the fibrous edge of the supinator and the extensor carpi radialis brevis, leading to the entrapment of the deep radial nerve. Entrapment of this nerve has been recognised as a cause of the pain associated with lateral epicondylitis.

2.5 Clinical Presentation and Diagnosis

Lateral epicondylitis (tennis elbow) is a condition characterised by lateral epicondyle pain and disability (Sharat and Maffulli 1997). The onset of pain may be sudden or gradual and is frequently aggravated by activities that involve gripping e.g. handshaking or turning door handles. Patients frequently report morning pain and stiffness (Field and Savoie 1998). In those who play racket sports the pain is most often aggravated by backhand strokes (Kamien 1990).

The diagnosis of lateral epicondylitis is based on the history and the reproduction of pain by one of the following tests:

1. Palpation of the lateral epicondyle, which reveals point palpatory tenderness (Sharat and Maffulli 1997).
2. Mill's test. This test involves palpation of the lateral epicondyle of the patient while the forearm is pronated, the wrist fully flexed and the elbow extended. A positive test is indicated by pain over the lateral epicondyle (Magee 1997:258)
3. Cozens test. This involves the examiner stabilising the patient's elbow and placing their thumb over the patient's lateral epicondyle. The patient is asked to make a fist, extend and radially deviate the wrist while the examiner resists the motion. A positive test is indicated by pain over the lateral epicondyle (Magee 1997:258)
4. Lateral epicondylitis test. This involves the examiner resisting extension of the third digit of the hand (distal to the proximal interphalangeal joint). This places stress on the extensor digitorum muscle and tendon. A positive test is indicated by pain over the lateral epicondyle (Magee 1997:258)

2.6 Differential Diagnosis

Field and Savoie (1998) suggest a number of other conditions that may be the source of lateral elbow pain. These include: osteochondritis dissecans, radial tunnel syndrome, radiocapitellar arthritis and posterior lateral plicas. Thomson et al. include cervical nerve root entrapment and lateral ligament strain in the differential diagnosis of lateral elbow pain. Simons (1998), as discussed earlier feels the influence of myofascial trigger points are often overlooked.

Oteochondritis dissecans generally occurs in younger patients presenting with diffuse elbow pain of insidious onset. Patients often complain of a loss of extension of the elbow, with intermittent locking and crepitations. (Field and Savoie 1998)

Radial tunnel syndrome differ from lateral epicondylitis in that the pain is usually more vague or diffuse, and generally felt more distally at the leading edge of the supinator muscle (Field and Savoie 1998).

Radiocapitellar arthritis may be differentiated from lateral epicondylitis by applying an axial load combined with gentle passive supination and pronation. This test results in compression of the radiocapitellar joint and causes pain if there is arthritic degeneration, but does not usually cause exacerbation of the pain associated with lateral epicondylitis (Field and Savoie 1998)

Posterior lateral plicas produce pain along the posterior lateral elbow. He lesion is usually easily palpated in the posterior lateral gutter (Field and Savoie 1998).

If cervical nerve root entrapment is the cause of the elbow pain, then nerve root tension test such as lateral cervical compression should reproduce the elbow pain. Palpation over C4, C5 and C6 may reproduce the pain or be particularly tender (Thomson et al. 1991:62)

Strain of the lateral ligament can be confirmed by a ligamentous instability test with the elbow extended and the wrist supinated (Thomson et al. 1991:62)

Recognition of the role played by myofascial trigger points is another factor to be considered. Simons (1998:734-5) explains that while the symptoms associated with lateral epicondylitis are generally accepted to be the result of repetitive micro trauma to the common extensor origin, they may also be the result of an enthesopathy of the common extensor origin due to chronic tension associated with taut bands of myofascial trigger points. Rachlin (1994:344) states that myofascial trigger points in the Brachioradialis, supinator and the extensor muscles of the forearm may be responsible for the symptoms of lateral epicondylitis

2.7 Treatment

According to Ernst (1992:55) most authors seem to agree upon a conservative approach to the treatment of lateral epicondylitis before progressing to more complex and invasive therapies. Viola (1998) adds that although conservative treatment of this condition has been examined in a number of studies, there is no unanimous agreement as to the most effective therapy. Many treatments have been suggested including: rest, laser, ultrasound, steroid injection, bracing and surgery.

2.7.1 Rest

Jackson (1997) suggests that the management of tennis elbow begins with rest and avoidance of any activity that results in pain. Sharat and Maffulli (1997) consider the elimination of painful activities important, and advocate complete rest which they suggest be obtained through the use of a splint or brace that holds the wrist in supination and extension and the elbow in flexion.

2.7.2 Laser

Vasseljen et al. (1992) compared low-level laser to placebo and concluded that laser was of limited value as a sole treatment for lateral epicondylitis, even though it was shown to have an effect over placebo. A further study by Krasheninnikoff et al. (1994), reported that laser was not significantly better than placebo in the treatment of lateral epicondylitis.

2.7.3 Ultrasound

Haker and Lundeberg (1991) conducted a placebo-controlled study to determine the effect of pulsed ultrasound in the treatment of lateral epicondylitis. The study involved 10 treatments of 10 minutes each, 2-3 times per week. Follow ups were done at 3 and 12 months. They found no statistically significant difference between the groups after the treatment period, or at follow-ups. Their results do not seem to support the use of pulsed ultrasound, with the chosen parameters, in lateral epicondylitis. The effect of continuous ultrasound versus placebo ultrasound and rest was investigated by Lundeberg, Abrahamson et al. (1988); they found that continuous ultrasound was significantly better than rest but not significantly better than placebo ultrasound.

2.7.4 Steroid injection

A comparative study involving lignocaine, triamcinolone, and hydrocortisone was conducted by Price et al. (1991). 2ml 1% preparations of lignocaine were compared with either 25 mg hydrocortisone or 10mg triamcinolone made up to 2ml with 1% lignocaine. The study revealed that within the first 8 weeks, pain relief was greater for triamcinolone than hydrocortisone although the differences were not statistically significant. The response to both steroid preparations was shown to be significantly better than for lignocaine up to this point but at 24 weeks, the degrees of improvement were similar for all three groups. In addition to this, many patients still had pain and relapses were reported to be common. Approximately half of all patients treated with the steroid preparations experienced post-injection worsening of the pain, which was sometimes severe and persistent. Skin atrophy was documented to have occurred in all groups, but was more frequent amongst those given triamcinolone. From this study it would appear that steroid preparations proved to be a less than effective long-term method for the control of pain in lateral epicondylitis.

According to Hertling and Kessler (1996:221) the use of corticosteriod injections may provide relief from the symptoms associated with lateral epicondylitis but fail to address the pathological process and as such are unlikely to have a permanent beneficial effect. Fu and Stone (1994:541) feel that the major benefit of using corticosteroid injections lies in their anti-inflammatory action and as result should only be used where active inflammation is present.

