THE EFFICACY OF SHOULDER ADJUSTMENTS ON PATIENTS SUFFERING FROM SHOULDER IMPINGEMENT SYNDROME

BY

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I, Sarah Louisa Munday, do hereby declare that this dissertation is representative of my own work.

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DEDICATION

This work is dedicated to my Mom, Dad, sister and brother. Your love and support carried me through the most trying times.

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ABSTRACT

Purpose

Impingement syndrome of the shoulder is a very common problem, yet the diagnosis and management of it is still not completely understood. The purpose of this investigation was to investigate the effectiveness of the chiropractic adjustment in order to determine whether or not it is an effective approach in the treatment of impingement syndrome.

Methods

This randomized controlled trial consisted of two groups. Each group consisted of fifteen subjects, under the age of forty years old, selected from the general population and randomly allocated to Group A or B, participation in this trial was purely voluntary.

Group A received placebo ultrasound, while group B received any shoulder girdle chiropractic adjustment according to the fixations found on motion palpation. Subjects in both groups had to comply with various inclusion criteria before being allowed to participate in the study. Each individual had a case history taken from them, and underwent a relevant physical examination as well as a regional examination of the cervical spine and shoulder girdle. The Numerical Pain Rating Scale and the short form McGill Pain questionnaires were answered at the initial consultation, at the end of the three week treatment period and lastly, at the one month follow-up.

Two-tailed statistical analysis was conducted at $\alpha = 0.05$, using the non-parametric Wilcoxon Signed Rank Test and the Mann-Whitney U Test comparing intra-group and intergroup data respectively. Further assessment of the data was conducted using power analysis. This data was presented in the form of tables and charts.

Results

According to the results of the Wilcoxon Sign-Rank Tests, within both groups, there was a subjective and objective improvement during the treatment program, which was increased after the one month follow-up period. This supports the hypotheses which states that there will be improvement within each group. There was, however, more statistically significant improvements in the adjustment group. According to the Mann -Whitney U tests, there were statistically significant differences between the two groups after the eighth treatment and one month follow-up which implies that the adjustment group was more effective in the treatment of impingement syndrome. Therefore one can accept the hypothesis that there is a significant difference between the two groups.

Conclusion

This study suggests that the chiropractic adjustment is more effective than placebo in the treatment of impingement syndrome of the shoulder. This however requires further research as a larger sample size is required. It is the opinion of the author that an adjustment is effective, time and cost efficient.

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DEFINITIONS

ADJUSTMENT

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

CHIROPRACTIC

A science of applied neurophysiologic diagnosis based on the theory that health and disease are life processes related to the function of the nervous system: irritation of the nervous system by mechanical, chemical, or psychic factors is the cause of disease; restoration and maintenance of health depend on normal function of the nervous system. (Saunders 1994: 312)

CONTRAINDICATION

Any condition, especially any disease condition, that renders one particular line of treatment improper or undesirable. (Gatterman 1990:407)

CREPITUS

A sound like that made by rubbing the hair between the fingers, or like that made by throwing fine salt into a fire. (Saunders 1994: 391)

FIXATION

Absence of motion of a joint in a position of motion, usually at the extremity of such motion. (Gatterman 1990: 408)

IMPINGEMENT SYNDROME

The progressive pathologic changes resulting from mechanical encroachment of the acromion, coracoacromial ligament, coracoid process, or acromioclavicular joint on the rotator cuff, including reversible oedema and hemorrhage, fibrosis, tendonitis, pain, bone spur formation, and tendon rupture. (Saunders 1994: 1632)

JOINT DYSFUNCTION

Joint mechanics showing area disturbances of function. (Gatterman 1990: 409)

MANIPULATION

Passive maneuver in which specifically directed manual forces are applied to vertebral and extravertebral articulations of the body, with the object of restoring mobility to restricted areas. (Gatterman 1990: 410)

OBJECTIVE CLINICAL FINDINGS

Refers to procedures utilised by the practitioner that objectively assess the patients' condition. This was achieved through passive range of motion assessment and algometer readings.

PASSIVE RANGE OF MOTION

The extent of movement (usually tested within a given plane) of an anatomical part at a joint when movement is produced by an outside force without voluntary assistance or resistance by the subject. (Travell and Simons 1983:3)

SUBJECTIVE CLINICAL FINDINGS

Diagnostic procedures, as completed by the patient, that subjectively assess the condition of the same patient. This was achieved through the use of two questionnaires (Numerical Pain Rating Scale-101 and the Short Form McGill Pain Questionnaire).

CHAPTER 1: INTRODUCTION

1.1 The problem and its setting

In 1995, the cumulative incidence of shoulder complaints was calculated in a Dutch general practice, and the incidence estimated at 14.7 per 1000 per year. The incidence of shoulder complaints was greater for women than for men and peaked in the age category 45-64 years. The subacromial impingement syndrome was the disorder diagnosed most frequently, in particular rotator cuff tendonitis (29%). (Van der Windt et al. 1995.)

The diagnosis of impingement syndrome rests mainly on clinical findings (Patte 1990). Initially, the pain is described as a dull ache about the shoulder following strenuous activity (Hawkins and Abrams 1987). The important positive clinical signs are: (1) point tenderness over the anterior shoulder; (2) a painful arc of abduction, maximum at 90 degrees; and (3) the presence of a positive "impingement sign" (Hawkins and Kennedy 1980). Stage 3 is characterized by a prolonged history of shoulder problems, characterized by partial and eventual complete thickness rotator cuff tears. (Hawkins and Kennedy 1980).

Petri et al. (1987) believe there is no proven best treatment for the painful shoulder. Shrode (1994) also agrees that shoulder experts are still not in complete agreement regarding the management and diagnosis of shoulder pain. Stage 3 often requires surgery (Jobe 1997 and Hawkins and Abrams 1987) and full recovery takes approximately 1 year from the date of surgery. (Jobe 1997)

An adjustment has two uses: 1) to relieve pain resulting from joint dysfunction and 2) to restore the range of motion to a joint whose function is impaired (Panzer 1995: 424).

According to Fu et al. (1991), restoration of the synchronous motion of the three joints about the shoulder to prevent impingement or subluxation is an important aspect of treatment of impingment syndrome. It seems logical, therefore, that an adjustment is capable of improving the joint dysfunction associated with impingement syndrome.

1.2 Aims and Objectives of the study

AIMS:

The aim of this study is to evaluate the relative effectiveness of shoulder adjustment with respect to the patient's perception and objective clinical findings as compared to placebo ultrasound in the treatment of patients with shoulder impingement syndrome.

OBJECTIVES:

1) To determine the efficacy of shoulder adjustment as opposed to placebo ultrasound in terms of objective clinical findings to ascertain a more effective approach in the treatment of shoulder impingement syndrome.

2) To determine the efficacy of shoulder adjustment as opposed to placebo ultrasound in terms of subjective clinical findings to ascertain a more effective approach in the treatment of shoulder impingement syndrome.

3) To integrate the objective and subjective data in order to determine the relative effectiveness of shoulder adjustment versus placebo ultrasound in the treatment of shoulder impingement syndrome.

1.3 Benefits of this study

The scientific community is of the opinion that studies concerning manipulative treatments are inconclusive and that there is a strong need for good quality clinical research in this field. (Haldeman 1992)

The treatment protocol explored in this study could provide a possible alternative to more invasive treatment protocols currently used.

An extensive review of the literature revealed contradictory information pertaining to the treatment of impingement syndrome of the shoulder. The benefits of this pilot study are that it should serve to open the way for future research into this field as well as providing alternative effective treatment options.

It must be emphasized that this is a pilot study. What the author hopes to achieve is to point toward possible relevance and the understanding in the treatment of impingement syndrome of the shoulder.

CHAPTER 2 : REVIEW OF THE RELATED LITERATURE

2.1 INTRODUCTION

The most common chronic shoulder injury in the athlete is the rotator cuff impingement syndrome. (Schwellnus et al. 1994)

In his literature review discussing painful shoulder conditions, Bennet (1983) comments that unsatisfactory treatment will result in impairing the quality of life and job performance. Whilst doing a double blind study on the successful treatment of shoulder pain syndrome using transdermal nitroglycerin, Berrazueta et al. (1996) stated how improper management results in an important social and economic cost.

Only one article on the use of manipulation was found in the literature and that was an anecdotal case by Shrode (1994). Shrode (1994) mentions that shoulder experts are still not in complete agreement regarding the management and diagnosis of shoulder pain.

2.2 INCIDENCE AND PREVALENCE

Impingement syndrome of the shoulder is one of the most common causes of shoulder pain and dysfunction (Altchek and Carson 1997). According to Jobe and Jobe (1983), it is the most common shoulder problem in sports medicine. It affects individuals subjecting their shoulders to repeated stress, athletes and many middle-aged and elderly persons in whom a cause may not be apparent (Vecchio et el. 1993).

In a cross-Canada survey of major swimming clubs, involving 2 496 swimmers, 15% at the time of the survey were having significant shoulder disability primarily due to impingement as it related to the butterfly and freestyle strokes (Hawkins and Kennedy 1974). However, according to Hawkins and Kennedy (1980), even the weekend athlete, following a vigorous game of tennis, may find himself suffering from the same underlying pathology.

In a survey by Van der Windt et al. in 1995, eighteen general practitioners representing a population of 35150 patients participated in an observational study to study the incidence and management of intrinsic shoulder disorders in Dutch general practice. During a period of one year the 18 general practitioners recorded 754 consultations concerning shoulder complaints in 472 patients; 392 of the patients presented with an incident complaint. The cumulative incidence of shoulder complaints was calculated and the incidence estimated at 14.7 per 1000 per year. The incidence of shoulder complaints was greater for women than for men and peaked in the age category 45-64 years. The subacromial impingement syndrome was the disorder diagnosed most frequently, in particular rotator cuff tendonitis (29%). (Van der Windt et al. in 1995.)

2.3 AETIOLOGY

According to Fu et al. (1991), the aetiology of injury to the rotator cuff is still under debate, however two main theories exist; extrinsic and intrinsic mechanisms of injury. Extrinsic causes are from the outside the rotator cuff. Intrinsic causes are a primary breakdown of the cuff. Extrinsic and intrinsic injuries to the rotator cuff are exacerbated by overuse syndromes. Primary and secondary causes of impingement lead to an indistinguishable tendonitis pattern. (Fu et al. 1991.)

2.3.1 Extrinsic causes

Extrinsic causes are forces acting outside the rotator cuff, such as the acromion, causing repetitive injury to the tendon and subsequent secondary changes within the tendon. This can either be a primary problem secondary to changes of the coracoacromial arch, or it can be secondary, caused by instability of the glenohumeral joint and a functional decrease in the size of the supraspinatus outlet. Primary impingement of the supraspinatus tendon on the coraco-acromial arch is responsible in the majority of non-athletic cases. (Fu et al. 1991.)

In 1972, Neer reported that impingement was associated with alterations on the undersurface of the anterior third of the acromion, the coracoacromial ligaments and sometimes the acromioclavicular joint. He demonstrated that the functional arc of elevation of the shoulder is forward, and that impingement occurs predominantly against the anterior edge of the acromion and the coracoacromial ligament. Internal rotation in the forward flexed position tends to drive the greater tuberosity farther under the coracoacromial arch so that the impingement area becomes directly under the coracoacromial ligament. The greater tuberosity also impinges against the lateral acromion and against the undersurface of the acromioclavicular joint with progressive abduction (Hawkins and Kennedy 1980).

Bigliani and Morrison (1986) reported on a morphologic study in which the variation in shape of the acromion was correlated with tears of the rotator cuff. They described three types of acromions. Type III, the "hook-type", was noted to be present in a higher frequency in complete tears of the rotator cuff.

Secondary impingement is defined by Jobe and Kvitne (1989) as a relative decrease in the supraspinatus outlet caused by instability of the glenohumeral joint. This is more common in younger patients, especially the throwing athletes (Fu et al. 1991). "Overhead" athletes place tremendous stresses on the dynamic and static stabilizers of their shoulders. These repetitive stresses result in microtrauma to the glenohumeral ligaments, eventually leading to attenuation of these structures. Without these static stabilizers, a mild instability pattern develops, placing increased demands on the rotator cuff. Fatigue of the rotator cuff allows the humeral head to translate anteriorly, and secondary mechanical impingement of the supraspinatus tendon on the coracoacromial arch can occur. The inflammatory changes proceed from this point. (Fu et al. 1991.)

Andrews et al. (1985) also theorized a role for the long head of the biceps in controlling superior humeral head translation with secondary impingement.

The soft tissues composing the subacromial "joint" are the rotator cuff, the long head of the biceps tendon, and the subacromial-deltoid bursa. Depending on the offending activity, each of these can become pathologically involved, alone or in combination. (Hawkins and Abrams 1987.)

Altchek and Carson (1997) identified other causes of decreased space within the supraspinatus outlet including osteophytes of the acromioclavicular joint, hypertrophy and enthesopathy of the coracoacromial ligament; os acromiale; malunion of the greater tuberosity, distal clavicle, or acromion; inflammatory bursitis; thickening of the rotator cuff; and a flap of rotator cuff secondary to a partial tear on the bursal side. All of these conditions have a significant impact on and decrease the overall volume of the subacromial space and the space available for the tendons of the rotator cuff, leading to eventual degeneration and tearing. (Altchek and Carson 1997.)

2.3.2 Intrinsic causes

According to Fu et al. (1991), inflammatory changes in the rotator cuff are probably a contributing factor to extrinsic and intrinsic causes and the main contributing factors in production of such tendonitis include over stress, impingement of the tendons and diminished blood supply. The area of relative ischemia of the supraspinatus tendon is the zone where the majority of rotator cuff pathologic changes are noted.

In addition to age related decrease in vascularity, upper extremity positioning has been shown to affect the circulation within the cuff (Rathbun and Macnab 1970). Rathbun and Macnab (1970) performed micropaque injection studies within the subclavian artery supplying the rotator cuff and identified a zone of avascularity within the supraspinatus tendon extending just proximal to the insertion on the greater tuberosity. This avascular area was positional. With the upper extremity at the side, this constant area of avascularity was clearly illustrated. With abduction, the vasculature of the supraspinatus tendon would perfuse normally (Rathbun and Macnab 1970.)

