# THE EFFICACY OF SHOULDER ADJUSTMENTS IN THE TREATMENT OF ROTATOR CUFF TENDINITIS

BY

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I, Maryam Azizi, do hereby declare that this dissertation is representative of my own work.

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DEDICATION

*Knowing is not enough; we must apply. Willing is not enough; we must do.*
*-- Bruce Lee*

This work is dedicated to my father, mother and brother.

My father for all the emotional and financial support that he has provided throughout my life. For always taking a keen interest in everything I decided to undertake and providing encouragement no matter what the outcome.

My mother has been the perfect friend and role model. Her support and sense of understanding have made me the success that I am today.

I thank both my parents for all their teachings and love. I hope only to make them proud in all that I do.

My brother has been more than my best friend. His presence in my life has carried me through the most trying times. His ability to make me laugh has been my light through the years.

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*"Friendship is unnecessary, like philosophy, like art... It has no survival value; rather is one of those things that give value to survival."*
*- C. S. Lewis*

Kirstin Shearar and Carla Bekker-Smith,

*"Anybody can sympathise with the sufferings of a friend, but it requires a very fine nature to sympathise with a friend's success."*
*- Oscar Wilde*

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*If you love life, don't waste time, for time is what life is made up of.*
*-- Bruce Lee*

## ABSTRACT

### Purpose

Rotator cuff tendinitis is a common problem, however, its diagnosis and management is not completely understood. The purpose of this research project was to investigate the efficacy of the chiropractic adjustment to determine whether or not it is an effective approach in the treatment of rotator cuff tendinitis.

### Methods

This randomized controlled trial consisted of two groups. Each group consisted of thirty subjects, of any age, selected from the general population and randomly allocated to Group 1 or 2, participation in this trial was voluntary.

Group 1 received chiropractic adjustment of the glenohumeral or acromioclavicular joint according to the fixations found on motion palpation and group 2 received placebo laser. Subjects in both groups had to comply with certain inclusion criteria before being allowed to participate in the study. Goniometer readings were taken to measure range of motion, algometer readings to measure pain threshold and the Numerical Pain Rating Scale was answered at the initial consultation, and on the third and sixth consultations.

The Unpaired and Friedman's T- tests were used to assess the intra and intergroup information from the first, third and sixth consultations. Groups 1 and 2 were compared in terms of age, gender, race and clinical severity prior to onset. The data was analysed at

the 95% level of confidence i.e. $p \leq 0.05$. This data was presented in the form of tables and charts.

Results

According to the algometer and goniometer readings there was objective improvement during the treatment program for both groups. There was, however, more statistically significant improvements in the adjustment group. According to the Numerical Pain Rating Scale-101, there was subjective improvement within both groups. Although statistical testing showed the difference between the groups to be insignificant, the adjustment group did show slightly more improvement.

Conclusion

This study suggests that the chiropractic adjustment is more effective in the treatment of rotator cuff tendinitis. It is also the opinion of the author that an adjustment is effective, time and cost efficient and easy to incorporate into any treatment program for rotator cuff tendinitis.

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## DEFINITIONS

### ADJUSTMENT

Specific form of direct articular manipulation utilizing either long or short leverage techniques with specific contacts, characterized 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. (Dox et al. 1993:96)

### 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. (Dox et al. 1993:114)

FIXATION

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

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 utilized by the practitioner that objectively assess the patient's condition. This was achieved through passive range of motion assessment using the goniometer and algometer readings for pain threshold assessment.

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 condtion of the same patient. This was achieved through the use of the Numerical Pain Rating Scale-101.

# CHAPTER 1: INTRODUCTION

## 1.1 The problem and its setting

A Dutch general practice conducted a study to calculate the cumulative incidence of shoulder pain. In 1995 the incidence was estimated at 14.7 per 1000 per year. Shoulder complaints were also found to more common in women and predominately found in the age category 45-64 years. Shoulder impingement syndrome was most frequently diagnosed, in particular rotator cuff tendinitis (29%) (Van der Windt et al. 1995).

The diagnosis of rotator cuff tendinitis rests mainly on clinical findings (Russ 1998). Characteristically, tendinitis is first felt or noticed some time after exercise, or more frequently, the following morning (Brukner 1996). 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 abduction stress test. (Schafer and Faye 1990:334-352).