2.7.5 Manipulation of the Elbow.

Maitland (1991:189) advocates the use of Mill's manipulation. He explains that while lateral epicondylitis involves a tendo-muscular component there is also a joint component, which needs to be addressed. Hyde and Gengenbach (1997:282) mention that loss of joint play at the radiocapitellar or proximal radioulnar joint is common in tennis elbow and that it is essential to restore full mobility. Roodt (2001), however, found no statistically significant difference between the experimental and control groups in a study that investigated the efficacy of manipulation of the elbow versus placebo.

2.7.6. Cross Friction and Bracing.

Nicholas and Hershman (1995:810) describe the use of transverse friction massage as an effective method of treating lateral epicondylitis by increasing circulation to the tissue and decreasing excessive or abnormal scar tissue formation. Shaik (2000) investigated the relative effectiveness of cross friction on its own versus cross friction and Mill's manipulation in the treatment of lateral epicondylitis, and found no statistically significant difference between the two groups. However both groups experienced subjective and objective improvements leading Shaik to conclude that "either treatment may be used in the treatment of lateral epicondylitis".

The use of a "counterforce brace" has been recommended by Prentice (1994:353). The brace, which redistributes compressive forces on the extensor mechanism thereby minimising stress at the common extensor origin, has been shown by EMG studies to enhance activity of the wrist extensors (Snyder-Mackler and Elper 1989). These results should be interpreted with caution due to the small sample size, and the fact that testing was preformed on patients without pathology. Well-designed studies to evaluate the various bracing devices available for the treatment of tennis elbow would be of interest.

2.7.7. Surgery

Kamien (1990) emphasizes that tennis elbow is nearly always a self-limiting condition, recommends that a conservative approach should be attempted prior to surgical intervention. Surgery should only be considered after 12 months of failed conservative therapy with a level of residual pain that "interferes with daily living".

Viola (1998) describes the following surgical techniques as being most common:

1. Excision of part of the extensor origin together with the orbicular ligament.
2. Distal tendon lengthening of the affected muscles.
3. Total release of the extensor musculature from the lateral epicondyle.
4. Denervation.

2.7.8. Dry needling

While no research into the use of dry needling was noted Simons (1998:734-5) explains that while the symptoms associated with lateral epicondylitis are generally accepted to be the result of repetitive micro trauma to the common extensor origin, they may also be the result of an enthesopathy of the common extensor origin due to chronic tension associated with taut bands of myofascial trigger points. Schneider (1994: 120) is also of the opinion that any tendonitis may be secondary to chronic muscle hypertonicity, which repeatedly overloads the tendinous attachment. Rachlin (1994:344) states that myofascial trigger points in the brachioradialis, and the extensor muscles of the forearm may be responsible for the symptoms of lateral epicondylitis. He is further of the opinion that trigger point activity may lead to a tightening of the fibrous edge of the extensor carpi radialis brevis and the supinator, which may lead to the entrapment of the deep radial nerve. The entrapment of this nerve has been recognised as a cause of the pain associated with lateral epicondylitis.

In the absence of modalities with proven efficacy in the treatment of lateral epicondylitis (Labelle et al. (1992)) it seems a baseline investigation is warranted in order to determine the efficacy of dry needling.

The aim of this study is to determine the efficacy of dry needling as a treatment for patients suffering from lateral epicondylitis. It is hypothesised that by effectively treating the associated myofascial trigger points in the extensor muscles of the forearm, the brachioradialis, the supinator, and the triceps there will be a reduction in the pain felt, firstly as result of diminished referred pain and secondly by effectively reducing the tension on the common extensor tendon. A number of authors (Schneider 1994, Simons, D.S. 1998:705) indicate that these muscles either refer pain over the lateral epicondyle or co-exist as it relates to trigger points. Rachlin (1994:153) suggests several mechanisms by which dry needling of trigger points may provide relief. These include:

1. Relief by mechanical disruption of the trigger point by disrupting muscle elements or nerve endings.
2. Relief may be a result of released intracellular potassium that leads to depolarisation of the nerve fibres.
3. Pain relief may also occur due to a release of endogenous opioids.

2.7.9 Summary

There is no scientific evidence in current literature to favour the use of any particular treatment protocol (Sharat and Maffulli 1997). Labelle et al. (1992) reviewed 185 articles pertaining to the treatment of lateral epicondylitis and concluded that there could be a significant improvement in the condition with any treatment due to the natural history of the condition or as result of the placebo effect. This led them to conclude that there is a need to evaluate all forms of therapy currently utilized in the treatment of lateral epicondylitis with properly controlled trails.

2.8 The Muscles Involved in this study

2.8.1 Origin, Insertion and Action

Muscle Name	Origin	Insertion	Action
1. Extensor carpi radialis longus	The lower third of the lateral supracondylar ridge	Posterior aspect of the second metacarpal	Extension and fixation of the wrist (Rachlin 1994:349).
2. Extensor carpi radialis brevis	The common extensor origin.	The styloid process of the base of the third metacarpal.	Extension and fixation of the wrist (Rachlin 1994:349).
3. Extensor carpi ulnaris	The common extensor origin and aponeurosis attached to the subcutaneous border of the ulna.	The dorsal aspect of the base of the fifth metacarpal.	Extension and adduction of the hand and fixator of the wrist (Rachlin 1994:349).
4. Brachioradialis	The upper two third of the lateral supracondylar ridge of the humerus.	The lateral aspect of the base of the radial styloid process.	Flexion of the elbow when the wrist is half way between supination and pronation (Rachlin 1994:349).

5. Extensor digitorum	Lateral epicondyle of the humerus	Extensor expansions of the medial four digits.	Extends the medial four digits at the metacarpophalangeal joints and extends the hand at the wrist (Moore 1992:587).
6. Supinator	The deep fibres attach just below the radial notch of the ulna. The oblique fibres attach more superficially from the back of the lateral epicondyle, lateral ligaments of the elbow, and the shaft of the radius.	The neck and shaft of the radius.	Supination of the radius (Rachlin 1994:336).
7. Triceps	Long head: from the infra-glenoid tubercle of the scapula. Medial head: the posterior surface of the humerus. Lateral	Attached by means of the conjoint tendon into the olecranon process of	Extension of the elbow (Rachlin 1994:345).

	head: posterior ridge of the humerus superior to the musculospiral groove.	the ulna.	

2.8.2 Pain referral patterns and location of myofascial trigger points.

1. **Extensor carpi radialis longus**: MFTP in this muscle refer pain to the lateral epicondyle and to the dorsum of the hand in the region of the anatomical snuff box. Central trigger points (TP) may be found in the forearm approximately the same distance as TP in the brachioradialis, but slightly closer to the ulna. Palpation of TP in the muscle may elicit a twitch response that results in radial abduction and extension of the hand (Simons 1998: 691-670).
2. **Extensor carpi radialis brevis**: MFTP in this muscle refer pain to the dorsum of the hand and wrist. TP generally lie approximately 5-6cm distal to the elbow crease, on the ulna side of the Brachioradialis. A twitch response may be elicited that results in extension of the hand with slight radial deviation (Simons 1998: 691-670).
3. **Extensor carpi ulnaris**: MFTP in this muscle refer primarily to the ulna side of the back of the wrist. The extensor carpi ulnaris "stands out" when the patient spreads their fingers. TP are located "7-8cm distal to the lateral epicondyle about 2-3cm from the sharp edge of the ulna towards to dorsal surface of the forearm" (Simons 1998: 691-670).
4. **Extensor digitorum**: MFTP in this muscle project pain down the forearm to the back of the hand, and often to the fingers that are moved by the muscle fibres. TP may be located 3-4cm distal to the head of the radius (Simons 1998: 713-4).
5. **Brachioradialis**: MFTP in this muscle refer pain to the wrist and base of the thumb in the web space between the index finger and the thumb.