Micropaque studies of the biceps tendon demonstrated similar properties of its intercapsular portion (Rathbun and Macnab 1970). Anatomically, these structures are intimately related and compose the "critical Zone" as they pass over the humeral head directly beneath the impingement area. Rathbun and Macnab (1970) postulated predictable degeneration of these tendons as a result of a constant avascular pattern as these tendons are used in the dependent position.

Altchek and Carson (1997) have proposed that the initial stages of impingement syndrome are caused by either an injury to or repetitive microtrauma of the rotator cuff. This injury causes a weakened and dysfunctional rotator cuff. Imbalance of the shoulder musculature between the weakened rotator cuff and a normal deltoid causes abnormal superior migration of the humeral head during arm elevation. The tuberosity repetitively abuts the coracoacromial arch, resulting over a long period of time in bony hypertrophy of the coracoacromial arch and tuberosity as well as further injury to the rotator cuff (Altchek and Carson 1997).

It seem logical that the avascular region of the two tendons is extremely vulnerable to this process of mechanical impingement and that the theories may be complimentary and dependent on each other to explain the impingement syndrome. Thus, chronic irritation in the avascular region of the supraspinatus tendon leads to an initial inflammatory response reflected in tendonitis (Hawkins and Kennedy 1980).

2.4 PATHOPHYSIOLOGY

Regardless of the mechanism of injury that initiates the impingement syndrome, there is a common pathophysiologic pathway at the microscopic level. Mechanical impingement, either primary or secondary, results in rotator cuff tendonitis and initiation of inflammatory changes (Fu et al. 1991).

Overuse, repetitive subacromial loading, and a vulnerable region of vascularity result in tendonitis (Hawkins and Abrams 1987). Overuse syndrome, whereby athletes train for a particular activity at the limits of physiologic range of motion, is directly responsible for tendonitis of the rotator cuff. The additive effects of these repetitive eccentric traction loads cause microtrauma to the supraspinatus

tendon. This microtrauma triggers the inflammatory pathway. Initially after injury, there is a transitory vasoconstriction. This is followed by a vasodilation and influx of the acute mediators of inflammation. Repetition, as in training, performing, or vocation, will not allow healing of the traumatized tissue, so chronic inflammation and tendonitis ensue. Eventually, neutral proteinases are released into the area by macrophages, leading to tissue destruction. (Herring and Wilson 1987.)

The supraspinatus tendon passes under the coracoacromial arch through a rigid and inextensible canal. Repetitive movement associated with certain activities may fray the muscle and its tendon because of friction created in its ring (Jacobson et al. 1989). The injury of the muscle is followed by the contraction of its antagonist muscles to immobilize the joint (Jacobson et al. 1989). The unusual blood supply also contributes to the supraspinatus muscle vulnerability to injury (Lohr and Uhthoff 1990). These changes contribute to inflammation of the rotator cuff, the basic lesion in the shoulder impingement syndrome (Fu et al. 1991).

With time and the progression of wearing and attrition, microtears and partial thickness rotator cuff tears may result. If this process continues into middle age, there may be secondary bony changes which may eventuate in complete thickness rotator cuff tears. These do not usually occur until the fifth or sixth decades in life. (Hawkins and Kennedy 1980.)

Neer (1983) has classified the impingement syndrome into three stages based on degeneration and pathology:
Stage 1 - "Edema and hemorrhage." This stage may result from excessive overhead use in sports or work. This involves usually the supraspinatus or the long head of the biceps (Jobe and Jobe 1983).

Stage 2 - "Fibrosis and tendonitis." With repeated episodes of mechanical inflammation, the bursa may become thickened and fibrotic: hence, the problem magnifies (Neer 1983).

Stage 3 - "Tears of the rotator cuff, biceps ruptures, and bone changes." With further impingement wear, incomplete or complete tears of the rotator cuff, biceps lesions, and bone alterations at the anterior acromion and greater tuberosity may occur (Neer 1983).

2.5 PERPETUATING FACTORS

The age of the athlete and the level of performance are predisposing factors to shoulder injury (Arroyo et al. 1997). The young athlete (18-35 years old) frequently has problems associated with instability and secondary impingement. The older overhead athlete often has degenerative processes associated with mechanical impingement on the coracoacromial arch (Neer 1983).

Stage 1 - This is usually observed in people younger than 25 years of age, but may occur at any age (Neer 1983).

Stage 2 - This lesion is common and is characteristically found in athletes ranging from 25 to 40 years of age. The shoulder functions satisfactorily for light activity but becomes symptomatic after vigorous overhead use. (Neer 1983).

Stage 3 - These lesions are found almost exclusively in patients older than 40 years of age (Neer 1983).

2.6 DIAGNOSIS OF IMPINGEMENT SYNDROME

The diagnosis of impingement syndrome rests mainly on clinical findings (Patte 1990). To date there are no conclusive invasive or noninvasive tests to diagnose the stage of impingement (Sklaar 1995).

Arthrography is the most reliable method for detecting a complete tear of the rotator cuff (Neer 1983). They are positive in full-thickness tears. The dye leaks through the defect and can be seen lying outside the cuff, usually adjacent to the undersurface of the acromion. In partial thickness tears of earlier stages of degeneration, arthrograms are usually negative (Hawkins and Kennedy 1980).

Abnormalities on the roentgenogram often lag behind the clinical course of impingement. Earlier stages of impingement often exhibit normal roentgenograms. The more significant roentgenographic findings found in some patients with stage 3 are: (1) cystic changes about the greater tuberosity; (2) sclerotic changes beneath the anterior third of the acromion; (3) osteophytes along the undersurface of the acromion, often associated with the coracoacromial ligament; (4) acromioclavicular joint changes; and (5) late narrowing of the subacromial space. (Hawkins and Abrams 1987.)

With a complete thickness rotator cuff tear there is frequently sclerosis, osteophyte formation and cystic degeneration on the acromion and on the greater tuberosity. Degeneration of the acromioclavicular joint with osteophytic formation on the clavicle and the acromion are most often present. Depending on the size of the rotator cuff tear, the distance between the acromion and humeral head is frequently diminished. Some of these changes we see on plain x-ray films may be present in Stage III lesions, but to a lesser degree. (Hawkins and Kennedy 1980.)

Double-contrast studies, sometimes with associated tomograms, have been helpful to evaluate the size of tears, as well as diagnosing partial tears. Ultrasound has been used to identify rotator cuff defects. The introduction of the arthroscope into both the subacromial space and the glenohumeral joint can diagnose cuff and biceps pathology. (Hawkins and Abrams 1987.)

2.7 EXAMINATION

The most important clinical sign in the diagnosis is a positive Neer's impingement sign. The diagnosis can be comfirmed by a positive Neer's impingement test (Schwellnus et al. 1994). The impingement sign consists of reproduction of pain when the arm is forcibly forward flexed by the examiner, jamming the greater tuberosity against the anteroinferior surface of the acromion. This maneuver causes pain in patients with impingement lesions of all stages. Relief of pain by injecting 10 ml of 1% lidocaine beneath the anterior acromion helps confirm the diagnosis of impingement. (Neer 1983.) Another method of demonstrating this impingement involves forward flexing the humerus to 90 degrees and forcibly internally rotating the shoulder. This maneuver drives the greater tuberosity farther under the coracoacromial ligament, similarly reproducing the impingement pain. (Hawkins and Kennedy 1980.)

A positive straight arm raising test, or "Speeds sign", which consists of forward flexion of the humerus with the elbow extended, and a positive resisted supination forearm test, or "Yergason's sign", will produce pain in the area of the bicipital groove when there is bicipital involvement (Hawkins and Abrams 1987).

The supraspinatus test is performed by first assessing the deltoid with the arm at 90 degrees of abduction and neutral rotation. The shoulder is then internally rotated and angled forward 30 degrees, with the thumbs pointing towards the floor. Muscle testing against resistance demonstrates a weakness or insufficiency of the supraspinatus secondary to a tear or pain associated with rotator cuff impingement. (Jobe and Jobe 1983).

2.8 CLINICAL CHARACTERISTICS OF IMPINGEMENT SYNDROME

2.8.1 Stage 1

Initially, the pain is described as a dull ache about the shoulder following strenuous activity. This pain may progress to discomfort during sport or activity, eventually affecting performance and interfering with sleep. (Hawkins and Abrams 1987.)

If the supraspinatus tendon is primarily involved, the important positive clinical signs are: (1) point tenderness over the greater tuberosity and usually the anterior acromion; (2) a painful arc of abduction, maximum at 90 degrees; and (3) the presence of a positive "impingement sign". (Hawkins and Kennedy 1980).

If the biceps tendon is also involved there will be (1) tenderness over the biceps tendon; (2) a positive straight arm raising test; and (3) a positive resisted supination forearm test. (Hawkins and Kennedy 1980).

2.8.2 Stage 2

Chronic inflammation or repeated intermittent episodes of impingement can lead to stage 2. The symptoms similarly consist of an aching discomfort frequently worse at night and interfering with sleep, and may progress to interfere with activities of daily living. (Hawkins and Abrams 1987.)

The clinical picture and consequent physical signs, including a positive impingement sign, are present as in stage 1. There is more commonly a stiffer shoulder with sometimes acromioclavicular joint tenderness. There may also be

a peculiar painful catching sensation as the arm is brought down from the abducted position, probably representing catching of the scar tissue under the impingement area. (Hawkins and Kennedy 1980.)

In addition, there is a greater degree of soft-tissue crepitus, due to scarring in the subacromial space, and mild limitation to both passive and active range of motion. (Hawkins and Abrams 1987.)

The shoulder functions satisfactorily for light activity but becomes symptomatic after vigorous overhead use (Neer 1983).

2.8.3 Stage 3

Stage 3 is characterized by a prolonged history of shoulder problems, characterized by refractory tendonitis, wearing and attrition of the supraspinatus and frequently biceps tendon, and partial and eventual complete thickness rotator cuff tears. (Hawkins and Kennedy 1980).

Symptoms may manifest as pain, minimal or severe, toothache-like in nature, often worse at night, and frequently prohibiting activities. This may be associated with or without complaints of weakness depending on the integrity of the rotator cuff. (Hawkins and Kennedy 1980.)

Frequently, all of the previous signs as described in stages 1 and 2 are present, particularly the presence of the impingement sign. However, these patients generally have more pain and stiffness, they do not have true but more pain-related weakness, and there is frequently bicipital findings and occasionally acromioclavicular tenderness. (Hawkins and Kennedy 1980.)

A minor insult at this stage may extend a degenerative or partial thickness tear, manifesting as sudden weakness with a diminished range of motion of the shoulder, often with an inability to elevate the arm. A complete thickness cuff tear may have minimal or significant pain, but always with the presence of a long history of shoulder problems. (Hawkins and Kennedy 1980.)

There may be varying amounts of weakness and inability to elevate the arm. The most common reliable signs include: (1) infraspinatis and supraspinatus wasting; (2) tenderness over the greater tuberosity and anterior acromion; (3) tenderness usually over the acromioclavicular joint; (4) a painful arc maximum at 90 degrees; (5) limited active but fuller passive range of motion, particularly related to abduction and external rotation; and (6) associated weakness of abduction and external rotation. The impingement sign is often dramatically positive since patients usually do have a full passive range of motion and is easily demonstrated. (Hawkins and Kennedy 1980.)

2.9 TREATMENT

According to Hawkins and Abrams (1987) the majority of patients with impingement respond to conservative treatment. However Petri et al. (1987) believes there is no proven best treatment for the painful shoulder. Shrode (1994) also agrees that shoulder experts are still not in complete agreement regarding the management and diagnosis of shoulder pain.

2.9.1 Stage 1

Neer (1983), Hawkins and Abrams (1987) and Fu et al. (1991) reported that stage 1 is a reversible lesion when participation in the appropriate rehabilitation takes place. Jobe (1997) reported that this often takes only 2 to 3 weeks.

According to Fu et al. (1991), the principles of rehabilitation are to restore basic joint function and to allow initial healing of inflamed tissue. They are designed to reverse immobility and restore neuromuscular balance in the shoulder girdle. Restoration of the synchronous motion of the three joints about the shoulder to prevent impingement or subluxation is an important aspect of this phase of treatment. Proprioceptive neuromuscular facilitation is designed to correct deficiencies in strength, flexibility, and coordination. (Fu et al. 1991.)

The inflamed rotator cuff must be protected from further aggravation with activity modification (Fu et al. 1991). Hawkins and Abrams (1987) suggested that occasionally, heat application and warm-up exercises prior to practice would be helpful prior to indulging in exertional activity. Warming up improves local nutrition and circulation prior to workout (Hawkins and Abrams 1987). Hawkins and Kennedy (1980) reported that ice should be used after workouts and that ultrasound may be useful in the treatment of impingement syndrome.

A randomized clinical trial was designed by Herrera-Lasso et al. (1993) to compare the effectiveness of ultrasound versus transcutaneous electrical nerve stimulation. The patients however received packages of treatment including pendular exercises and therapeutic heat. A statistically significant improvement in pain and range of flexion was shown for both packages of treatment but no statistically significant difference was found between them. (Herrera-Lasso et al. 1993). A randomized, double-blind, placebo-controlled study by Nykanen (1995) was carried out to study the effect of pulsed ultrasound in the painful shoulder. There was no significant difference between the placebo or treatment groups after the treatment period or at follow-ups. Other lesions may have been present and heat and massage was also given. This therefore could have obscured results. (Nykanen 1995).

The ultrasound dosage to biceps and supraspinatus tendons varies depending upon the amount of interposing tissue. The biceps tendon which is more superficial requires between 0.8 and 1.2 w/cm for 5 minutes daily for 10 days. The supraspinatus tendon requires 1.2 to 1.5 w/cm for 5 minutes daily for 10 days. (Hawkins and Kennedy 1974).