Green et al. (1998) believe there is no proven best treatment for the painful shoulder. Almekinders and Temple (1998) also believe that further investigation is required regarding the diagnosis and management of shoulder pain. Stage 3 of rotator cuff tendinitis often requires surgery (Brukner 1996) and full recovery takes approximately one 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. (1995), restoring normal motion within the three joints about the shoulder will help to prevent subluxation, impingement and tendinitis. This is therefore, an important aspect of treatment of rotator cuff tendinitis. An adjustment is capable of improving the joint dysfunction associated with rotator cuff tendinitis, and it therefore seems logical that it will be beneficial in the treatment of this condition.

## 1.2 Aims and Objectives of the study

The aim of this study was to characterize shoulder girdle fixations in patients with rotator cuff tendinitis and to evaluate the effect of shoulder adjustments using subjective and objective clinical findings, in the treatment of rotator cuff tendinitis.

### OBJECTIVES

The first objective is to evaluate the presence of shoulder girdle fixations in terms of joint location (glenohumeral and/or acromioclavicular), direction of fixation in patients with rotator cuff tendinitis.

The second objective is to evaluate the effect of shoulder adjustments as apposed to placebo laser in terms of subjective findings in the treatment of rotator cuff tendinitis.

The third objective is to evaluate the effect of shoulder adjustments as opposed to placebo laser in terms of objective findings in the treatment of rotator cuff tendinitis.

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 1992:58). This study hoped to further research regarding the effectiveness of manipulative treatment for this common shoulder disorder.

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 rotator cuff tendinitis (Green et al. 1998). The benefits of this pilot study are that it should serve to open the way for future research into this field as well providing alternative effective treatment options.

It must be emphasized that this was a pilot study. What the author hopes to achieve is to point toward possible relevance and the understanding in the treatment of rotator cuff tendinitis.

## CHAPTER 2: REVIEW OF THE RELATED LITERATURE

### 2.1 INTRODUCTION

The most frequently recorded shoulder disorder in general practice is rotator cuff tendinitis (Van der Windt et al. 1995)

A study by Yassi et al. (1996), showed repetitive strain injuries, especially rotator cuff tendinitis to be increasing and reaching epidemic proportions in certain industries and in most industrialized countries. The average time loss and cost of these injuries was significantly more than other non-repetitive strain injuries. Green et al. (1998) stated that there is little evidence to support or refute the efficacy of common interventions for shoulder pain.

Only one article was found involving manipulation and was for the treatment of shoulder impingement syndrome. In this 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

Rotator cuff tendinitis is one of the most common causes of shoulder pain and dysfunction seen in athletes (Brukner 1996). According to Brukner (1996), it is the most common shoulder problem in sports medicine. It is prevalent in individuals who subject their shoulders to repeated stesses, overhead athletes and middle-aged and elderly persons in whom a cause may not be apparent (Arroyo et al. 1997).

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 rotator cuff tendinitis and impingement (Hawkins and Kennedy 1974). According to Barry and McGuire (1996), even a non-competitive athlete may find himself suffering from the same underlying pathology following a vigorous weekend game of tennis.

In a survey by Van der Windt et al. in 1995, eighteen general practitioners representing a population of 35 150 patients participated in an observational study to study the incidence and management of intrinsic shoulder disorders in Dutch general practice. Over a period of one year the 18 general practitioners reported 754 consultations concerning shoulder complaints in 472 patients; 392 of the patients presented with an incident complaint. The cumulative incidence of shoulder complaints was 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. Subacromial impingement syndrome was the disorder diagnosed most frequently, in particular rotator cuff tendinitis (29%) (Van der Windt et al. 1995).

## 2.3 AETIOLOGY

According to Fu et al. (1995), the aetiology of injury to the rotator cuff is still uncertain, however two main theories exist; extrinsic and intrinsic mechanisms of injury. Extrinsic causes are from outside the rotator cuff. Intrinsic causes are a primary breakdown of the cuff. Extrinsic and intrinsic injuries to the rotator cuff are accelerated by overuse. Primary and secondary causes of impingement lead to an indistinguishable pattern of tendinitis (Fu et al. 1995.).

2.3.1. Extrinsic causes

Extrinsic causes are forces that act outside the rotator cuff, such as the acromion, causing repetitive injury to the tendon and secondary changes within the tendon. This can either be a primary problem secondary to changes of the coracoacromial arch, or it can be secondary. Secondary problems are 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 coracoacromial arch is responsible in the majority of non-athletic cases (Fu et al. 1995).