Pain may also be referred to the lateral epicondyle. Asking the patient to flex the forearm against resistance may more easily identify the Brachioradialis. TP may then be located by grasping the muscle in a pincer grasp between the thumb and the fingers (Simons 1998: 691).

6. **Supinator**: TP in this muscle refer pain primarily to the lateral epicondyle and the surrounding lateral aspect of the epicondyle. Pain may also be referred to the dorsal aspect of the web of the thumb. TP location involves flexion the elbow, to relax the brachioradialis muscle, and pronation of the forearm. TP in the supinator may then be identified directly over the radius below the biceps tendon and the brachioradialis (Simons 1998).
7. **Triceps**: MFTP in the lateral portion of the medial head refer pain to the lateral epicondyle and the radial aspect of the forearm. TP may be located 4-6cm above the lateral epicondyle (Simons 1998).

Chapter 3

3.1 Objective

This study was a randomised, placebo controlled clinical trial, to investigate the efficacy of dry needling in the treatment of lateral epicondylitis.

3.2 Research Methodology

3.2.1 Subjects

The study was limited to patients, age eighteen to sixty, who resided in the province of KwaZulu Natal. Shaik (2000), and Roodt (2001) both included patients between the ages of ten and seventy but it was felt that lateral epicondylitis rarely occurs in children, with a peak incidence between thirty and fifty five years of age (Jackson 1997). Advertisements requesting participation in the clinical trial involving chiropractic treatment of "Tennis elbow" were placed on notice boards at Technikon Natal, local universities, and technikons, local sports clubs as well as in local newspapers. The individuals who responded to these advertisements were assessed and if they complied with the inclusion criteria for the study, they were accepted into the research program. Patients presenting to the Chiropractic Day Clinic with lateral epicondylitis were considered for entrance into the study. Patients who displayed any of the exclusion criteria were not accepted in to the research program.

The inclusion criteria for the study were as follows:

A diagnosis of lateral epicondylitis based on:

a) Pain around the lateral epicondyle that is aggravated by active wrist extension.

b) A positive finding of at least one of the following tests, preformed according to the procedure set out by Magee (1997: 258):

1. **Lateral Epicondylitis test**: This involves the examiner resisting extension of the third digit of the hand (distal to the proximal interphalangeal joint). This places stress on the extensor digitorum muscle and tendon. A positive test is indicated by pain over the lateral epicondyle (Magee 1997:258)
2. **Cozens test**: This involves the examiner stabilising the patient's elbow and placing their thumb over the patient's lateral epicondyle. The patient is asked to make a fist, extend and radially deviate the wrist while the examiner resists the motion. A positive test is indicated by pain over the lateral epicondyle (Magee 1997:258)
3. **Mills test**: This test involves palpation of the lateral epicondyle of the patient while the forearm is pronated, the wrist fully flexed and the elbow extended. A positive test is indicated by pain over the lateral epicondyle (Magee 1997:258)

Exclusion criteria were as follows:

Any condition to which trigger point needling was contraindicated resulted in the patient's exclusion. (Rachlin 1994: 175-176) list the following as contraindications to dry needling:

1. The presence of a systemic or local infection
2. Patients with a bleeding disorder or who are on anticoagulant therapy
3. Patients who are pregnant

Patients who did not have trigger points, either active or latent, in the extensor muscles of the forearm, the Brachioradialis, or the supinator were also excluded from the study. Patients who were currently taking any analgesic or anti-inflammatory medication, which may have affected the condition, were requested to stop doing so for the duration of their participation in the study or be excluded from entering the study.

Each patient underwent an initial consultation consisting of a case history (appendix A), physical examination (appendix B), and elbow regional examination (appendix C). If radiographs were considered necessary to aid in diagnosis, then the patient was excluded from the study. At this point a diagnosis of lateral epicondylitis was confirmed followed by three treatments in a nine-day period for both groups (White 2000). Patients were requested to not receive any other treatment or undergo any lifestyle changes for the duration of the study.

3.2.2 Subject Allocation.

The population size was restricted to sixty patients with random allocation being used to separate patients into treatment and placebo groups. Thirty patients were assigned to each group. The allocation method involved the use of sixty pieces of paper, thirty of which contained the letter "A" and thirty of which contained the letter "B". The marked papers were placed in a box and the patients were requested to draw one piece of paper. The patients were then grouped according to the paper chosen. The "A" group received dry needling, and the "B" group received placebo acupuncture.

3.2.3.Study Design

Subjects in group A had the treatment procedure explained to them. They were assessed for myofascial trigger points in the supinator, the brachioradialis and hand extensors, and the triceps muscles as set out by Simons, D.S. (1998. 675, 705-708,729). Trigger points that were found were needled according to the procedure set out by Rachlin (1994. 336-337, 348-353, 345-346), which involved direct insertion of the needle. The needle was then left in position for 5 minutes (White 2000). Subjects in group B had the procedure explained to them. They were assessed for myofascial trigger points in the supinator, the brachioradialis and hand extensors, and the triceps muscles as set out by Simons, D.S. (1998), and any trigger points found were noted. They were seated while placebo acupuncture needles were used over the trigger points found. Streitberger and Kleinhenz (1998) report that the Sham needle unit is " sufficiently credible to be used in investigations of the effects of acupuncture".

Treatment was halted on any patients that became asymptomatic during the course of the study, however these patients continued to be evaluated, and treatment was resumed if they became symptomatic again.

3.3 The Data

Data was obtained from the patient, with the McGill pain questionnaire (appendix E) and the Numerical Rating Scale (NRS101) (appendix F) being used to record the patient's subjective response. Each patient selected for the study was required to complete a Short-Form McGill Pain Questionnaire (Melzack 1987), which provided information on the quality of pain experienced, and an NRS101 (Jensen et al. 1986) which was be used to assess the perceived pain intensity. Objective data was obtained through the use of a hand held dynamometer with the elbow straight (180 degrees) before the 1st, 2nd, and 3rd treatments, and 10 minutes after the 3rd treatment. De Smet and Fabry (1997) showed that grip force was reduced at the pathological side, especially when the elbow was straight (i.e. 180 degrees). Agre et al. (1987) conducted a study, which determined that the portable dynamometer was reliable for the testing of upper extremity strength. The lateral epicondyle was carefully palpated in each patient to identify the area of most tenderness. An algometer was then used to quantify the tenderness over this point before the 1st, 2nd, and 3rd treatments and then five minutes after the 3rd treatment. All data obtained was treated confidentially. It will be retained at the Chiropractic day clinic at Technikon Natal for a period of 5 years and then be shredded.