In a randomized, double-blind, placebo-controlled study by Saunders (1995), the efficacy of low-level laser therapy was evaluated in supraspinatus tendonitis. The study only had 24 patients, but the results revealed that the treatment group had less pain, less weakness and less tenderness. In another randomized, double-blind, placebo-controlled study of the effectiveness of low level laser treatment of rotator cuff tendonitis, however, Vecchio et al. (1993) found all patients to improve from baseline, but found no difference between the two groups.

Hawkins and Kennedy (1980) also suggested that anti-inflammatory agents and local steroid injections may help, but the literature again has conflicting opinions.

The effect of triamcinolone versus naproxen therapy was compared in a randomized, double-blind, placebo-controlled study (Petri et al. 1987). It was concluded that both gave significantly better results than placebo in the treatment of the painful shoulder (Petri et al. 1987). This study was not specifically for patients with impingement syndrome, so there could have been a variety of disorders. In another double blind study done by Berrazeuta et al. (1996) transdermal nitroglycerin was found to be significantly more effective than placebo for the treatment of painful shoulders. Again this study was not specifically for impingement syndrome.

Blair et al. (1996) carried out a prospective, randomized, controlled, double-blind study to determine the efficacy of injections of corticosteroids for subacromial impingement syndrome. This was found to substantially decrease pain and increase range of motion. In this study, however, both treatment groups had physical therapy as well. (Blair et al. 1996).

Shrode (1994) treated a 16 year old female suffering from a 4 month history of shoulder pain. A clinical diagnosis of bilateral stage 1 impingement of the shoulder was made. The patient was given the supraspinatus synchronization exercise, chiropractic manipulative therapy, ice, high voltage electrical muscle stimulation and rehabilitation exercise band exercises were also used. The patient was treated for seven treatments over a 4 week period with resolution of the condition. (Shrode 1994).

2.9.2 Stage 2

As stage 2 symptoms become evident, a greater emphasis is placed on range of motion and flexibility. According to Hawkins and Abrams (1987) this stage is not reversible by activity modification and time. The goals are to control symptoms, using conservative measures as in stage 1, and maintain range of motion, allowing for reasonable function. Patients often gain symptomatic control with conservative measures, but occasionally require decompression. (Hawkins and Abrams 1987.) Surgery is considered for this type of disability only when it has persisted in spite of conservative treatment for 18 months (Neer 1983).

2.9.3 Stage 3

In stage 3, strengthening is emphasized along with pain control and flexibility (Hawkins and Abrams 1987). Stage 3 however often requires surgery (Jobe

1997 and Hawkins and Abrams 1987). A complete-thickness rotator cuff tear presenting with persistent pain and weakness for more than three months in the older athlete might suggest surgical repair (Hawkins and Kennedy 1980).

Arthroscopic subacromial decompression / acromioplasty is becoming the standard of orthopaedic care when conservative measures have failed (Altchek and Carson 1997). Surgical procedures to achieve decompression include: coracoacromial resection, anterior acromioplasty, distal clavicle resection, and acromioclavicular joint inferior osteophyte resection (Hawkins and Abrams 1987). The goal of decompression of the subacromial space is pain relief. Improvement of function and limitation of progression are secondary goals. (Hawkins and Abrams 1987.) Tibone et al. (1986) reported pain relief post-operatively of 76%, however only 32% of the professional pitchers were able to return to the same level of competition after surgery.

A careful postoperative rehabilitation program is critical to the success of surgery (Hawkins and Abrams 1987). It begins with the most basic of activities and progresses to the most sophisticated. Full recovery however takes approximately 1 year from the date of surgery (Jobe 1997).

2.10 SUMMARY

Impingement syndrome of the shoulder is a common problem, especially in athletes. The majority of patients do respond to conservative care, however there are many conflicting ideas about what is the correct treatment for the patient. There does not appear to be a study comparing the relative effectiveness of the chiropractic adjustment in the treatment of impingement syndrome, only the anecdotal case by Shrode in 1994.

The aim of this dissertation will be to compare an adjustment versus placebo ultrasound in the treatment of impingement syndrome, in attempt to find out if the adjustment is more effective, not only as a primary therapy, but also as an adjunctive therapy for this common and distressing problem.

CHAPTER 3: MATERIALS AND METHODS

3.1 INTRODUCTION

This study was designed as a comparative, clinical trial, involving a sample group of 30 patients. The objective was to compare two treatment groups (shoulder adjustment versus placebo ultrasound) to assess for intra-group improvement. On conclusion of the treatment protocols, an inter-group statistical analysis was performed to determine whether one treatment protocol was more effective than the other. The more effective treatment group could then be used as either the primary treatment for impingement syndrome of the shoulder or it could be used as an adjunct to other treatment options.

3.2 THE SUBJECTS

Patients were obtained by means of consecutive sampling, using advertisements posted around the Technikon Campus and in local swimming magazines. No restrictions were placed on a patient's sex, racial group, income bracket or area of residence.

Any patient presenting to the clinic with shoulder pain, under the age of forty was considered a potential candidate for the study. These patients were then briefly screened and further investigations took place only if the researcher deemed the patient suitable for the study. The screening procedure involved questioning the patient on the cause of injury, and a brief range of motion assessment of the shoulder girdle.

3.3 INCLUSION AND EXCLUSION CRITERIA OF PATIENTS

1) Patients had to be younger than forty years of age.

2) Only patients diagnosed by the researcher as having impingement syndrome of the shoulder were considered.

3) Any patient suffering from a local or systemic pathology would not be eligible for this study.

4) Patients were not allowed to have had any treatment for the shoulder within the previous six weeks and were not allowed to take any analgesics for the duration of their participation.

5) The patient's condition had to comply with at least three of the following four physical findings:

- Palpable tenderness over the greater tuberosity;
- Palpable tenderness along the anterior edge of the acromion;
- A painful arc of abduction between 60 and 120 degrees; and
- A positive impingement sign.

6) Patients were excluded:

- if there was a history of traumatic shoulder dislocation, or if their injury involved any clicks or pops.
- if there were palpable clicks or other sounds on examination that may suggest a loose body.

- if there was any weakness to resistance in internal rotation and abduction of the shoulder.
- if the pain radiated distally, below the elbow.
- if there was a history of surgery in the previous two years.

Patients had to comply with all of the inclusion criteria in order to be accepted into the research program.

3.4 THE SAMPLE GROUP

A sample of thirty patients was randomly divided into two groups of fifteen according to the process of randomization as described by Scott-Dawkins (1995). Fifteen labels representing shoulder adjustment and fifteen representing placebo ultrasound were folded such that they were obscured and then put into a hat. Before the first patient was treated, all thirty cards were drawn consecutively to determine the order as to what group each patient was assigned to upon acceptance into the study. The patients were told that they had either joined the adjustment group or the ultrasound group. The position of any patient that dropped out was then replaced by the next new patient joining the study.

Patients who passed the initial screening test and inclusion criteria underwent a detailed case history (appendix B), physical examination (appendix C) , cervical spine regional examination (appendix D) and shoulder regional examination (appendix E). If, after this consultation the patient was still deemed acceptable, a series of eight treatments within a three week period were booked. A follow-up appointment was then scheduled for one month after the eighth treatment.

3.5 INTERVENTIONS

Group A received placebo ultrasound while group B received shoulder adjustments. The patients in group A and group B had their shoulders assessed by the method described by Schafer and Faye (1990:332-352) and the direction of any restrictions were noted.

The patients in group A were required to sit in a comfortable position with their shoulder girdle exposed during the treatment. The ultrasound unit was set on zero, and the time set to 6 minutes.

The patients in group B were required to sit in a comfortable position with their shoulder girdle exposed. Their shoulder girdle was adjusted in the direction of the fixation as described by Schafer and Faye (1990:332-352).

If any of the patients experienced a full recovery, that is a score of zero for 'worst pain experienced' in the NRS-101 questionnaire and the Short Form McGill questionnaire, no more treatments were given unless they experienced pain again within the three week treatment period.

3.6 MEASUREMENTS

3.6.1 Subjective Measures

At the initial consultation as previously stated, the case history, physical examination, cervical spine regional examination and shoulder regional examination were completed.

Each patient was required to fill out a patient consent form (appendix F) granting the researcher permission to use them in the study. In addition this ensured that each patient was given a full description of the study and their role therein. The patient was obliged to fill out the short form McGill Pain Questionnaire (appendix G) and the Numerical Pain Rating scale-101 (appendix H). These two forms subjectively assessed various aspects of the patient's pain.

At consultations two to seven, no objective or subjective measurements were administered. Only the allocated research treatment was performed on the patient. At treatment eight and at the one month follow-up, the objective and subjective measurements were repeated so that any improvement during the treatment and the duration of that improvement could be assessed.

The short form of the of the McGill Questionnaire used in this study was described by Melzack (1987) as a means of subjectively providing information regarding the sensory, effective and evaluative dimensions of the patient's pain. The short form McGill-pain questionnaire (SFMPQ) was developed to be used where detailed information regarding pain is required quickly. The questionnaire is divided into two sections. The first section consists of eleven adjectives describing the sensory dimensions of the pain. The second section consists of four adjectives representing the effective dimension of pain and was not used in the study.

The Numerical Pain Rating Scale-101 (NPRS-101) was chosen because of the ease with which it can be administered and scored. Jensen et al. (1986) established its validity and reliability when proving subjective information about the levels of pain perceived by the patient. It was used to monitor the patient's progress with a decrease in pain intensity indicating improvement.

The patient was asked to indicate, between 0 and 100, when the pain was at its worst. Likewise this was repeated on a second identical line when the pain was at its least with '0' indicating no pain and '100' indicating the most severe pain. The two values from the 'worst pain' and the 'least pain' were added together, divided by two and expressed as a percentage of 100.

3.6.2 Objective Measurements

An objective assessment of changes in the patient's condition during the treatment and after one month was required for this study. To this end two instruments, the algometer and the goniometer, were used.

Algometer readings were carried out of the most sensitive areas of the shoulder during the initial consultation while the range of motion of the shoulder was measured using the goniometer. These two instruments gave an objective assessment of the patient. The algometer and the goniometer were again used after the eighth treatment and at the one month follow-up appointment.

Fischer (1986) studied the use of the algometer in the quantification of tender spots and concluded a high reproducibility and an excellent validity of measurements obtained. According to Fischer (1986), the reliability of the algometer as a tool for the diagnosis of tender spots as well as assessment of treatment results has been documented. Fischer (1986) states that changes in the patient's pressure threshold under standard clinical conditions can be regarded as reliable data.

The algometer used in this study was the FDK20 force-dial made by Wagner Instruments (P.O. BOX 1217, Greenwhich, CT, 06836, U.S.A. Tel.: 203 869 9861) and supplied by Activator Methods Inc.

The algometer was used as follows:

- The dial on the gauge was set at zero.
- The 1cm rubber disc was placed on the point of maximum tenderness already located and documented at the first consultation.
- The patient was told to express the point at which pain is first perceived.
- The pressure was gradually increased at a rate of one kilogram per second as recommended by Fischer (1986).
- The pressure ceased as soon as the patient indicated discomfort either verbally or by withdrawing.
- The reading on the dial was then recorded on the Algometer readings form (appendix J).

The procedure for the use of the goniometer was as follows:

- The patient was made to stand with the feet positioned flat on the floor and the arms positioned in the anatomical position at the sides.
- Forward flexion was measured as the angle between the arm and the thoracic rib cage as the arm moves in a forward direction away from the body.
- Extension was measured as the angle between the arm and the thoracic rib cage as the arm moves in a backward direction away from the body.
- Abduction was measured as the angle between the arm and the thoracic rib cage as the arm moves upwards and outwards towards the ear.
- Adduction was measured as the angle between the arm and the thoracic rib cage as the arm moves inwards across the body.
- External rotation was measured with the elbow bent to 90 degrees, arm held at 90 degrees abduction, and the palm facing outwards.
- Internal rotation was measured with the elbow bent to 90 degrees, arm held at 90 degrees abduction, and the palm facing inwards.

- Horizontal abduction was measured with the arm raised to 90 degrees of abduction, then moved posteriorly as far as possible.
- Horizontal adduction was measured with the arm raised to 90 degrees of abduction, then moved anteriorly as far as possible.
- Any specific midrange arc of painful range of motion was noted.

3.7 STATISTICAL PROCEDURES

The sample size was small (30) therefore non-parametric tests were used to do the analysis. Parametric tests such as the two-sample unpaired t-test could not be used as the sample size per group was too small.

3.7.1 PROCEDURE 1: Wilcoxon sign rank test

The Wilcoxon Sign Ranked Test was used to find out whether there was any statistically significant change within group 1 and within group 2 between treatment 1 and the final treatment, between the final treatment and the follow-up appointment and finally between treatment 1 and the follow up appointment i.e.

Tx1 vs. Tx8
T8 vs. FU
Tx1 vs. FU

Hypothesis testing and the decision rule:

The null hypothesis (H°) stated that there was no significant improvement between treatments 1 and the final treatment, between the final treatment and the follow-up appointment. The alternative hypothesis (H1) stated that there would be a significant difference between the treatment intervals stated above.

H° : there was no significant difference

H1: there was a significant difference

α = 0.05= the level of significance

For a two-tailed test,

Reject H° if $P \leqslant \alpha / 2 = 0.025$

Accept H° if $P > \alpha / 2 = 0.025$

P was the observed significance level.

3.7.2 PROCEDURE 2: Mann-Whitney Unpaired tests

This test was used to make comparisons between the two experimental groups. The two groups were treated as being independent of one another. The purpose was to find out whether there was a significant difference between the two groups at the α / 2= 0.025 level of significance with respect to the goniometric readings (flexion, extension, abduction, adduction, external rotation, internal rotation, horizontal abduction and horizontal adduction), algometer readings, Numerical Pain Rating Scale-101 (the average of the worst and least pain), and the Short Form McGill Pain Questionnaire.

Hypothesis testing and the decision rule:

The null hypothesis (H°) stated that there was no significant difference between the two groups with respect to the variable of interest. The alternative hypothesis (H1) stated that there was a significant difference between the two groups.

$H^\circ : \mu 1 = \mu 2$

H1: $\mu 1$ and $\mu 2$ were significantly different from each other.

$\alpha = 0.05$ = the level of significance.