Alterations on the undersurface of the anterior third of the acromion, the coracoacromial ligaments and sometimes the acromioclavicular joint are some of the changes associated with rotator cuff tendinitis (Klaiman and Gerber 1996). It was demonstrated that the functional arc of elevation of the shoulder is forward, and that impingement occurs predominately against the anterior edge of the acromion and the coracoacromial ligament. When the arm is internally rotated in the forward flexed position this 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 as abduction progresses (Curtis and Wilson 1996).

Primary bony mechanical impingement can occur in young athletes and is most commonly seen in those patients with a prominent type III (hooked) acromial morphology. In athletes with a coracoacromial arch that predisposes an individual to

impingement, repeated overhead activity may lead to an overuse syndrome (Arroyo et al. 1997).

Secondary impingement is result of instability in the glenohumeral joint causing a decrease in the supraspinatus outlet (Arroyo et al. 1997). This is more common in younger athletes, especially the throwing athletes (Fu et al. 1995). The dynamic and static stabilizers of their shoulders are placed under stress with overhead movements, making "overhead" athletes more susceptible to injury. These repetitive stresses result in microtrauma to the glenohumeral ligaments, eventually leading to attenuation of these structures. Decreased functioning of the static stabilizers leads to mild instability, which in turn places increased demands on the rotator cuff. Eventual fatigue of the rotator cuff allows the humeral head to translate anteriorly, with resultant secondary mechanical impingement of the supraspinatus tendon on the coracoacromial. At this point inflammatory changes become evident (Fu et al. 1995).

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 activity involved, each of these can become affected pathologically, alone or in combination (Curtis and Wilson 1996).

### 2.3.2 Intrinsic causes

Extrinsic and intrinsic causes are dependant on inflammatory changes in the rotator cuff. The main contributing factors in the production of a tendinitis include over stress,

impingement of the tendons and diminished blood supply. The area of relative ischaemia of the supraspinatus tendon is the zone where the majority of the rotator cuff pathologic changes are noted (Fu et al. 1995).

The vascular supply of frequently injured tendons been studied and it is suggested that decreased vascularity predisposed the supraspinatus tendon to injury (Brukner 1996). Injury to or repetitive microtrauma of the rotator cuff are responsible for the initial stages of impingement syndrome (Fulcher et al. 1998). This injury causes a weakened and dysfunctional rotator cuff. Muscle imbalance of the shoulder between the weakened rotator cuff and a normal deltoid causes the humeral head to migrate upward during elevation of the arm. Repetitive abrasion between the tuberosity and the coracoacromial arch over long periods of time result in bony hypertrophy of these two structures combined with injury to the rotator cuff (Fulcher et al. 1998).

The previously mentioned avascular region of the tendons will obviously be more vulnerable to impingement and may help to explain the aetiology of rotator cuff tendinitis. It would appear that chronic irritation in the avascular region of the supraspinatus tendon leads to the initial inflammatory response reflected in rotator cuff tendinitis (Clancy and Hagan 1996).

## 2.4 PATHOPHYSIOLOGY

Mechanical impingement, either primary or secondary, results in rotator cuff tendinitis and initiation of inflammatory changes (Fu et al. 1995). Microscopically, the pathophysiological pathway is the same.

Hypovascularity, age-related degeneration impingement, repetitive microtrauma and macrotrauma result in rotator cuff tendinitis (Blevins 1997). "Overhead" athletes train for activities that require movement at the limits of physiologic range of motion. This overuse is directly responsible for rotator cuff tendinitis. Repetitive eccentric traction loads cause microtrauma to the supraspinatus tendon. This is the initial injury after which there is vasoconstriction and inflammatory changes. The following vasodilation brings with it acute mediators of inflammation. The tissue is not permitted to heal because of the repetitive motions of the athletes training or sport so chronic inflammation and tendinitis ensue.

The supraspinatus tendon passes under the coracoacromial arch through a rigid and inextensible canal. Repetitive mechanical load results in microinjuries of the tendon tissue. If the injurious effects of repetitive motion continues to exceed the healing capability of the tendon, a symptomatic tendon injury or tendinitis can develop (Almekinders and Temple 1998).

Neer (1983) classified rotator cuff tendinitis 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 (Baquie 1997).

Stage 2 – "Fibrosis and tendinitis." 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

Shoulder injury in athletes is largely dependent on the age of the athlete and their level of performance (Arroyo et al. 1997). Younger athletes (18-35 years old) frequently have problems associated with instability and secondary impingement. Older overhead athletes often have 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).