3.4 Statistical Analysis

Statistical analysis involved the use of the Mann-Whitney U-test to perform inter-group comparison of the subjective data. For objective data inter-group comparison was made by using the unpaired t-test. Intra-group comparisons were made using Friedman's T-test and the Dunn procedure where applicable. All tests were carried out at 5% level of significance and appropriate p-values were used for decision making. The SPSS package version 9 was used for all data analysis.

Chapter 4

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 comments and interpretations to accept or reject the null hypothesis.

4.2 Hypothesis

The null hypothesis (Ho) states that there is no difference between Group 1 and Group 2 at the $\alpha = 0.05$ level of significance. The alternate hypothesis (Ha) states that there is a difference at the same level.

4.3 Analysed Data

Data was analysed at $\alpha = 0.05$ level of significance.

Decision rule:

If $p < \alpha$, reject the null hypothesis Ho.

If $p \geq \alpha$, do not reject the null hypothesis Ho.

p is the reported p-value.

4.4 Demographic data

Table 1: Age, Gender and Racial Distribution

	Group 1	Group 2	Overall
Age:			
Minimum	23	18	18
Maximum	60	53	60
Average	39yrs	35yrs	36yrs
Gender:			
Male	15	10	25
Female	15	20	35
Racial			
White	27	29	56
Black	2	0	2
Indian	1	1	2
Other	0	0	0

Table 2: Reported Mechanism of Injury

Reported Mechanism of injury	Number of Patients
Racket sports: Tennis	14
Squash	7
Badminton	1
Other Sports: Taebo (punching movements)	4
Water polo	1
WCBB (Wheelchair basketball)	2
Cricket (throwing)	1
Motor X	1
Hockey	1
Non-sporting activities: Carrying parcels	6
Computer mouse/ Typing	5
Massaging patients	6
Using scissors	1
Handshaking	1
Using screw driver	1
Using craft knife	1
Driving car	1
Bumped elbow	1
Using hand held Laser	2
Ironing	1
Insidious onset	2

Table 3: Positive Diagnostic Tests

Test	Number of positive tests
Cozen's	33
Mill's	41
Epicondylitis Test	25

Table 4 Prevalence of Myofascial trigger Points

Muscle containing the myofascial trigger point.	Number of Patients with trigger points In each of the muscles.
Extensor carpi radialis longus	47
Extensor carpi radialis brevis	13
Extensor digitorum	50
Extensor carpi ulnaris	3
Supinator	44
Brachioradialis	13
Triceps (lateral head)	12

4.5. Comparison between two independent samples

Table 5: Results of the Mann-Whitney U Test comparing groups 1 and 2 with respect to the NRS 101

Data was analysed at $\alpha = 0.05$ level of significance.

The null hypothesis (Ho) states that there is no difference between Group 1 and Group 2 at the $\alpha = 0.05$ level of significance. The alternate hypothesis (Ha) states that there is a difference at the same level.

Decision rule:

If $p < \alpha$, reject the null hypothesis Ho.

If $p \geq \alpha$, do not reject the null hypothesis Ho.

p is the reported p-value.

NRS 101	Group	Mean	P-value
1	1	35.6333	0.650
	2	34.2000	
2	1	26.8000	0.072
	2	31.7667	
3	1	18.9500	<0.001
	2	30.2500	
4	1	17.7500	<0.001
	2	28.5500	

The results indicate that at the α=0.05 level of significance, no difference was observed at treatments 1 and 2, however a difference was noted at treatment 3 and at the follow up (reading 4). As a result the null hypothesis is accepted for treatments 1 and 2 but rejected for readings 3 and 4. This suggests that there was an improvement in the quantity of pain reported by patients in group1 (i.e. the experimental group) after 2 treatments. One may conclude then that dry needling may have an effect on the patient's perception of the quantity of pain they experience as result of lateral epicondylitis.

Table 6: Results of the Mann-Whitney U Test comparing groups 1 and 2 with respect to the McGill pain questionnaire.

Data was analysed at α = 0.05 level of significance. The null hypothesis (Ho), the alternate hypothesis (Ha), and the decision rule were similar to that stated on page 41.

McGill	Group	Mean	P-value
1	1	9.4333	0.171
	2	7.8333	
2	1	6.3667	0.228
	2	6.9000	
3	1	4.1667	0.002
	2	6.1000	
4	1	3.8000	.001
	2	5.9000	

The results indicate that at the α=0.05 level of significance there was no observed difference between groups 1 and 2 at the 1st and 2nd readings. At reading 3 (taken before the 3rd treatment) and at reading 4 (taken after the 3rd treatment) there was an observed difference between group 1 and 2.

As a result the null hypothesis is accepted for treatments 1 and 2 but rejected for readings 3 and 4. The results suggest that there was an improvement in the quality of pain experienced by patients in group1 (i.e. the experimental group) after 2 treatments. One may conclude then that dry needling may have an effect on the patient's perception of the quality of pain they experience as result of lateral epicondylitis.

Table 7 Results of the two independent sample t-test comparing groups 1 and 2 with respect to the Algometer values.

Data was analysed at α = 0.05 level of significance. The null hypothesis (Ho), the alternate hypothesis (Ha), and the decision rule were similar to that stated on page 41.

Algometer values	Group	Mean	Std deviation	Std error	P-value
1	1	1.8597	0.9002	0.1644	0.208
	2	1.6117	0.5712	0.1043	
2	1	2.1020	0.6977	0.1274	0.008
	2	1.6487	0.5631	0.1028	
3	1	2.1627	0.7311	0.1335	0.011
	2	1.7277	0.5288	0.0097	
4	1	2.1763	0.6496	0.1186	0.003
	2	1.7130	0.5161	0.0942	

The results indicate that at the α=0.05 level of significance there was no observed difference between algometer readings in group 1 and 2 prior to the first treatment. All subsequent readings indicate a difference in the algometer readings in group1 and 2 (i.e. improvement in group 1, the experimental group) As a result the null hypothesis was rejected, and one may conclude that dry needling increased the amount of pressure that the patients were able to tolerate over the lateral epicondyle.

Table 8 Results of the two independent sample t-test comparing groups 1 and 2 with respect to the Dynamometer values

Data was analysed at α = 0.05 level of significance. The null hypothesis (Ho), the alternate hypothesis (Ha), and the decision rule were similar to that stated on page 41.

Dynamometer readings	Group	Mean	Std deviation	Std error	P-value
1	1	35.4000	15.6013	2.8484	0.978
	2	35.2967	13.0481	2.3822	
2	1	39.1977	16.3568	2.9863	0.384
	2	35.8100	13.4253	2.4511	
3	1	40.6813	15.7640	2.8781	0.221
	2	35.9557	13.7505	2.5105	
4	1	40.7793	15.6939	2.8653	0.241
	2	36.3457	13.5486	2.4736	

The results indicate that at the $\alpha=0.05$ level of significance, no difference was observed between group 1 and 2 at all 4 readings. The null hypothesis is thus accepted. As a result one may conclude that dry needling did not increase the grip strength in patients suffering from lateral epicondylitis.

4.6. Comparison between Two related samples in Group 1.

Friedman's T-test was utilized for intra-group comparison. The decision rule was as follows:

Ho: The three treatments yield identical results.