For a two-tailed test,

Reject H° if $P \leqslant \alpha / 2 = 0.025$

Accept H° if $P > \alpha / 2 = 0.025$

Note: P was the observed significance level.

3.7.3 PROCEDURE 3: Summary statistics

Summary statistics including the mean, standard deviation and standard error were obtained to support the results from the Wilcoxon's signed-rank test and the Mann-Whitney U test.

If the two statistical tests calculated any significant difference between the 2 groups, then the mean was used to identify the superior group. The reliability of the mean was then measured using the standard deviation which measures the spread of the data around the mean. The bigger the value, the bigger the spread of the values and hence the less reliable the data. The standard error was used to measure the reliability of the mean used in the statistical tests.

As the Mann-Whitney U test and the Wilcoxon Signed-rank test used the median within the calculations, the mean was used to complement the results, increasing the reliability of the statistical analysis.

3.7.4 PROCEDURE 4: Diagrammatic representation of the data

Barcharts and tables were constructed to present the major findings of the study as a visual summary. These barcharts and tables were able to give a summary of the results obtained from the Mann-Whitney and Wilcoxon signed ranked tests. The barcharts were made using the software package Microsoft EXCEL 97

SR-1 supplied by MICROSOFT CORPORATION. The tables were constructed using Microsoft Word 97 SR-1 Version 6.0 also supplied by MICROSOFT CORPORATION. Furthermore the demographic data obtained from the patient's files were displayed using bar charts and tables, again using Microsoft EXCEL 97 SR-1.

The statistical package STATGRAPHICS PLUS VERSION 6+, supplied by MANUGISTICS INC. (2115 East Jefferson Street, Rockville, Maryland, 20852, USA) were used for data entry and analysis.

CHAPTER 4: RESULTS

4.1 INTRODUCTION

This chapter will present the results obtained from the clinical trial. The first set of data represents the Demographic data obtained from the patient's files.

The second set of data represents the statistical analysis of the results. As the sample group size was thirty patients, non-parametric hypothesis testing was used. The results from the statistical analysis are tabulated to display the mean, the standard deviation, the standard error and the probability value. The P-value is compared to the level of significance, which is set at $\alpha = 0.05$, for all the tests.

The objective findings to be analyzed included the algometer and the goniometer readings of flexion, extension, abduction, adduction, external rotation and internal rotation. The subjective findings to be statistically analyzed included the Numerical Pain Rating Scale-101 and the Short Form McGill Pain Questionnaire.

4.2 DEMOGRAPHIC DATA

Figure 1: The ratio of males to females within the sample was 16:14.

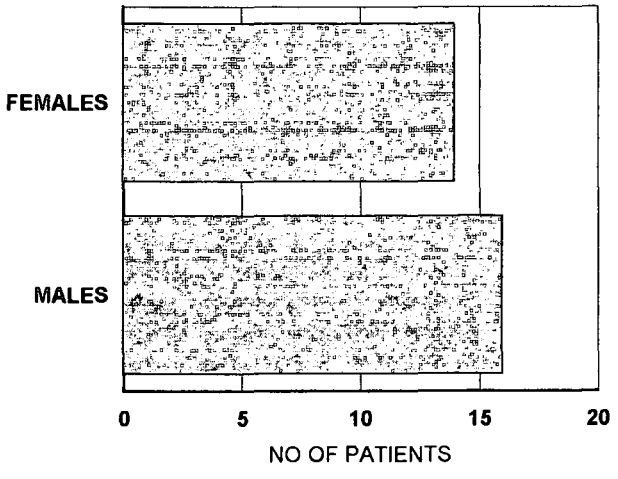


Table 1: The sport the patients participate in

	Group 1 (Placebo ultrasound)	Group 2 (Adjustment)	Total
Swimming	5	8	13
Tennis	3	2	5
Weight lifting	1	2	3
Surfing	2	0	2
Rugby	1	1	2
Waterpolo	1	1	2
Cricket	0	1	1
No sport	2	0	2

Table 2: The age distribution and gender distribution within the sample group

	GROUP 1 (PLACEBO ULTRASOUND)	GROUP 2 (ADJUSTMENT)	TOTAL
Age distribution Age range: Average age:	 19-32 23.27	 16-38 22.27	 16-38 22.77
Gender distribution Male Female	 6 9	 10 5	 16 14

Table 3: Patients who have previously been diagnosed with and treated for impingement syndrome of the shoulder

	GROUP 1 (PLACEBO ULTRASOUND)	GROUP 2 (ADJUSTMENT)	TOTAL
Previously diagnosed and treated	11	5	16
Not previously diagnosed and treated	4	10	14

4.3 THE STATISTICAL ANALYSIS

4.3.1 Abbreviations

S.D. = Standard deviation

S.E. = Standard error

P-value = The observed significance level of the test

H° = The null hypothesis

H1 = The alternate hypothesis

α = The level of significance of the test

NPRS-101 = The Numerical Pain Rating scale-101 Questionnaire

SFMGPQ = The short form McGill Pain Questionnaire

Tx 1 = Treatment one

Tx 8 = Treatment eight

FU = Follow-up appointment

H. Abd = Horizantal abduction

H. Add = Horizantal adduction

4.4 NON-PARAMETRIC HYPOTHESIS TESTING

4.4.1 INTRA-GROUP ANALYSIS: Wilcoxon signed-ranked tests

4.4.1.1 Analysis of **objective** findings of GROUP 1 (placebo ultrasound)

Table 4: The results of the Wilcoxon's signed-ranked test comparing the algometer and all goniometer readings between the first treatment and eighth treatment for Group 1

	Group 1: Placebo Ultrasound						
	Treatment 1				Treatment 8		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Goniometer							
Flexion	179.67	1.29	0.33	1.000	179.67	1.29	0.33
Extension	57.00	6.76	1.75	1.000	57.00	6.76	1.75
Abduction	174.33	8.84	2.28	0.059	177.00	5.61	1.45
Adduction	54.33	4.58	1.18	1.000	54.33	4.58	1.18
External Rotation	86.33	2.97	0.77	0.157	87.00	2.54	0.65
Internal Rotation	89.00	3.38	0.87	0.317	89.33	2.58	0.67
H. Abduction	54.33	4.95	1.28	1.000	54.33	4.95	1.28
H. Adduction	128.00	4.14	1.07	1.000	128.00	4.14	1.07
Algometer	3.07	1.64	0.33	0.036	3.49	2.03	0.37

For the goniometer readings of flexion, extension, abduction, adduction, internal and external rotation, and for the algometer reading, the null hypothesis is accepted and one can conclude that at the 95% confidence level, there was no significant objective improvement between the first and the eighth treatments.

The standard deviation shows the spread of the data around the mean value. In all instances above in both treatments, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 5: The results of the Wilcoxon's signed-ranked test comparing the algometer and all goniometer readings between the first treatment and the one month follow-up appointment for Group 1

	Group 1: Placebo Ultrasound						
	Treatment 1				Follow-up Appointment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Goniometer							
Flexion	179.67	1.29	0.33	0.317	180.00	0.00	0.00
Extension	57.00	6.76	1.75	1.000	57.00	6.76	1.75
Abduction	174.33	8.84	2.28	0.039	177.67	5.30	1.37
Adduction	54.33	4.58	1.18	1.000	54.33	4.58	1.18
External Rotation	86.33	2.97	0.77	0.083	87.33	2.58	0.67
Internal Rotation	89.00	3.38	0.87	0.317	89.67	2.29	0.60
H. Abduction	54.33	4.95	1.28	1.000	54.33	4.95	1.28
H. Adduction	128.00	4.14	1.07	1.000	128.00	4.14	1.07
Algometer	3.07	1.64	0.33	0.012	3.67	2.80	0.43

For the goniometer readings of flexion, extension, abduction, adduction, internal and external rotation, the null hypothesis is accepted and one can conclude that at the 95% confidence level, there was no significant objective improvement between the first treatment and the one month follow-up appointment.

For the algometer reading, the null hypothesis is rejected which indicates that at a 95% confidence level, one can conclude that there was significant objective improvement between the first treatment and the month follow-up appointment.

In all instances above in both treatments, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 6: The results of the Wilcoxon's signed-ranked test comparing the algometer and all goniometer readings between the eighth treatment and the one month follow-up appointment for Group 1

	Group 1: Placebo Ultrasound						
	Treatment 8				Follow-up Appointment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Goniometer							
Flexion	179.67	1.29	0.33	0.317	180.00	0.00	0.00
Extension	57.00	6.76	1.75	1.000	57.00	6.76	1.75
Abduction	177.00	5.61	1.45	0.317	177.67	5.30	1.37
Adduction	54.33	4.58	1.18	1.000	54.33	4.58	1.18
External Rotation	87.00	2.54	0.65	0.317	87.33	2.58	0.67
Internal Rotation	89.33	2.58	0.67	0.317	89.67	2.29	0.60
H. Abduction	54.33	4.95	1.28	1.000	54.33	4.95	1.28
H. Adduction	128.00	4.14	1.07	1.000	128.00	4.14	1.07
Algometer	3.49	2.03	0.37	0.248	3.67	2.80	0.43

For the goniometer readings of flexion, extension, abduction, adduction, internal and external rotation, and for the algometer reading, the null hypothesis is accepted

and one can conclude that at the 95% confidence level, there was no significant objective improvement between the eighth treatment and the one month follow-up appointment.

In all instances above in both treatments, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

4.4.1.2 Analysis of **subjective** findings of GROUP 1 (Placebo Ultrasound)

Table 7: The results of the Wilcoxon's signed-rank test comparing the Numerical Pain Rating Scale-101 (NPRS-101) and the Short Form McGill Pain Questionnaire (SFMGPQ) between the first and the eighth treatment.

	Group 1: Placebo Ultrasound						
	Treatment 1				Treatment 8		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
NPRS-101	49.00	19.52	5.04	0.001	24.00	11.72	3.03
SFMGPQ	27.34	11.27	2.91	0.001	19.10	12.63	3.26

For the NPRS-101 and the SFMGPQ, the null hypothesis is rejected and one can conclude that at a 95 % confidence level, there was significant improvement between treatments one and eight.

The standard deviation of the SFMGPQ showed that the spread of the data around the mean, was similar enough to render the two sets of data reliable and comparable.

There was a slight difference between the standard deviations of the NPRS-101 (Tx 1: 19.52 vs.. Tx 8: 11.72). Treatment 1 showed greater spread around the mean. This data is therefore more unreliable than that of treatment 2.

Table 8: The results of the Wilcoxon's signed-rank test comparing the Numerical Pain Rating Scale-101 (NPRS-101) and the Short Form McGill Pain Questionnaire (SFMGPQ) between the first treatment and the one month follow-up appointment.

	Group 1: Placebo Ultrasound						
	Treatment 1				Follow-up Appointment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
NPRS-101	49.00	19.52	5.04	0.001	19.83	12.26	3.17
SFMGPQ	27.34	11.27	2.91	0.001	16.57	12.29	3.17

For the NPRS-101 and the SFMGPQ, the null hypothesis is rejected and one can conclude that at a 95 % confidence level, there was significant improvement between treatments one and the one month follow-up appointment.

The standard deviation of the SFMGPQ showed that the spread of the data around the mean, was similar enough to render the two sets of data reliable and comparable.

There was a slight difference between the standard deviations of the NPRS-101 (Tx 1: 19.52 vs.. Tx 8: 12.26). Treatment 1 showed greater spread around the mean. This data is therefore more unreliable than that of the follow-up appointment.

Table 9: The results of the Wilcoxon's signed-rank test comparing the Numerical Pain Rating Scale-101 (NPRS-101) and the Short Form McGill Pain Questionnaire (SFMGPQ) between the eighth treatment and the one month follow-up appointment.

	Group 1: Placebo Ultrasound						
	Treatment 8				Follow-up Appointment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
NPRS-101	24.00	24.00	11.72	0.011	19.83	12.26	3.17
SFMGPQ	19.10	19.10	12.63	0.020	16.57	12.29	3.17

For the NPRS-101 and the SFMGPQ, the null hypothesis is rejected and one can conclude that at a 95 % confidence level, there was significant improvement between treatments eight and the one month follow-up appointment.

There were slight differences between the standard deviations of the NPRS-101 (Tx 8: 24.00 vs.. Follow-up: 12.26) and the SFMGPQ (Tx 8: 19.10 vs.. Follow-up: 12.29). Treatment 8 showed greater spread around the means. This data is therefore more unreliable than that of the follow-up appointment.

4.4.1.3 Analysis of objective findings of GROUP 2 (adjustment)

Table 10: The results of the Wilcoxon's signed-ranked test comparing the algometer and all goniometer readings between the first and eighth treatments for Group 2

	Group 2: Adjustment						
	Treatment 1				Treatment 8		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Goniometer							
Flexion	179.33	2.58	0.67	0.317	179.67	1.29	0.33
Extension	56.00	5.41	1.40	1.000	56.00	5.41	1.40
Abduction	166.00	20.55	5.31	0.027	172.67	15.68	4.05
Adduction	50.67	4.95	1.28	1.000	50.67	4.95	1.28
External Rotation	85.00	4.63	1.20	0.257	86.00	3.87	1.00
Internal Rotation	87.33	4.17	1.08	1.000	87.33	4.17	1.08
H. Abduction	51.67	5.88	1.52	1.000	51.67	5.88	1.52
H. Adduction	125.67	8.21	2.12	1.000	125.67	8.21	2.12
Algometer	3.97	1.44	0.31	0.011	4.81	2.27	0.39

For the goniometer readings of flexion, extension, abduction, adduction, internal and external rotation, the null hypothesis is accepted and one can conclude that at the 95% confidence level, there was no significant objective improvement between the first and the eighth treatments.

For the algometer reading, the null hypothesis is rejected which indicates that at a 95% confidence level, one can conclude that there was significant objective improvement between the first and the eighth treatments.