H1: At least one treatment tends to yield larger values than at least one other treatment.

If $p < 0.05$, reject the null hypothesis.

Table 9 Friedman T-test for the NRS101 for group 1

Reading	Mean Rank	Rank Total	$\lvert Rj\text{-}Rj'\rvert$
1	3.72	111.6	25.5 |R1-R2|
2	2.87	86.1	30 |R2-R3|
3	1.87	56.1	9.6 |R3-R4|
4	1.55	46.5	65.1 |R1-R4|

N	30
Chi-Square	67.635
df	3
p-value	<0.001

The Friedman T-test for the NRS101 for group 1 revealed a p-value of <0.001. As a result the null hypothesis was rejected (at the α=0.05 level of significance). This suggests that there was an over all improvement in the patient's perception of the quantity of pain in the experimental group.

As a result of the null hypothesis being rejected the Dunn procedure (Multiple comparison procedure) was carried out to assess the effect of each treatment.

The formula utilized was as follows:

Let Rj and Rj' be the jth and j'th treatment rank totals. Let α be the experimentwise error rate.

If $\lvert Rj-Rj' \rvert > z\sqrt{\frac{bk(k+1)}{6}}$, then Rj and Rj' are declared significant.

In the above formula: b=number of blocks

K=the number of treatments

Z=value in the inverse nomal distribution

corresponding to (1-[α/k(k-1)])

If K=4, Z= 2.409

If |Rj-Rj′| > 24.09, then Rj and Rj′ are declared significantly different.

Results of the procedure:

|R1-R2| = 111.6 - 86.1= 25.5 > 24.09 (i.e. R1 and R2 are different)
|R2-R3| = 86.1 - 56.1= 30 > 24.09 (i.e. R2 and R3 are different)
|R3-R4| = 56.1 - 46.5= 9.6 < 24.09 (i.e. R3 and R4 are not different)
|R1-R4| = 111.6 – 46.5= 65.1> 24.09 (i.e. R1 and R4 are different)

The results of the Dunn procedure suggest, that in the experimental group, there was an improvement in the patient's perception of their quantity of pain (NRS101) after the 1st and 2nd treatment and over all. No improvement seems to be evident after the 3rd treatment. This suggests that the most of the therapeutic effect occurred as result of the 1st and 2nd dry needling treatments.

Table 10 Friedman T-test for the McGill pain questionnaire group 1

Friedman's T-test was utilized for intra-group comparison. Data was analysed at $\alpha = 0.05$ level of significance. The null hypothesis (Ho), the alternate hypothesis (Ha), and the decision rule were similar to that stated on page 45.

Reading	Mean Rank	Rank Total	|Rj-Rj′|
1	3.80	114	26.1 |R1-R2|
2	2.93	87.9	34.8 |R2-R3|
3	1.77	53.1	8.1 |R3-R4|
4	1.50	45	69 |R1-R4|

N	30
Chi-Square	74.976
df	3
p-value	<0.001

The Friedman T-test for the McGill pain questionnaire group 1 revealed a p-value of <0.001 as a result the null hypothesis was rejected (at the α=0.05 level of significance). This suggests that there was an over all improvement in the patient's perception of the quality of pain (as measured by the McGill pain questionnaire) in the experimental group.

As a result of the null hypothesis being rejected the Dunn procedure (Multiple comparison procedure) was carried out to assess the effect of each treatment.

The formula used was the same as that used on page 46/7.

If $|Rj-Rj'|$ > 24.09, then Rj and Rj' are declared significantly different.

Results of the procedure:

$|R1-R2|$ = 114 – 87.9 = 26.1 > 24.09 (i.e. R1 and R2 are different)
$|R2-R3|$ = 87.9 – 53.1 = 34.8 > 24.09 (i.e. R2 and R3 are different)
$|R3-R4|$ = 53.1 – 45 = 8.1 < 24.09 (i.e. R3 and R4 are not different)
$|R1-R4|$ = 114-45 = 69 > 24.06 (i.e. R1 and R4 are different)

The results show that there was a difference after the 1st and 2nd treatment, and overall. No difference was noted between R3 and R4 (i.e. after the 3rd treatment). Once again it would seem that most of the improvement in the patient's perception of the quality of pain (McGill pain questionnaire) occurred after the 1st and 2nd treatments.

Table 11 Friedman's T-test for Algometer values for group 1

Friedman's T-test was utilized for intra-group comparison. Data was analysed at α = 0.05 level of significance. The null hypothesis (Ho), the alternate hypothesis (Ha), and the decision rule were similar to that stated on page 45.

Reading	Mean Rank
1	2.08
2	2.53
3	2.73
4	2.65

N	30
Chi-Square	5.686
df	3
p-value	0.128

The results of Friedman's T-test revealed a p-value of 0.128 (at the α=0.05 level of significance) as a result the null hypothesis was accepted suggesting that there was no overall improvement in the algometer readings in the experimental group.

Table 12 Friedman T-test for Dynamometer readings in group 1

Friedman's T-test was utilized for intra-group comparison. Data was analysed at α = 0.05 level of significance. The null hypothesis (Ho), the alternate hypothesis (Ha), and the decision rule were similar to that stated on page 45.

Reading	Mean Rank	Rank Total	|*Rj*-*Rj*'|	
1	1.40	42	29.4	R1-R2
2	2.38	71.4	20.7	R2-R3

3	3.07	92.1	2.4 $\lvert R3\text{-}R4 \rvert$	
4	3.15	94.5	52.5 $\lvert R1\text{-}R4 \rvert$	

N	30
Chi-Square	37.405
Df	3
p-value	<0.001

The Friedman T-test for the Dynamometer readings in group 1 revealed a p-value of <0.001 as a result the null hypothesis was rejected (at the $\alpha=0.05$ level of significance). This suggests that there was an over all improvement in the patient's grip strength measurement in the experimental group.

As a result of the null hypothesis being rejected the Dunn procedure (Multiple comparison procedure) was carried out to assess the effect of each treatment.

The formula utilized was the same as that used on page 46/7.

If $\lvert Rj\text{-}Rj' \rvert > 24.09$, then Rj and Rj′ are declared significantly different.

Results of the procedure:

$\lvert R1\text{-}R2 \rvert = 42 - 71.4 = 29.4 > 24.09$ (i.e. R1 and R2 are different)
$\lvert R2\text{-}R3 \rvert = 71.4 - 92.1 = 20.7 < 24.09$ (i.e. R2 and R3 are not different)
$\lvert R3\text{-}R4 \rvert = 92.1 - 94.5 = 2.4 < 24.09$ (i.e. R3 and R4 are not different)
$\lvert R1\text{-}R4 \rvert = 94.5 - 42 = 52.5 > 24.09$ (i.e. R1 and R2 are different).

The results of the Dunn procedure reveal that there was an improvement in then grip strength measurement after the 1st treatment, and overall. No improvement was suggested after the 2nd and 3rd treatments. This suggests that most of the improvement occurred after the 1st treatment.

4.7. Comparison between Two related samples in Group 2

Friedman's T-test was utilized for intra-group comparison. The decision rule was follows:

Ho: The three treatments yield identical results.

H1: At least one treatment tends to yield larger values than at least one other treatment.

If $p < 0.05$, reject the null hypothesis.

Table 13 Friedman T-test for the NRS101 for group 2

Reading	Mean Rank	Rank Total	R_j-$R_{j'}$	
1	3.38	101.4	13.5	R1-R2
2	2.93	87.9	24.3	R2-R3
3	2.12	63.6	16.5	R3-R4
4	1.57	47.1	54.3	R1-R4

N	30
Chi-Square	49.653
Df	3
p-value	<0.001

The Friedman T-test for the NRS101 for group 2 revealed a p-value of <0.001 as a result the null hypothesis was rejected (at the $\alpha=0.05$ level of significance). This suggests that there was an over all improvement in the patient's perception of the quantity of pain in the control group (i.e. group 2).

As a result of the null hypothesis being rejected the Dunn procedure (Multiple comparison procedure) was carried out to assess the effect of each treatment.

The formula utilized was as follows:

Let Rj and Rj' be the jth and j'th treatment rank totals. Let α be the experimentwise error rate.

If $|Rj-Rj'| > z\sqrt{\frac{bk(k+1)}{6}}$, then Rj and Rj' are declared significant.

In the above formula: b=number of blocks

K=the number of treatments

Z=value in the inverse nomal distribution

corresponding to $(1-[\alpha/k(k-1)])$

If K=4, Z= 2.409

If $|Rj-Rj'| > 24.09$, then Rj and Rj' are declared significantly different.

Results of the procedure:

$|R1-R2| = 101.4 - 87.9 = 13.5 < 24.09$ (i.e. R1 and R2 are not different)
$|R2-R3| = 87.9 - 63.6 = 24.3 > 24.09$ (i.e. R2 and R3 are different)
$|R3-R4| = 63.6 - 47.1 = 16.5 < 24.09$ (i.e. R3 and R4 are not different)
$|R1-R4| = 101.4 - 47.1 = 54.3 > 24.09$ (i.e. R1 and R4 are different)

The results of the Dunn procedure suggest, that in the control group, there was an improvement in the patient's perception of their quantity of pain (NRS101) after the 2nd treatment and overall ($|R1-R4|$). No significant improvement seems to be evident after 1st or the 3rd treatments.

Table 14 Friedman T-test for the McGill pain questionnaire group 2

Friedman's T-test was utilized for intra-group comparison. Data was analysed at $\alpha = 0.05$ level of significance. The null hypothesis (Ho), the alternate hypothesis (Ha), and the decision rule were similar to that stated on page 51.

Reading	Mean Rank	Rank Total	$\lvert Rj-Rj' \rvert$
1	3.48	104.4	25.5 $\lvert R1-R2 \rvert$
2	2.63	78.9	18 $\lvert R2-R3 \rvert$
3	2.03	60.9	5.4 $\lvert R3-R4 \rvert$
4	1.85	55.5	48.9 $\lvert R1-R4 \rvert$

N	30
Chi-Square	52.232
Df	3
p-value	<0.001

The Friedman T-test for the McGill pain questionnaire group 2 revealed a p-value of <0.001 as a result the null hypothesis was rejected (at the α=0.05 level of significance). This suggests that there was an over all improvement in the patient's perception of the quality of pain (as measured by the McGill pain questionnaire) in the control group.

As a result of the null hypothesis being rejected the Dunn procedure (Multiple comparison procedure) was carried out to assess the effect of each treatment.

The formula used was the same as that used on page 52.

If $\lvert Rj-Rj' \rvert > 24.09$, then Rj and Rj' are declared significantly different.

Results of the procedure:

$\lvert R1-R2 \rvert = 104.4 - 78.9 = 25.5 > 24.09$ (i.e. R1 and R2 are different)

|R2-R3| = 78.9 – 60.9 = 18 < 24.09 (i.e. R2 and R3 are not different)
|R3-R4| = 60.9 – 55.5 = 5.4 < 24.09 (i.e. R3 and R4 are not different)
|R1-R4| = 104.4 – 55.5 = 48.9 > 24.09 (i.e. R1 and R4 are different)

The results show that there was an improvement after the 1st treatment and overall. No improvement was noted after the 2nd and 3rd treatments. It would seem that most of the improvement in the patient's perception of the quality of pain (McGill pain questionnaire) occurred after the1st treatment.

Table 15 Friedman's T-test for Algometer values for group 2

Friedman's T-test was utilized for intra-group comparison. Data was analysed at α = 0.05 level of significance. The null hypothesis (Ho), the alternate hypothesis (Ha), and the decision rule were similar to that stated on page 51.

Reading	Mean Rank	Rank Total	|Rj-Rj'|	
1	1.85	55.5	12.9	|R1-R2|
2	2.28	68.4	22.5	|R2-R3|
3	3.03	90.9	6	|R3-R4|
4	2.83	84.9	29.4	|R1-R4|

N	30
Chi-Square	20.309
df	3
p-value	0.001

The results of Friedman's T-test revealed a p-value of < 0.001 (at the α=0.05 level of significance) as a result the null hypothesis was rejected suggesting that there was an overall improvement in the algometer readings in the control group.

As a result of the null hypothesis being rejected the Dunn procedure (Multiple comparison procedure) was carried out to assess the effect of each treatment.

The formula utilized was the same as that used on page 52.

If $|Rj-Rj'| > 24.09$, then Rj and Rj' are declared significantly different.

Results of the procedure:

$|R1-R2| = 55.5 - 68.4 = 12.9 < 24.09$ (i.e. R1 and R2 are not different)
$|R2-R3| = 68.4 - 90.9 = 22.5 < 24.09$ (i.e. R2 and R3 are not different)
$|R3-R4| = 90.9 - 84.9 = 6 < 24.09$ (i.e. R3 and R4 are not different)
$|R1-R4| = 55.5 - 84.6 = 29.4 > 24.09$ (i.e. R1 and R4 are different)

Results of the Dunn procedure revealed that there was no improvement in the algometer readings after any of the individual treatments, although there appears to be an over all improvement after all 3 treatments.

Table 16 Friedman's T-test for Dynamometer readings in group 2

Friedman's T-test was utilized for intra-group comparison. Data was analysed at $\alpha = 0.05$ level of significance. The null hypothesis (Ho), the alternate hypothesis (Ha), and the decision rule were similar to that stated on page 51.

Reading	Mean Rank
1	2.12
2	2.47
3	2.58

4	2.83

N	30
Chi-Square	5.423
df	3
p-value	.143

The Friedman T-test for the Dynamometer readings in group 2 revealed a p-value of 0.143 as a result the null hypothesis was accepted. This suggests that there was no improvement in the grip strength measurements in the control group after all 3 treatments. As result of the null hypothesis being accepted the Dunn procedure was not carried out.