In all instances above in both treatments, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 11: The results of the Wilcoxon's signed-ranked test comparing the algometer and all goniometer readings between the first treatment and the one month follow-up appointment for Group 2

	Group 2: Adjustment						
	Treatment 1				Follow-up Appointment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Goniometer							
Flexion	179.33	2.58	0.67	0.317	179.67	1.29	0.33
Extension	56.00	5.41	1.40	1.000	56.00	5.41	1.40
Abduction	166.00	20.55	5.31	0.016	174.00	15.38	3.97
Adduction	50.67	4.95	1.28	1.000	50.67	4.95	1.28
External Rotation	85.00	4.63	1.20	0.257	86.00	3.87	1.00
Internal Rotation	87.33	4.17	1.08	1.000	87.33	4.17	1.08
H. Abduction	51.67	5.88	1.52	1.000	51.67	5.88	1.52
H. Adduction	125.67	8.21	2.12	1.000	125.67	8.21	2.12
Algometer	3.97	1.44	0.31	0.003	5.94	5.70	0.62

For the goniometer readings of flexion, extension, adduction, internal and external rotation, the null hypothesis is accepted and one can conclude that at the 95% confidence level, there was no significant objective improvement between the first treatment and the one month follow-up appointment.

For the goniometer readings of abduction, and the algometer reading, the null hypothesis is rejected which indicates that at a 95% confidence level, one can conclude that there was significant objective improvement between the first treatment and the one month follow-up appointment.

In all instances above in both treatments, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 12: The results of the Wilcoxon's signed-ranked test comparing the algometer and all goniometer readings between the eighth treatment and the one month follow-up appointment for Group 2

	Group 2: Adjustment						
	Treatment 8				Follow-up Appointment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Goniometer							
Flexion	179.67	1.29	0.33	1.000	179.67	1.29	0.33
Extension	56.00	5.41	1.40	1.000	56.00	5.41	1.40
Abduction	172.67	15.68	4.05	0.317	174.00	15.38	3.97
Adduction	50.67	4.95	1.28	1.000	50.67	4.95	1.28
External Rotation	86.00	3.87	1.00	1.000	86.00	3.87	1.00
Internal Rotation	87.33	4.17	1.08	1.000	87.33	4.17	1.08
H. Abduction	51.67	5.88	1.52	1.000	51.67	5.88	1.52
H. Adduction	125.67	8.21	2.12	1.000	125.67	8.21	2.12
Algometer	4.81	2.27	0.39	0.003	5.94	5.70	0.62

For the goniometer readings of flexion, extension, abduction, adduction, internal and external rotation, the null hypothesis is accepted and one can conclude that at the 95% confidence level, there was no significant objective improvement between the eighth treatment and the one month follow-up appointment.

For the algometer reading, the null hypothesis is rejected which indicates that at a 95% confidence level, one can conclude that there was significant objective improvement between the eighth treatment and the one month follow-up appointment.

In all instances above in both treatments, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

4.1.1.4 Analysis of **subjective** findings of GROUP 2 (adjustment)

Table 13: The results of the Wilcoxon's signed-rank test comparing the Numerical Pain Rating Scale-101 (NPRS-101) and the Short Form McGill Pain Questionnaire (SFMGPQ) between the first and the eighth treatment.

	Group 2: Adjustment						
	Treatment 1				Treatment 8		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
NPRS-101	37.97	16.39	4.23	0.001	16.73	18.19	4.70
SFMGPQ	32.18	14.82	3.83	0.005	16.56	17.86	4.61

For the NPRS-101 and the SFMGPQ, the null hypothesis is rejected and one can conclude that at a 95 % confidence level, there was significant improvement between treatments one and eight.

In all instances above in both treatments, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 14: The results of the Wilcoxon's signed-rank test comparing the Numerical Pain Rating Scale-101 (NPRS-101) and the Short Form McGill Pain Questionnaire (SFMGPQ) between the first treatment and the one month follow-up appointment.

	Group 2: Adjustment						
	Treatment 1				Follow-up Appointment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
NPRS-101	37.97	16.39	4.23	0.001	10.73	18.71	4.83
SFMGPQ	32.18	14.82	3.83	0.001	8.17	16.40	4.23

For the NPRS-101 and the SFMGPQ, the null hypothesis is rejected and one can conclude that at a 95 % confidence level, there was significant improvement between treatments one and the one month follow-up appointment.

In all instances above in both treatments, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 15: The results of the Wilcoxon's signed-rank test comparing the Numerical Pain Rating Scale-101 (NPRS-101) and the Short Form McGill Pain Questionnaire (SFMGPQ) between the eighth treatment and the one month follow-up appointment.

	Group 2: Adjustment						
	Treatment 8				Follow-up Appointment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
NPRS-101	16.73	18.19	4.70	0.028	10.73	18.71	4.83
SFMGPQ	16.56	17.86	4.61	0.008	8.17	16.40	4.23

For the NPRS, the null hypothesis is accepted and one can conclude that, at a 95% confidence level, there was no significant subjective improvement between treatment 8 and the one month follow-up appointment.

For the SFMGPQ, the null hypothesis is rejected and one can conclude that at a 95 % confidence level, there was significant improvement between treatment eight and the one month follow-up appointment.

In all instances above in both treatments, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

4.4.2 INTERGROUP ANALYSIS: Mann-Whitney Unpaired two tailed tests

This test was used to evaluate whether there was a difference in effectiveness of either of the two experimental groups.

4.4.2.1 Analysis of **objective** findings:

Table 16: The results of the Mann-Whitney U test comparing the algometer readings of groups 1 and 2 at the first consultation, at the eighth consultation and at the one month follow-up appointment.

	Group 1: Placebo				Group 2: Adjustment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Treatment 1	3.07	1.28	0.33	0.074	3.97	1.20	0.31
Treatment 8	3.49	1.42	0.37	0.025	4.81	1.51	0.39
Follow-up Appointment	3.67	1.67	0.43	0.014	5.94	2.39	0.62

POWER ANALYSIS ALGOMETER	
Treatment 1	0.4762
Treatment 8	0.6579
Follow-up Appointment	0.8308

The null hypothesis is accepted at the first treatment, which indicates that at α = 0.05 level of significance there is no statistically significant difference between group 1 and group 2.

The null hypothesis is rejected at the eighth treatment and at the one month follow-up appointment, which indicates that at $\alpha = 0.05$ level of significance there was statistically a significant difference between group 1 and group 2.

In all instances above in both groups, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 17: The results of the Mann-Whitney U test comparing the goniometer readings of flexion of groups 1 and 2 at the first consultation, at the eighth consultation and at the one month follow-up appointment.

	Group 1: Placebo				Group 2: Adjustment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Treatment 1	179.67	1.29	0.33	0.962	179.33	2.58	0.67
Treatment 8	179.67	1.29	0.33	1.000	179.67	1.29	0.33
Follow-up Appointment	180.00	0.00	0.00	0.317	179.67	1.29	0.33

POWER ANALYSIS FLEXION	
Treatment 1	0.0697
Treatment 8	0.0500
Follow-up Appointment	0.1549

The null hypothesis is accepted, which indicates that at $\alpha = 0.05$ level of significance there is no statistically significant difference between group 1 and group 2.

In all instances above in both groups, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 18: The results of the Mann-Whitney U test comparing the goniometer readings of extension of groups 1 and 2 at the first consultation, at the eighth consultation and at the one month follow-up appointment.

	Group 1: Placebo				Group 2: Adjustment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Treatment 1	57.00	6.76	1.75	0.927	56.00	5.41	1.40
Treatment 8	57.00	6.76	1.75	0.927	56.00	5.41	1.40
Follow-up Appointment	57.00	6.76	1.75	0.927	56.00	5.41	1.40

POWER ANALYSIS EXTENSION	
Treatment 1	0.0697
Treatment 8	0.0697
Follow-up Appointment	0.0697

The null hypothesis is accepted, which indicates that at α = 0.05 level of significance there is no statistically significant difference between group 1 and group 2.

In all instances above in both groups, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 19: The results of the Mann-Whitney U test comparing the goniometer readings of abduction of groups 1 and 2 at the first consultation, at the eighth consultation and at the one month follow-up appointment.

	Group 1: Placebo				Group 2: Adjustment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Treatment 1	174.33	8.84	2.28	0.103	166.00	20.55	5.31
Treatment 8	177.00	5.61	1.45	0.563	172.67	15.68	4.05
Follow-up Appointment	177.67	5.30	1.37	0.590	174.00	15.38	3.97

POWER ANALYSIS ABDUCTION	
Treatment 1	0.2756
Treatment 8	0.1566
Follow-up Appointment	0.1283

The null hypothesis is accepted, which indicates that at α = 0.05 level of significance there is no statistically significant difference between group 1 and group 2.

In all instances above there was a difference between the standard deviations of the 2 groups. Group 2 showed greater spread around the mean. This data is therefore more unreliable than that of group 1.

Table 20: The results of the Mann-Whitney U test comparing the goniometer readings of adduction of groups 1 and 2 at the first consultation, at the eighth consultation and at the one month follow-up appointment.

	Group 1: Placebo				Group 2: Adjustment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Treatment 1	54.33	4.58	1.18	0.042	50.67	4.95	1.27
Treatment 8	54.33	4.58	1.18	0.042	50.67	4.95	1.27
Follow-up Appointment	54.33	4.58	1.18	0.042	50.67	4.95	1.27

POWER ANALYSIS ADDUCTION	
Treatment 1	0.5225
Treatment 8	0.5225
Follow-up Appointment	0.5225

The null hypothesis is accepted, which indicates that at α = 0.05 level of significance there is no statistically significant difference between group 1 and group 2.

In all instances above in both groups, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 21: The results of the Mann-Whitney U test comparing the goniometer readings of external rotation of groups 1 and 2 at the first consultation, at the eighth consultation and at the one month follow-up appointment.

	Group 1: Placebo				Group 2: Adjustment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Treatment 1	86.33	2.97	0.77	0.482	85.00	4.63	1.20
Treatment 8	87.00	2.54	0.66	0.534	86.00	3.87	1.00
Follow-up Appointment	87.33	2.58	0.67	0.371	86.00	3.87	1.00

POWER ANALYSIS EXTERNAL ROTATION	
Treatment 1	0.1412
Treatment 8	0.1217
Follow-up Appointment	0.1799

The null hypothesis is accepted, which indicates that at α = 0.05 level of significance there is no statistically significant difference between group 1 and group 2.

In all instances above in both groups, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 22: The results of the Mann-Whitney U test comparing the goniometer readings of internal rotation of groups 1 and 2 at the first consultation, at the eighth consultation and at the one month follow-up appointment.

	Group 1: Placebo				Group 2: Adjustment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Treatment 1	89.00	3.38	0.87	0.259	87.33	4.17	1.08
Treatment 8	89.33	2.58	0.67	0.208	87.33	4.17	1.08
Follow-up Appointment	89.67	2.29	0.59	0.103	87.33	4.17	1.08

POWER ANALYSIS INTERNAL ROTATION	
Treatment 1	0.2035
Treatment 8	0.3216
Follow-up Appointment	0.4425

The null hypothesis is accepted, which indicates that at $\alpha = 0.05$ level of significance there is no statistically significant difference between group 1 and group 2.

In all instances above in both groups, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 23: The results of the Mann-Whitney U test comparing the goniometer readings of horizontal abduction of groups 1 and 2 at the first consultation, at the eighth consultation and at the one month follow-up appointment.

	Group 1: Placebo				Group 2: Adjustment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Treatment 1	54.33	4.95	1.28	0.181	51.67	5.88	1.52
Treatment 8	54.33	4.95	1.28	0.181	51.67	5.88	1.52
Follow-up Appointment	54.33	4.95	1.28	0.181	51.67	5.88	1.52

POWER ANALYSIS ADDUCTION	
Treatment 1	0.2961
Treatment 8	0.2961
Follow-up Appointment	0.2961

The null hypothesis is accepted, which indicates that at α = 0.05 level of significance there is no statistically significant difference between group 1 and group 2.

In all instances above in both groups, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 24: The results of the Mann-Whitney U test comparing the goniometer readings of horizontal adduction of groups 1 and 2 at the first consultation, at the eighth consultation and at the one month follow-up appointment.

	Group 1: Placebo				Group 2: Adjustment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Treatment 1	128.00	4.14	1.07	0.596	125.67	8.21	2.12
Treatment 8	128.00	4.14	1.07	0.596	125.67	8.21	2.12
Follow-up Appointment	128.00	4.14	1.07	0.596	125.67	8.21	2.12

POWER ANALYSIS ADDUCTION	
Treatment 1	0.0910
Treatment 8	0.0910
Follow-up Appointment	0.0910

The null hypothesis is accepted, which indicates that at α = 0.05 level of significance there is no statistically significant difference between group 1 and group 2.

In all instances above in both groups, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

4.4.2.2 Analysis of subjective findings

Table 25: The results of the Mann-Whitney U test comparing the Numerical Pain Rating Scale-101 values of groups 1 and 2 at the first consultation, at the eighth consultation and at the one month follow-up appointment.

	Group 1: Placebo				Group 2: Adjustment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Treatment 1	49.00	19.52	5.04	0.139	37.97	16.39	4.23
Treatment 2	24.00	11.72	3.03	0.149	16.73	18.19	4.70
Follow-up Appointment	19.83	12.26	3.17	0.019	10.73	18.72	4.83

POWER ANALYSIS NPRS	
Treatment 1	0.3569
Treatment 8	0.2316
Follow-up Appointment	0.3205

The null hypothesis is accepted, which indicates that at α = 0.05 level of significance there is no statistically significant difference between group 1 and group 2.

The null hypothesis is rejected at the one month follow-up appointment, which indicates that at α = 0.05 level of significance there was statistically a significant difference between group 1 and group 2.

In all instances above in both groups, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

Table 26: The results of the Mann-Whitney U test comparing the Short Form McGill Pain Questionnaire values of groups 1 and 2 at the first consultation, at the eighth consultation and at the one month follow-up appointment.

	Group 1: Placebo				Group 2: Adjustment		
	Mean	S.D.	S.E.	P-Value	Mean	S.D.	S.E.
Treatment 1	27.34	11.27	2.91	0.373	32.18	14.82	3.83
Treatment 2	19.10	12.63	3.26	0.532	16.56	17.86	4.61
Follow-up Appointment	16.57	12.29	3.17	0.005	8.17	16.40	4.23

POWER ANALYSIS SFMGPQ	
Treatment 1	0.1555
Treatment 8	0.0699
Follow-up Appointment	0.3250

The null hypothesis is accepted, which indicates that at α = 0.05 level of significance there is no statistically significant difference between group 1 and group 2.