Chapter 5

This chapter will discuss the results of the objective and subjective clinical data gathered from algometer and dynamometer measurements, the Short Form McGill Pain Questionnaire and the Numerical Pain rating Scale (NRS 101)

5.1 Demographic Data

Table one provides a break down of the age, racial and gender demographics of the study. The average age of participants was 36, which falls into the age interval of between 30 and 55 that was described by Jackson (1997:104) as the period of peak incidence. 93,33% of participants were from the white population with only 6,67% belonging to the Indian or Black racial groups. This demographic seems to indicate that lateral epicondylitis rarely occurs outside the white race group. Shaik (2000) argued, and I would agree, that these figures might have been biased by the method of advertising, the location of the Chiropractic day clinic and the lack of awareness of the role of chiropractic in the management of the condition in the previously disadvantaged communities of South Africa.

Thomson (1991:60) reported an equal gender distribution. This study was slightly bias towards the female population, with 58% of the participants being female and 42% being male.

Table 2 indicates that while racket sports are a common aetiological factor (36,67% of participants in the study reported racket sports to be the mechanism of injury) they are by no means the only aetiological factor. A wide range of other sporting and non-sporting activities (a total of 17 besides racket sports) were reported as possible mechanisms of injury. Some of the more commonly reported included carrying heavy parcels (10%), massaging clients/ patients (10%) and using a computer mouse (8,33%).

Table 3 indicated that Mill's test was most often "positive" with 68.33% of participants reporting pain over the lateral epicondyle on performance of the test.

Table 4 was used to indicate the frequency at which myofascial trigger points occurred in the muscles included in the study. Of interest is that no participant in the study had to be excluded due to the lack of trigger points (either active or latent) in the muscles listed. This would seem in part to add some substance to Simons' (1998) opinion that myofascial trigger point activity plays a role in the development and perpetuation of lateral epicondylitis. 83,33% were found to have trigger points in the extensor digitorum muscle.

73,33% were found to have trigger points in the supinator muscle, which Simons (1998) describes as the "Tennis Elbow" muscle. Interestingly only 21,67% of participants were found to have trigger points in the extensor carpi radialis brevis, which Cyriax and Cyriax (1993) explain is more frequently the site of the lesion as result of increased tensile loads placed on its tendon by the radial head when the tendon is stretched for example during extension of the elbow. The higher incidence of trigger points in the extensor carpi radialis longus (78,33%) may possibly be the result of increased activity in the extensor carpi radialis longus to compensate for the "lesion" in the extensor carpi radialis brevis.

5.2 The First Objective: To investigate the efficacy of dry needling myofascial trigger points in the posterior distal muscles of the upper extremity as a treatment for lateral epicondylitis, in terms of objective clinical findings.

5.2.1 Inter-group Analysis

Evaluation of the 1st treatment shows any variance in findings between the 2 groups in terms of their original presentation. Comparison of the 2 groups at reading 4 after 3 treatments provides information as to whether dry needling has had an effect greater than placebo.

Statistical data may be found in tables 7 and 8. The two independent sample t-test was used to compare groups one and two in terms of objective measures. Comparison of Algometer readings between the two groups indicates that at the $\alpha=0.05$ level of significance, no significant difference was observed at the 1st measure, however all subsequent readings indicate a significant improvement in the experimental group (i.e. group one). This would seem to suggest the null hypothesis be rejected, indicating that dry needling has an effect greater than placebo in terms of the amount of pressure that the patients were able to tolerate over the lateral epicondyle. The second subjective measure (i.e. Dynamometer readings) did however not show any statistically significant difference between the experimental and control groups at all four measurements. As a result one may conclude that dry needling does not significantly increase the grip strength in patients suffering from lateral epicondylitis.

5.2.2 Intra-group Analysis

Intra-group analysis examines the improvement in each group from the 1st to the last treatment, and provides information on the therapeutic effect of dry needling over placebo, in the treatment of lateral epicondylitis.

Statistical data may be found in tables11, 12, 15, and 16. Results of the analysis of the algometer readings indicate that in group1 there was no significant overall improvement. In group2 a significant overall improvement was observed. No significant improvement was noted, however after any of the individual treatments.

Analysis of Grip strength (dynamometer), tables 12 and 16, indicate that in group1 a significant overall improvement was noted. Analysis of the effect of the individual treatments revealed the most of the improvement was evident after the 1st treatment. In group 2 no significant improvement was noted after all 3 treatments.

5.3 The Second Objective: To investigate the efficacy of dry needling myofascial trigger points in the posterior distal muscles of the upper extremity as a treatment for lateral epicondylitis, in terms of subjective clinical findings.

5.3.1 Inter-group Analysis.

Evaluation of the 1st treatment shows any variance in findings between the 2 groups in terms of their original presentation. Comparison of the 2 groups at reading 4 after 3 treatments provides information as to whether dry needling has had an effect greater than placebo.

Statistical data may be found in tables 5 and 6. The Mann-Whitney Test was used to compare the 2 groups with respect to the subjective measures. The results indicate that at the α=0.05 level of significance, no significant difference was observed at treatments 1 and 2, however a significant difference was noted at treatment 3 and at the follow up (reading 4). As a result the null hypothesis was rejected, indicating that dry needling had an effect greater than placebo in terms of subjective measures. One may conclude that dry needling effectively improves the patient's perception of the quantity and quality of the pain that they experience as result of lateral epicondylitis.

5.3.2. Intra-group Analysis.

Friedman's t-test was used to determine the overall effect of dry needling versus placebo in terms of the subjective measurements. The results revealed a significant improvement in both groups in terms of the two subjective measures (i.e. the NRS101, quantity of pain, and the Mc Gill short form pain questionnaire, quality of pain).

Chapter 6: Conclusions and Recommendations

The purpose of this study was to determine the efficacy of dry needling the posterior distal muscles of the upper extremity as a treatment for lateral epicondylitis.

Sixty patients were included in the study. They all under went a case history, physical examination and an elbow regional examination. They were then randomly allocated into the experimental or control groups. The thirty patients in the experimental group received dry needling while the thirty included in the control group received placebo or "sham" needling.

All participants in the study received three treatments over a nine-day period with subjective and objective measurements being taken before the 1st, and 2nd treatments, and before and after the 3rd treatment (i.e. four measurements overall).

Examination of the statistical data revealed that there was a significant improvement in the experimental and control groups in terms of the subjective measurements. Inter-group comparison revealed a statistically significant improvement in terms of the subjective measures in the experimental group. There also appeared to have been a significant improvement in the algometer reading, which was the objective measure used to assess the amount of pressure that the patient was able to tolerate over the lateral epicondyle. There was however no significant difference observed in the dynamometer reading, which was the objective measure used to assess the patient's grip strength.

The results of this study seem to suggest that dry needling is more effective than "sham" needling at improving the patient's perception of the quantity and quality of pain that they experience. It also appears to be a more effective means of increasing the amount of pressure that the patient is able to tolerate over the lateral epicondyle. It would thus seem that dry needling might be a key component of any treatment protocol designed to manage lateral epicondylitis.

The results of this study may provide some weight to Simon's opinion that myofascial trigger point activity in the posterior distal musculature of the upper extremity may play a role in the aetiology and perpetuation of lateral epicondylitis.

It would be interesting to investigate the benefit of a dry needling used in conjunction with other treatment modalities, or as part of a comprehensive rehabilitation protocol.