The null hypothesis is rejected at the one month follow-up appointment, which indicates that at α = 0.05 level of significance there was statistically a significant difference between group 1 and group 2.

In all instances above in both groups, the S.D. values, showing the spread of the data around the mean, were similar enough to render the two sets of data reliable and comparable.

CHAPTER 5: DISCUSSION

5.1 INTRODUCTION

In this chapter the results reported in chapter 4 will be discussed.

Any statistically significant information will be highlighted and examined for reliability. Furthermore, graphs will be used to highlight and clarify relevant information.

Intragroup Analysis - The assessment of the intragroup results from the first treatment to the final treatment represents the relative effectiveness of the treatment protocol in the treatment of impingement syndrome. The comparison of the final treatment to the one month follow-up appointment indicates whether or not the treatment's relative effectiveness was maintained. The first treatment to the one month follow-up appointment serves to indicate the relative long term effectiveness and to whether the problem has returned or not.

Intergroup Analysis - The evaluation of the first treatment measurements, shows any variance in the subjective and objective findings between the two groups in terms of their original signs and symptoms. The comparison of the final treatments confirms which treatment is more effective. Appraisal of the one month follow-up appointment measurements represent which treatment method has maintained its influence on symptomatology more effectively.

5.2 DEMOGRAPHIC DATA

The throwing motion involved in baseball pitching and quarterbacking, the serve and overhead in tennis, and the motions in swimming are examples of those especially susceptible to develop shoulder impingement syndrome (Hawkins and Kennedy 1980). Thirteen of the 30 patients in this study were swimmers (Table 1).

Advertising articles were placed in swimming magazines, so this was to be expected. The next highest was tennis, with 5 of the patients tennis players. Only 2 of the patients did not attribute their shoulder pain to any sport. The above information supports Fu et al's (1991) findings in saying that impingement syndrome is caused mainly by overhead activities.

The female to male ratio in this study was 8:7 (Figure 1). Previous studies on impingement syndrome have not been consistent with regard to female : male ratios. The type of activity or sport is probably more important than the gender of the athlete. It has been observed that women more likely develop shoulder problems when working in production industries than men (Saunders 1995).

The average age of 22.77 and range of 16-38 years (Table 2) was not reflective of the population with impingement syndrome because the criteria for inclusion in this study was patients younger than forty years of age, to target patients in stages 1 or 2 of impingement syndrome. The majority of studies done, have targeted late stage II and early stage III impingement syndrome, and the range therefore has been 23-80 years (Post and Cohen 1986, Saunders 1995, Herrera-Lasso et al. 1993 and Blair et al. 1996). Age is no barrier to developing this problem and, in fact, the older the patient the more persistent the problem (Hawkins and Kennedy 1980). Two of the three patients in this study that were over thirty, had persistant shoulder problems throughout the course of treatment, one in the adjustment group and one in the placebo group.

Eleven of the fifteen patients in the placebo group had been treated previously, whereas only 5 of the 15 in the adjustment group had been treated previously (Table 3). This could be an indication as to why the placebo group did not respond as well as the adjustment group; the placebo group may have had more chronic injuries and may have suspected a placebo treatment.

5.3 OBJECTIVE MEASUREMENTS

5.3.1 Range of Motion

Figure 2: The various values for the goniometer, for group 1, over the study period can be seen in below.

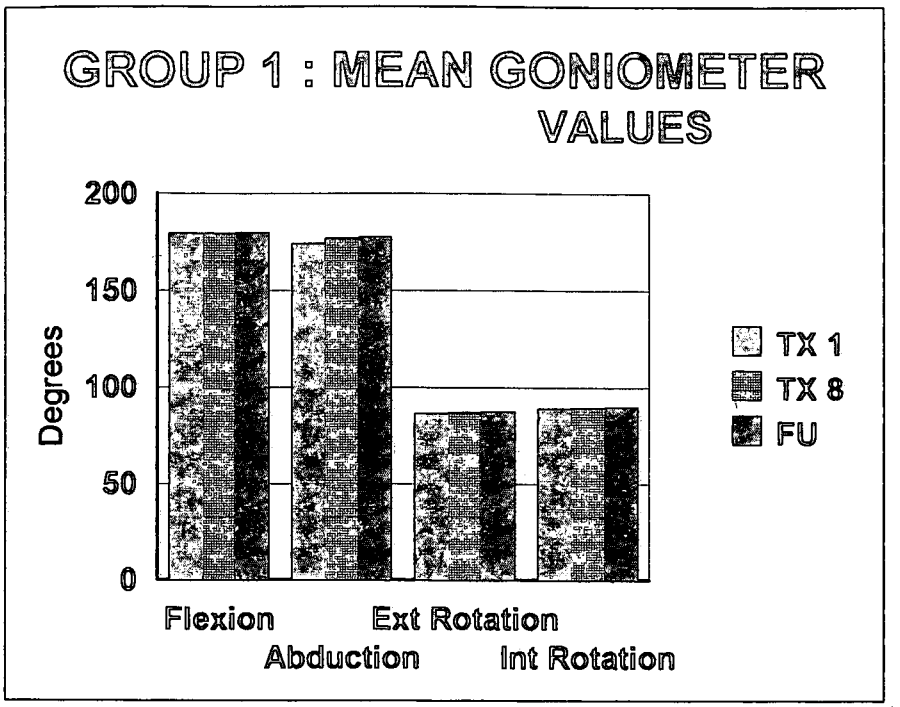
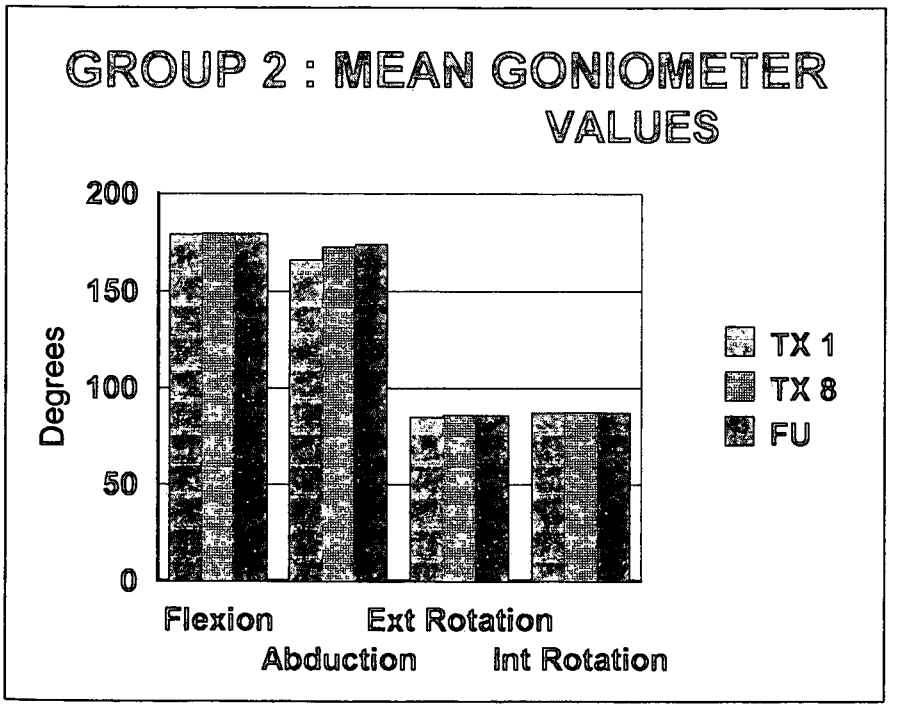


Figure 3: The various values for the goniometer, for group 2, over the study period can be seen below.



According to Magee (1992: 97), the average ranges of movement are:

Flexion:	160-180°
Extension:	50-60°
Abduction:	170-180°
Adduction:	50-75°
External rotation:	80-90°
Internal rotation:	60-100°
Horizontal abduction:	45°
Horizontal adduction:	130°

This study supports the values of flexion, extension, abduction, adduction, external and internal rotation, but contradicts horizontal abduction and horizontal adduction. Group 1 had a peak mean horizontal abduction of 54.33° (Table 23) while Group 2 had a peak mean of 51.67°. Group 1 had a peak mean horizontal adduction of 128° (Table 24), while Group 2 had a peak mean of 125.67°.

Swimmers have varying degrees of instability at the shoulder and hence poor control and positioning of the humeral head in the glenoid (Reid 1992: 934). This could explain the increased range of motion for horizontal abduction. For horizontal adduction, the average range of motion is deceased compared to the norm. This could be due to a tight posterior capsule, which may also be associated with rotator cuff impingement (Jobe 1997).

5.3.1.1 Discussion of Intragroup analysis

Within Group 1, no movements showed statistically significant improvements (Table 4). The general *clinical* trend for Group 1, from the first treatment through to the eighth treatment, was to show only very slight mean improvements for abduction, external rotation and internal rotation. Abduction showed a mean improvement of 2.67° (treatment 1 - 174.33°; treatment 8 - 177.00°). External rotation showed a

mean improvement of 0.67° (treatment 1 - 86.33°; treatment 8 - 87.00°). Internal rotation showed a mean improvement of 0.33° (treatment 1 - 89.00°; treatment 8 - 89.33°).

There was no statistically significant improvement between the eighth treatment and the one month follow-up appointment (Table 6). There was again however, still more but slight mean improvements until the follow-up appointment for flexion, abduction, external rotation and internal rotation. Flexion showed a mean improvement of 0.33° (treatment 8 - 179.67°; follow-up - 180.00°). Abduction showed a mean improvement of 0.67° (treatment 8 - 177.00°; follow-up - 177.67°). External rotation showed a mean improvement of 0.33° (treatment 8 - 87.00°; follow-up - 87.33°). Internal rotation showed a mean improvement of 0.34° (treatment 8 - 89.33°; follow-up - 89.67°).

Thus very slight improvements can be seen in this category with placebo. These improvements could be due to the natural history of the condition. It must be emphasized that the general trends were clinical observations rather than statistical evidence.

Within Group 2, the trends were similar to Group 1 with improvements in the general *clinical* trend in flexion, abduction and external rotation from the first treatment through to the eighth treatment (Table 10). For flexion, there was a mean improvement of 0.34° (treatment 1 - 179.33°; treatment 8 - 179.67°). Abduction showed a mean improvement of 6.67° (treatment 1 - 166.00°; treatment 8 - 172.67°). External rotation showed a mean improvement of 1.00° (treatment 1 - 85.00°; treatment 8 - 86.00°).

There was no statistically significant improvement between the eighth treatment and the one month follow-up appointment (Table 12). Abduction showed a mean improvement of 1.33° (treatment 8 - 172.67°; follow-up - 174.00°).

From the first treatment through to the one month follow-up appointment, abduction showed statistically a significant difference (Table 11). The mean showed an improvement of 8.00° (treatment 1 - 166.00°; follow-up - 174.00°). Thus, adjustment, with time, seems to improve the range of motion of the shoulder girdle, in particular abduction, and it does have greater lasting potential.

5.3.1.2 Discussion of Intergroup analysis

There was no statistically significant difference between the two groups with regards to mean gain in range of motion at any stage in the treatment program.

Comparing the groups prior to the first treatment established a baseline to ensure that the two groups were comparable in nature. There was a difference in abduction with Group 1 having a mean of 174.33° as compared to Group 2 with a mean of 166.00° (Table 19). However Group 1 showed better reliability with a standard deviation of 8.84 as compared to 20.55. The mean values however become more comparable by the follow-up appointment (Group 1 mean: 177.67° vs. Group 2 mean: 174.00°).

The only other baseline value to differ was adduction (Table 20). Group 1 had a mean value of 54.33° and Group 2 had a mean value of 50.67°. These two values however remained the same throughout the treatments and the follow-up appointments. It must be recalled that neither abduction or adduction showed significant statistical difference when using the Mann Whitney U test.

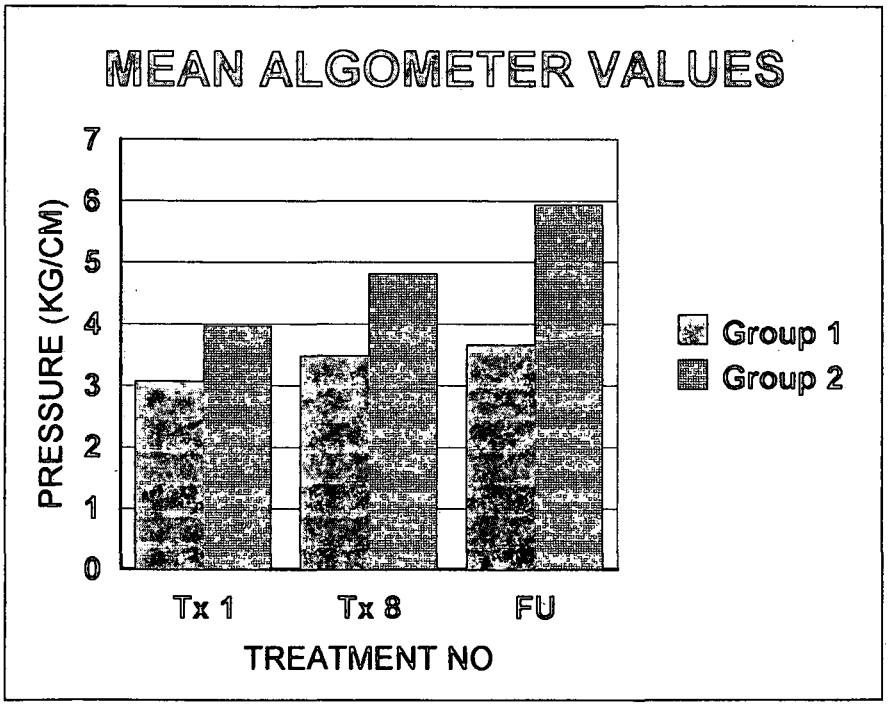
One can therefore accept the null hypothesis which states that there is no significant difference between the two groups with regards to the two treatments. This may be because of the type of patients involved in this study. The majority of the patients are swimmers and already have increased range of motion in their shoulder girdles.

5.3.2 Algometer

The algometer was used to measure the amount of force that the patient could tolerate on the most sensitive part of the shoulder girdle. Improvement would be signified by a decrease in the sensitivity and an ensuing increase in the amount of pressure the patient would allow.

The algometer used had two scales of measurement. The pressure could be measured in pounds per cm squared or kilograms per cm squared. It is advised that an operator should be certain which scale is being used from the first treatment, so that two different scales are not used when measuring the amount of pressure that can be tolerated.

Figure 4: The various values for the algometer, for both groups, over the study period can be seen below.



5.3.2.1 Discussion of Intragroup analysis

In **Group 1**, there was statistically no significant improvement between treatment 1 and treatment 8 (Table 4). The mean did show a 0.42 improvement (treatment 1 - 3.07; treatment 8 - 3.49). There was also no significant improvement between treatment 8 and the one month follow-up appointment (Table 6), but again there was a slight improvement in the mean of 0.18 (treatment 8 - 3.49; follow-up - 3.67).

There was statistically a significant improvement between the initial treatment and after the one month follow-up appointment (Table 5). The mean showed 0.6 improvement (treatment 1 - 3.07; follow-up - 3.67). Thus, good improvement is seen over time in this category with placebo.

Group 2 showed statistically significant improvement over the treatment program (Table 10), after the one month follow-up (Table 12), and between treatment eight and the one month follow-up appointment (Table 11). The mean improved by 0.84 over the treatment program (treatment 1 - 3.97; treatment 8 - 4.81), and by 1.13 between treatment eight and the one month follow-up (treatment 8 - 4.81; follow-up - 5.94). Thus adjustment seems to reduce the sensitivity experienced by the patient as well as also having long term benefits.

The algometer readings improved significantly between treatment 1 and treatment 8 for the adjustment group (Table 10) but not the placebo group (Table 4). This shows that an adjustment is better than placebo with regards to algometer readings for the treatment of impingement syndrome. Both groups improved significantly from treatment 1 to the end of the follow-up appointment (Table 5 and Table 11). This may be due to the natural course of the condition.

5.3.2.2 Discussion of Intergroup analysis

At the initial consultation there was statistically no significant difference between the two groups. There was a mean difference of 0.9 between the two groups (placebo: 3.07; adjustment: 3.97). Thus the placebo started off slightly more severe than the adjustment group. However after the eighth treatment and at the one month follow up there was statistical significance between the two groups. At treatment eight there was a mean difference of 1.32 (placebo: 3.49; adjustment: 4.81), which indicates that the adjustment group's pain decreased in sensitivity. At the one month follow-up there was a mean difference of 2.27 (placebo: 3.67; adjustment: 5.94). This shows that both group's pain decreased in sensitivity, however the adjustment group improved more so than the placebo group.

5.3.3 Conclusion of objective measurements

Within the range of motion analysis, the only statistically significant improvements seen, were in the adjustment group for abduction. This is probably because, when presenting with this condition, it is abduction that is usually decreased to help confirm diagnosis. The other movements are not as often affected. There was no statistically significant difference between the two groups at any stage in the treatment program. As was discussed previously, this may be due to the majority of patients being swimmers, who already have increased range of motion in their shoulder girdles.

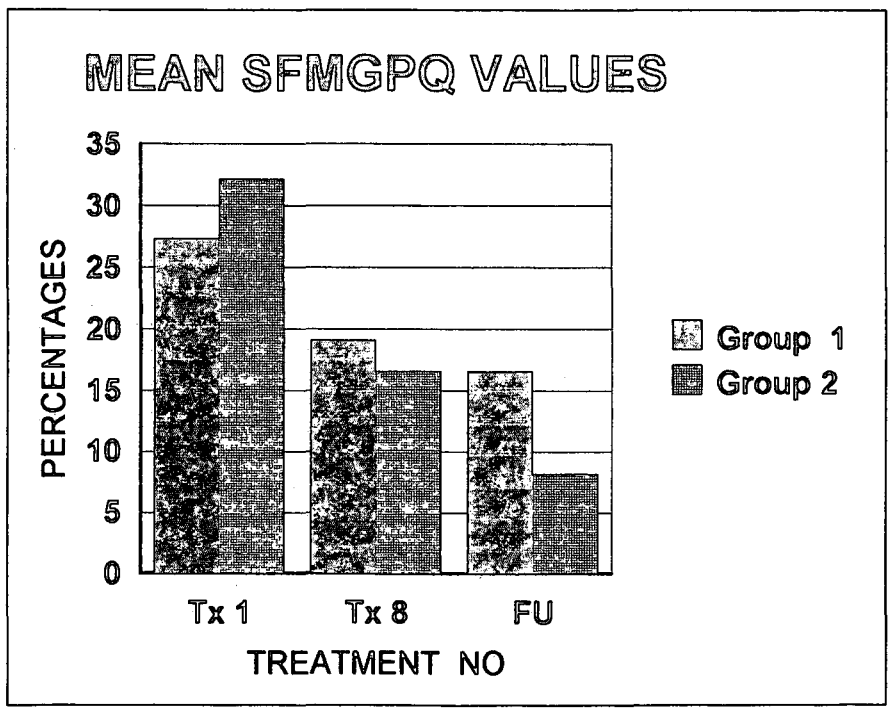
When analyzing the algometer readings, the adjustment group showed more statistically significant improvements than the placebo group. The adjustment group showed statistically significant improvements during the treatment program whereas the placebo group did not. Both groups showed significant improvements between the initial treatments and the one month follow-up appointments. This may be due to the natural history of the condition, however although both groups showed decreased sensitivity, the adjustment group seemed to have improved more so than the placebo group.

5.4 SUBJECTIVE MEASUREMENTS

5.4.1 The Numerical Pain Rating Scale-101

The Numerical Pain Rating Scale-101 (NPRS-101) was chosen because of the ease with which it can be administered and scored. Jensen et al. (1986) established its validity and reliability when providing subjective information about the levels of pain perceived by the patient. It was used to monitor the patient's progress with a decrease in pain intensity indicating improvement. The mean values of both groups at the relevant consultations have been tabulated below.

Figure 5: The mean percentage of pain perception of group 1 and group 2 at treatment one, eight and the follow-up.



5.4.1.1 Discussion of Intragroup analysis

Group 1 showed statistically significant decrease in pain over the treatment program (Table 7), and after the one month follow-up (Table 9), as well as between treatment eight and the one month follow-up apppointment (Table 8). The mean percentage decrease of pain was 25.00% over the treatment program (treatment 1 - 49.00%; treatment 8 - 24.00%), and by 4.17% between treatment eight and the one month follow-up (treatment 8 - 24.00%; follow-up - 19.83%). Thus placebo seems to reduce the patient's pain as well as also having long term benefits.

Group 2 showed statistically significant decrease in pain over the treatment program (Table 13), and after the one month follow-up (Table 15). The mean decrease in pain was 21.24% over the treatment program (treatment 1 - 37.97%; treatment 8 - 16.73%), and 6.00% between treatment eight and the one month follow-up (treatment 8 - 16.73%; follow-up - 10.73%). Thus adjustment seems to reduce pain as well as also having long term benefits.

Both groups therefore showed significant improvements between treatment 1 and treatment 8 (Table 7 and Table 13) and after the one month follow-up appointment. Group 1 also showed a significant improvement between treatment 8 and the one month follow-up appointment (Table 9), whereas Group 2 did not. This suggests that the natural progresssion of the disease may be improvement of the condition, because no extra treatments were given during this time.

5.4.1.2 Discussion of Intergroup analysis

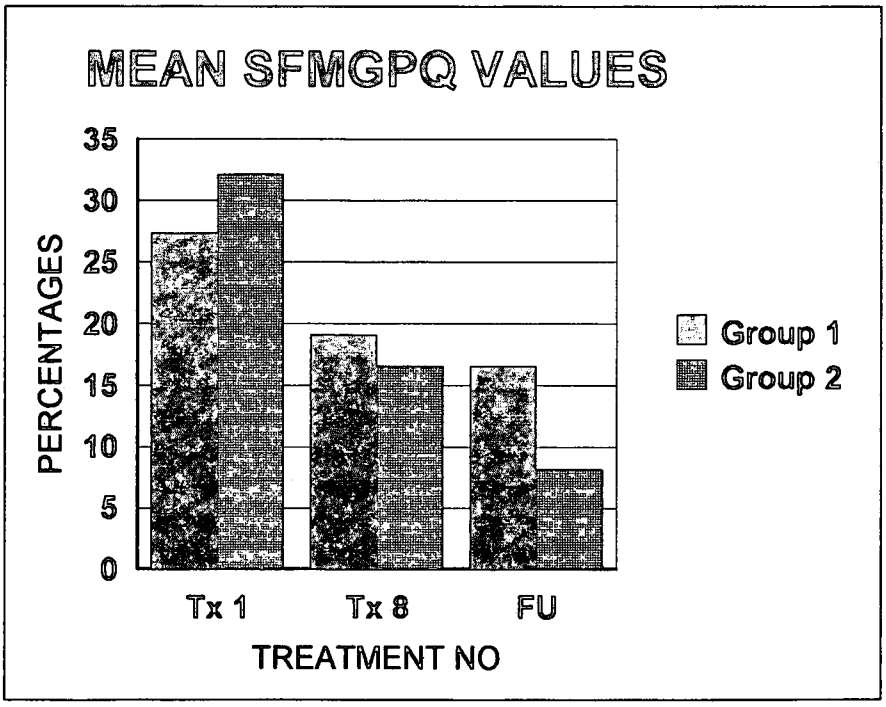
At the initial consultation there was statistically no significant difference between the two groups (Table 25). There was a mean difference of 11.03 between the two groups (placebo: 49.00; adjustment: 37.97). Thus the placebo group started off slightly more severe than the adjustment group. After the eighth treatment there

was still no significant difference between the two groups. There was a mean difference of 7.27 (placebo: 24.00; adjustment: 16.73). The placebo group was still more severe, however not as severe as at the first treatment. At the one month follow-up there was significant difference between the two groups. There was a mean difference of 9.1 (placebo: 19.83; adjustment: 10.73). This shows that both group's perceived level of pain decreased, however the adjustment group improved more so than the placebo group.

5.4.2 Short Form McGill Pain Questionnaire

The short form of the McGill Pain Questionnaire used in this study was described by Melzack (1987) as a means of subjectively providing information regarding the sensory, affective and evaluative dimensions of the pain. Improvement would be indicated by a decrease in the values as the program progressed.

Figure 6: The mean percentage of pain perception of group 1 and group 2 at treatment one, eight and the follow-up.



5.4.2.1 Discussion of Intragroup analysis

Group 1 showed statistically significant decrease in pain over the treatment program (Table 7), and after the one month follow-up (Table 9), as well as between treatment eight and the one month follow-up apppointment (Table 8). The mean percentage decrease of pain was 8.24% over the treatment program (treatment 1 - 27.34%; treatment 8 - 19.10%), and by 2.53% between treatment eight and the one month follow-up (treatment 8 - 19.10%; follow-up - 16.57%). Thus placebo seems to reduce pain as well as also having long term benefits. This could either be due to the natural history of the disease or psychological, the patient thinking that he is getting treatment.

Group 2 showed statistically significant decrease in pain over the treatment program (Table 13), and after the one month follow-up (Table 15), as well as between treatment eight and the one month follow-up apppointment (Table 14). The mean decrease in pain was 15.62% over the treatment program (treatment 1 - 32.18%; treatment 8 - 16.56%), and 8.39% between treatment eight and the one month follow-up (treatment 8 - 16.56%; follow-up - 8.17%). Thus adjustment seems to reduce pain as well as also having long term benefits.

Both groups also showed a significant improvement between treatment 8 and the one month follow-up appointment (Table 9 and Table 15). This suggests that the natural progresssion of the disease may be improvement of the condition, because no extra treatments were given during this time.

5.4.2.2 Discussion of Intergroup analysis

At the initial consultation there was statistically no significant difference between the two groups (Table 26). There was a mean difference of 4.84 between the two groups (placebo: 27.34; adjustment: 32.18). Thus the adjustment group started off slightly more severe than the placebo group. After the eighth treatment there was

still no significant difference between the two groups. There was a mean difference of 2.54 (placebo: 19.10; adjustment: 16.56). The adjustment group was still more severe, however not as severe as at the first treatment. At the one month follow-up there was significant difference between the two groups. There was a mean difference of 8.4 (placebo: 16.57; adjustment: 8.17). This shows that both group's perceived level of pain decreased, however the adjustment group improved more so than the placebo group.

5.4.3 Conclusion of subjective measurements

When analyzing the NPRS-101, both groups showed statistically significant improvements between the initial treatments and the eighth treatments, and after the one month follow-up appointments. The placebo group also showed significant improvement between treatment 8 and the one month follow-up appointment. This is contradictory because this group had more treatments previous to starting this study, therefore one would expect this group to improve less than the adjustment group. Intergroup analysis, however shows that the adjustment group's perceived level of pain decreased more so than the placebo group.

When analysing the SFMGPQ, both groups showed statistically significant improvements between the initial treatments and the eighth treatments, after the one month follow-up appointments, as well as between treatments eight and the one month follow-up appointment. Intergroup analysis again shows that the adjustment group's perceived level of pain decreased more so than the placebo group.

Both of the above subjective measurements show that the natural history of the condition is improvement, even in statistical proportions, however with the addition of the adjustment there are more perceived improvements.

5.5. POWER ANALYSIS

The chance of commiting Type II error (b) increases the smaller the sample size.

- Power is (1 - b).
- The chance of not "getting it wrong" (that is "getting it right").
- So the smaller the b, the greater the power.

When we look at the relevant power of each subjective and objective findings, at each treatment, we can see that the power of the tests are overall very weak. This shows that the chance of missing possible statistical significant results is high. The algometer readings (Table 16) show fairly high power (over 0.5 or 50%). If the sample size had in fact been larger the null hypothesis might have been accepted fewer times. Consequently, there may have been an improvement between treatment intervals.