Below is a list of recommendation for further study into this condition:

- Introduction of a second examiner, who should be blinded as to which treatment the patient is receiving, to collect and collate data. This would serve to diminish observer bias.
- A follow-up examination at periodic intervals to assess the long- term effect of dry needling in the treatment of lateral epicondylitis.

- Studies which; assess treatment protocols rather than individual treatment modalities should be attempted.

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TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
CASE HISTORY

Appendix A

Patient:.. Date: ....

File # :.. Age : ....

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

Intern :..Signature:...

FOR CLINICIANS USE ONLY:

Initial visit

Clinician:.. Signature :...

Case History:

Examination:

Previous: Current:

X-Ray Studies:

Previous: Current:

Clinical Path. lab:

Previous: Current:

Case Status:

PTT:...

Signature:.. **Date:**.................................

Conditional:

Reason for Conditional:..

Signature: .... **Date:** ....

All Conditions met in Visit No.:..

To be signed into PTT:...

Signature:.. **Date:** ....

Signed off:...

Intern's Case History:

1. **Source of History:**

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

3. **Present Illness:**

Complaint 1	Complaint 2

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

- Environmental Hazards (Home, School, Work)
- Exercise and Leisure
- Sleep Patterns
- Diet
- Current Medication
  Analgesics/week:

- Tobacco
- Alcohol
- Social Drugs

7. **Immediate Family Medical History:**

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

8. **Psychosocial history:**

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

9. **Review of Systems:**

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

TECHNIKON NATAL

Appendix B

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

PHYSICAL EXAMINATION

Patient:____________________File#: ____________________Date:__________
Clinician:____________________Signature:____________________
Intern:____________________Signature:____________________

1. VITALS

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

2. GENERAL EXAMINATION

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

3. CARDIOVASCULAR EXAMINATION

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

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

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

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

Percussion: - borders of heart

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

4. RESPIRATORY EXAMINATION

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

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

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

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

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

5. ABDOMINAL EXAMINATION

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

Inspection - Shape:
- Scars:
- Hernias:

Palpation - Superficial:
- Deep = Organomegally:

- Masses (intra- or extramural)
- Aorta:

Percussion - Rebound tenderness:
- Ascites:
- Masses:

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

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

6. G.U.T EXAMINATION

External genitalia:
Hernias:
Masses:
Discharges:

7. NEUROLOGICAL EXAMINATION

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

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

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

Evidence of head trauma:

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

Cranial Nerves:

I Any loss of smell/taste:
Nose examination:

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

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

III	Ocular Muscles: Eye opening strength:		
IV	Inferior and Medial movement of eye:		
V	a.	Sensory	- Ophthalmic: - Maxillary: - Mandibular:
	b.	Motor	- Masseter: - Jaw lateral movement:
	c.	Reflexes	- Corneal reflex - Jaw jerk
VI	Lateral movement of eyes		
VII	a.	Motor	- Raise eyebrows: - Frown: - Close eyes against resistance: - Show teeth: - Blow out cheeks:
	b.	Taste	- Anterior two-thirds of tongue:

VIII General Hearing:

Rinnes = L: R:

Webers lateralisation:

Vestibular function
- Nystagmus:
- Rombergs:
- Wallenbergs:

Otoscope examination:

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

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

XII Inspection of tongue (deviation):

Motor System:

a. Power

- Shoulder	= Abduction & Adduction:
	= Flexion & Extension:
- Elbow	= Flexion & Extension:
- Wrist	= Flexion & Extension:

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

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

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

Sensory System:

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

b. Joint position sense
- Finger:
- Toe:

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

Cerebellar function:

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

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

8. SPINAL EXAMINATION:(See Regional examination)

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

9. BREAST EXAMINATION:

Summon female chaperon.

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

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

ELBOW REGIONAL EXAMINATION

Appendix C

Patient: ______________________________ File No.: ________ Date: __________
Intern / Resident: _______________________ Signature: ______________________
Clinician: ____________________________ 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

Patient information sheet, for the study entitled, THE EFFICACY OF DRY NEEDLING IN THE TREATMENT OF LATERAL EPICONDYLITIS

Dear participant

The aim of this study is to evaluate the use of dry needling in the treatment of lateral epicondylitis (tennis elbow). Sixty people will be required to complete this study. The participants will be randomly divided into two groups of thirty patients each. One group will receive dry needling, which involves the insertion of acupuncture needles into trigger points in muscles, and the other will receive placebo dry needling. There is a fifty- percent chance of you being in either group. Sterile condition will be maintained at all times with the use of alcohol swabs, gloves, and sterile acupuncture needles. Each needle will only be used once and then be discarded in medical waste bins.

You will need to return for a maximum of three treatments spread over a nine-day period. It would be appreciated if you would refrain from taking any anti-inflammatory or analgesic medication, or undergoing any lifestyle modifications which may affect your condition, during the course of this study. Failure to adhere to this may result in your exclusion from the study. Any patient who is suffering from a systemic or local infection, is pregnant, suffers from a bleeding disorder or is on anticoagulant medication will also be excluded from the study as they may suffer adverse effects from the use of acupuncture needles.

Your participation in this study is voluntary and you are free to withdraw at any time. All information obtained during the course of the study will be confidential; it will be retained for five years and then be shredded. All treatments will be preformed under the supervision of a qualified chiropractor and will be free of charge. Those patients who fall into the placebo group will be eligible for free treatment following completion of the study.

Thank you for your participation in this study.

Yours sincerely

Garrick Haswell (chiropractic intern)

Appendix E

INFORMED CONSENT FORM

Date:________________________

To be completed in duplicate by the patient.

TITLE OF RESEARCH

The efficacy of dry needling in the treatment of lateral epicondylitis.

NAME OF RESEARCH STUDENT

Garrick Haswell

NAME OF SUPERVISOR

Dr. H. White

PLEASE CIRCLE THE APPROPRIATE ANSWER.

1.Have you read the information sheet? Yes/No
2. Have you had an opportunity to discuss the study? Yes/No
3. Have you had the opportunity to ask questions? Yes/No
3. Have you received satisfactory answers to your questions?
4. Do you understand the implications of your involvement in this study? Yes/No
5. Do you understand that you are free to withdraw from this study at any time? Yes/No
6. Do you agree to voluntarily participate in this study? Yes/No

Please do not sign unless the researcher has adequately answered all your questions.

PATIENT/SUBJECT Name____________________
Signature_______________

PARENT/ GUARDIAN Name____________________
Signature_______________

WITNESS Name____________________
Signature_______________

RESEARCH STUDENT Name____________________ Signature_______________

NUMERICAL PAIN RATING SCALE 101.

Appendix F

Patient Name:______________________________

File number:________________ Date:____________

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, 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.

0 ______________________________ 100

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, 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.

0 ______________________________ 100

Appendix G

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 H

File No:________ Group:

Algometer Readings

Reading	1	2	3	4
Right				
Left				

Dynamometer Readings

Reading	1	2	3	4
Right				
Left				

Myofascial Trigger point Location

ECRL	
ECRB	
ECU	
ED	
BRACHIORADIALIS	
SUPINATOR	
TRICEPS	