5.6 CONCLUSION

We can therefore conclude that overall the adjustment treatment seemed to demonstrate greater improvement with the algometer readings, the NPRS-101, and the SFMGPQ, as there was a statistically significant difference at the one month follow-up appointment. This also shows the adjustment group to have more positive long term potential than short term.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

The results of this study over the three week treatment period and one month follow-up period, indicate that adjustments appear to be more effective than placebo ultrasound, in the treatment of impingement syndrome of the shoulder. There was a statistically significant difference between the two groups.

The goniometer used in this study was not very accurate. In future studies, a more accurate goniometer should be used, or measurements should be taken from when the patient first feels the pain. This way, improvements may be more easily noted. It is also recommended that passive ranges of motion be analysed instead of active ranges of motion. Wong and Nansel (1992) have shown that measuring passive ranges of motion in the cervical spine demonstrates range of motion asymmetries to a greater extent than active ranges of motion. This also needs to be shown in the shoulder girdle. In measuring passive ranges of motion, 'cortical influences' are absent and the effects of a certain treatment on the ranges of motion of the joint may therefore become more apparent. The use of passive movement would also exclude the influence that muscle can have on reducing mobility and would, hence, be a more reliable indicator of pure joint movement (Wong and Nansel 1992).

In order for the findings to have a higher level of validity, a larger sample size would be recommended. A sample size of thirty subjects enables one to make inferences but not specific conclusions. It is, therefore, recommended that a much larger sample size be utilised should this study be repeated.

The author also feels that the experience and reliability of the examiner be taken onto consideration. The limited experience of any undergraduate researcher in the field of manual therapy may bias the results and it is suggested that more experienced manual therapists repeat this study in order to further substantiate the role of manipulation in the treatment of impingement syndrome.

The accuracy of measurement parameters should also be taken into consideration. It is recommended that the issue of patient blinding and compliance also be addressed.

In a busy practice time will always be an important consideration. Motion palpating and the adjustment takes about five minutes. It is also cost effective. A cost efficiency analysis is recommended. The adjustment is therefore time and cost efficient and can easily be incorporated into a treatment regime.

Considering the results within the study, it seems that the adjustment treatment is more effective than placebo. A larger sample size is essential to validate these findings and in future studies of this nature.

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APPENDICES

APPENDIX A

TREATMENT GROUP ALLOCATION

TABLE DISPLAYING THE SEQUENCE OF RANDOM TREATMENT ALLOCATION

PATIENT NUMBER 1	**ADJUSTMENT**
PATIENT NUMBER 2	**ADJUSTMENT**
PATIENT NUMBER 3	**ADJUSTMENT**
PATIENT NUMBER 4	**ADJUSTMENT**
PATIENT NUMBER 5	**ADJUSTMENT**
PATIENT NUMBER 6	PLACEBO ULTRASOUND
PATIENT NUMBER 7	PLACEBO ULTRASOUND
PATIENT NUMBER 8	PLACEBO ULTRASOUND
PATIENT NUMBER 9	PLACEBO ULTRASOUND
PATIENT NUMBER 10	PLACEBO ULTRASOUND
PATIENT NUMBER 11	PLACEBO ULTRASOUND
PATIENT NUMBER 12	**ADJUSTMENT**
PATIENT NUMBER 13	PLACEBO ULTRASOUND
PATIENT NUMBER 14	PLACEBO ULTRASOUND
PATIENT NUMBER 15	**ADJUSTMENT**
PATIENT NUMBER 16	**ADJUSTMENT**
PATIENT NUMBER 17	PLACEBO ULTRASOUND
PATIENT NUMBER 18	**ADJUSTMENT**
PATIENT NUMBER 19	**ADJUSTMENT**
PATIENT NUMBER 20	**ADJUSTMENT**
PATIENT NUMBER 21	**ADJUSTMENT**
PATIENT NUMBER 22	**ADJUSTMENT**
PATIENT NUMBER 23	**ADJUSTMENT**
PATIENT NUMBER 24	PLACEBO ULTRASOUND
PATIENT NUMBER 25	**ADJUSTMENT**
PATIENT NUMBER 26	PLACEBO ULTRASOUND
PATIENT NUMBER 27	PLACEBO ULTRASOUND
PATIENT NUMBER 28	PLACEBO ULTRASOUND
PATIENT NUMBER 29	PLACEBO ULTRASOUND
PATIENT NUMBER 30	PLACEBO ULTRASOUND

APPENDIX B

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC
CASE HISTORY

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

FOR CLINICIAN'S USE ONLY
Initial visit clinician:_____Signature:_____

Case History:

Examination:
Previous: Current:

X-Ray Studies:
Previous: Current:

Clinical Path. lab:
Previous: Current:

Case Status:

PTT: Conditional: Signed Off: Final Sign out:

Recommendations:

Intern's Case History

1. Source of History:

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

3. Present Illness:

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

4. Other Complaints:

5. Past Medical History:

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

6. Current health status and life-style:

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

7. Immediate Family Medical History:

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

8. Psychosocial history:

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

9. Review of Systems:

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

APPENDIX C

TECHNIKON NATAL

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:

Any loss of smell/taste:
Nose examination:

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:

APPENDIX D

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

Patient: _____ File: _____

Date: _____ Intern/Resident: _____

Clinician: _____ Sign: _____

OBSERVATION:

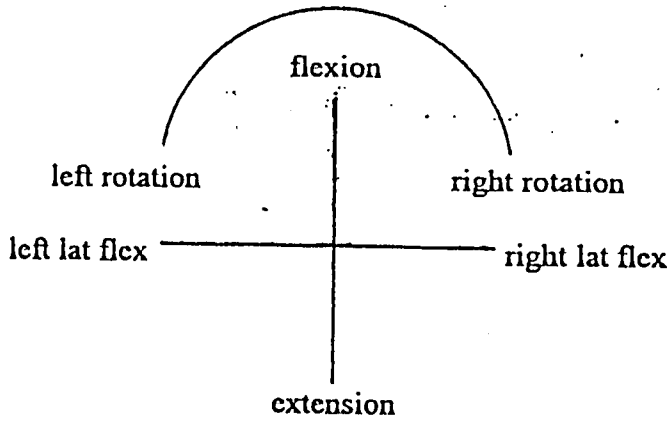
Posture
Swellings
Scars
Discolouration
Hair Line
Bony & Soft Tissue Contours

Shoulder position:
Left:
Right:
Muscle spasm
Facial expression

RANGE OF MOTION:

Flexion (45'):
L/R Rotation (70'):

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



PALPATION:

Lymph Nodes
Thyroid Gland
Trachea

ORTHOPAEDIC EXAMINATION:

Tenderness
Trigger Points:
SCM
Scalenii
Post Cervicals
Trapezius
Lev Scap

Doorbell sign
Kemp's test
Cervical distraction
Halstead's test
Hyperabduction test
Shoulder abduction test

Cervical compression
Lateral compression
Adson's test
Costoclavicular test
Eden's test
Shoulder depression test

Dizziness rotation test
Brachial plexus tension

Lhermitte's sign

NEUROLOGICAL EXAMINATION:

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

VASCULAR:

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

MOTION PALPATION & JOINT PLAY:

Left: Motion Palpation:
Joint Play:

Right: Motion palpation:
Joint Play:

Basic Exam: Shoulder:
Case History:

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

Upper T horacics:
Motion Palpation:
Joint Play:

Basic Exam: Thoracic Spine:
Case History:

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

APPENDIX E

TECHNIKON NATAL

SHOULDER REGIONAL EXAMINATION

Patient: _____ **File no:** _____ **Date:** _____

Intern / Resident: _____ Signature: _____

Clinician: _____ Signature: _____

.....

Observation

Posture _____ S-C joints _____
Skin _____ Clavicles _____
Swelling _____ A-C joints _____
Shoulder levels _____ Scapulae _____
Comments: _____

Palpation

S-C joint _____ SCM _____ Scalenes _____
Sternum _____ Ribs and costal cartilages _____
Clavicle _____ Coracoid process _____
A-C joint _____ Acromion _____
Greater tuberosity _____
Lesser tuberosity _____
Intertubercular (bicipital) groove _____
Trapezius _____ Deltoid _____
Biceps _____ Triceps _____
Supraspinatus insertion _____
Musculotendinous portion of supraspinatus _____
Axilla: Lymph nodes _____
Brachial artery _____
Serratus anterior (medial wall) _____
Pectoralis major (anterior wall) _____
Lattisimus dorsi (posterior wall) _____
Scapula: Borders _____ Spine _____
Supraspinous fossa _____
Infraspinous fossa _____
Cervico-thoracic spine _____

Active Movements (note ROM and pain)

Elevation through abduction (170-180°) _____
Painful arc with abduction? _____
Elevation through forward flexion (160-180°) _____
Elevation through scapula plane (170-180°) _____
Lateral rotation (80-90°) _____ Medial rotation (60-100°) _____
Extension (50-60°) _____ Adduction (50-75°) _____
Horizontal adduction/abduction (130°) _____
Circumduction (200°) _____
Apley's Scratch _____

Passive Movements (note end-feel, ROM and pain)

Elevation through abduction (bone to bone or tissue stretch) _____
Elevation through forward flexion (tissue stretch) _____
Lateral rotation (tissue stretch) _____
Medial rotation (tissue stretch) _____
Extension (tissue stretch) _____
Adduction (tissue approximation) _____
Horizontal adduction (tissue stretch or approximation) _____
Horizontal abduction (tissue stretch) _____
Quadrant Test _____

Resisted Isometric Movements (note strength and pain)

Flexion _____
Extension _____
Adduction _____
Abduction _____
Medial rotation _____
Lateral rotation _____
Elbow flexion _____
Elbow extension _____

Joint Play Movements (and motion palpation)

SC joint: Supero-inferior (shrug shoulder with arm at side) _____
Horizontal add/abduction (arm abducted 90°) _____

AC joint: A-P shear _____
Supero-inferior shear _____

Scapula: Normal scapulo-humeral rhythm? _____
General mobility of scapula _____

Glenohumeral joint:

Lateral movement of humeral head _____
Inferior movement of humeral head (Caudal glide) _____
Anterior movement of humeral head (P-A glide) _____
Posterior shear of humera head (A-P glide): At 10° flexion _____
At 90° flexion _____
Backward glide of humeral head in abduction _____
Long-axis distraction of humeral head in abduction _____
Downward and backward (S-I → A-P) _____
Outward and backward (med-lat → A-P) _____
External rotation of humeral head _____
Internal rotation of humeral head _____

Instability Tests

Load and Shift Tests:

Anterior translation of humeral head (25%) _____
Posterior translation of humeral head (50%) _____
Inferior translation of humeral head (50%) _____

Anterior Instability Tests:

Anterior drawer test _____
Rowe test _____
Fulcrum test _____
Apprehension (crank) test _____
Clunk test (tear of labrum) _____
Rockwood Test _____
Anterior instability Test _____
Protzman Test _____

Posterior Instability Tests:

Posterior Drawer Test _____
Posterior Apprehension Test _____
Norwood Stress Test _____
Push-pull Test _____
Jerk Test _____

Inferior and Multi-directional Instability Tests:

Inferior shoulder Instability Test (Sulcus Sign) _____
Feagin Test (antero-inferior instability) _____

A-C Joint Stress Test: _____

S-C Joint Stress Test: _____

Tests for muscle or tendon pathology

Speed's Test (bicipital tendonitis) _____
Yurguson's Test (bicipital tendonitis) _____
Gilchrest Sign (bicipital tendonitis) _____

Supraspinatus Test (supraspinatus tendonitis) _____
Hawkins-Kennedy Impingement Test (supraspinatus tendonitis) _____

Drop-arm Test (rotator cuff tear) _____
Impingement Test _____
Pectoralis Major Contracture Test _____
Ludington's Test (rupture of long head of biceps) _____

3. Tests for neurological function

Brachial Plexus Tension Test _____
Tinel's Sign (Scalene triangle) _____

Dermatomes: C4 _____ C5 _____ C6 _____ C7 _____ C8 _____ T1 _____ T2 _____.

Reflexes: Biceps (C5/6) _____
Triceps (C7/8) _____

4. Thoracic Outlet Syndrome Tests

Adson's Test _____
Halstead's Test _____
Costoclavicular Test _____
Eden's Test (cervical rib) _____
Hyperabduction Test _____
Roos Test _____
Allen's Test _____

Radiological Examination: _____

Diagnosis: _____

Management Plan: _____

APPENDIX F

INFORMED CONSENT FORM

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

TITLE OF 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_____ Signature_____
(in block letters)

PARENT/GUARDIAN* Name_____ Signature_____
(in block letters)

WITNESS Name_____ Signature_____
(in block letters)

RESEARCH STUDENT Name_____ Signature_____
(in block letters)

APPENDIX G

ALGOMETER READINGS

PATIENT NAME:_____ FILE NO.:_____

DATE:_____

TREATMENT NO.:_____

READING ONE:_____

DATE:_____

TREATMENT NO.:_____

READING TWO:_____

DATE:_____

TREATMENT NO.:_____

READING THREE:_____

APPENDIX H

SHORT-FORM McGILL PAIN QUESTIONNAIRE

PATIENT NAME:_____ FILE NO.:_____

DATE:_____ TREATMENT NO.:_____

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 I

NUMERICAL PAIN RATING SCALE 101

PATIENT NAME:_____ FILE NO.:_____

DATE:_____ TREATMENT NO.:_____

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 J

GONIOMETER READINGS

PATIENT NAME: _____ FILE NO.: _____

DATE: _____ TREATMENTNO.:_____

	RIGHT SHOULDER	LEFT SHOULDER
FLEXION	_____	_____
EXTENSION	_____	_____
ABDUCTION	_____	_____
ADDUCTION	_____	_____
EXTERNAL ROTATION	_____	_____
INTERNAL ROTATION	_____	_____
HORIZANTAL ABDUCTION	_____	_____
HORIZANTAL ADDUCTION	_____	_____