Anatomical variation such as differences in alignment and range of motion could theoretically predispose a tendon to injury in athletes by placing increased mechnical stress on certain tendons (Almekinders and Temple 1998).

## 2.6 DIAGNOSIS OF ROTATOR CUFF TENDINITIS

The diagnosis of rotator cuff tendinitis rests mainly on clinical findings (Russ 1998). 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).

Roentgenogram studies are often unreliable as abnormalities will only be apparent well into the course of the tendinitis. Earlier stages of rotator cuff tendinitis 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 coracoacomial ligament; (4) acromioclavicular joint changes; and (5) late narrowing of the subacromial space (Blevins 1997).

## 2.7 EXAMINATION

Tenderness over the supraspinatus tendon, proximal to, or at it's insertion into the greater tuberosity of the humerus. Active movement reveals a painful arc on abduction between approximately 70 degrees and 120 degrees. Symptoms of rotator cuff tendinitis can be reproduced with the impingement test as well as pain at the extremes of resisted flexion.

Pain will also occur with resisted contraction of the supraspinatus muscle (Brukner 1996).

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 tendinitis (Rupp et al. 1995).

## 2.8 CLINICAL CHARACTERISTICS OF ROTATOR CUFF TENDINITIS

### 2.8.1 Stage 1

Characteristically, tendinitis is initially felt as a tooth-ache like pain after exercise, or frequently the following morning (Brukner 1996). This pain may progress to discomfort during sport or activity, eventually affecting performance and interfering with sleep (Belzer and Durkin 1996).

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) painful arc of abduction, maximum at 90 degrees; and

(3) a positive shoulder abduction stress test.

(Schafer and Faye 1990:334-352)

2.8.2 Stage 2

Chronic inflammation or repetitive episodes of impingement can lead to stage 2. The symptoms still consist of an aching discomfort often worse at night that interferes with sleep, and may progress to interfere with everyday activities. (Brukner 1996).

The clinical picture and physical signs are present as in stage 1.There is often a stiffer shoulder with acromioclavicular joint tenderness. There may also be a painful catching sensation as the arm is lowered from the abducted position, which could represent catching of the scar tissue under the impingement area.
(Belzer and Durkin 1996).

Repetitive microtrauma leads to eventual scarring in the subacromial space and this is manifested as soft-tissue crepitus, associated with mild limitation to both passive and active range of motion (Barry and McGuire 1996).

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

2.8.3 Stage 3

Characteristic of this stage is a long history of shoulder problems, characterized by a refractory tendinitis, wear and tear of the supraspinatus and frequently biceps tendon, with partial and eventual complete thickness rotator cuff tears (Brukner 1996).

Patients experience toothache-like pain that may be minimal or severe. The pain is often worse at night and often prohibits daily activities This may be associated with or without complaints of weakness depending on the integrity of the rotator cuff (Belzer and Durkin 1996).

All of the previous signs described in stages 1 and 2 are frequently present. By this stage patients generally have more pain and stiffness, weakness is experienced and is found to be more pain related, and there are frequently bicipital findings as well as tenderness about the acromioclavicular joint. (Belzer and Durkin 1996).

In the case of a degenerative or partial thickness tear, the rotator cuff is vulnerable and any minor insult could result in a full thickness tear (Brukner 1996). This would manifest as sudden weakness and decreased range of motion, seen primarily as inability to elevate the arm (Klaiman and Gerber 1996).

Complete and partial tears of the rotator cuff are common in older athletes. They are probably due to the process of degeneration within the tendon. There may or may not be a history of shoulder injury (Brukner 1996).

There may be varying amounts of weakness as well as an inability to elevate the arm. Common and reliable signs include: (1) infraspinatus 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. A painful abduction stress test is often positive (Koehler et al. 1996).

## 2.9 TREATMENT

According to Brukner (1996) the majority of patients with rotator cuff tendinitis respond well to conservative treatment. However, Green et al. (1998) believe there is no proven best treatment for shoulder pain. Almekinders and Temple (1998) agree that further research is required regarding the diagnosis and management of rotator cuff tendinitis.

### 2.9.1 Stage 1

Brukner (1996), and Fu et al. (1995) reported that stage 1 generally responds well to conservative treatment and is reversible with the appropriate rehabilitation.
The main goals in the treatment and rehabilitation of stage 1 rotator cuff tendinitis is to promote healing of inflamed tissue and restore joint motion and function. This includes restoring mobility and neuromuscular balance to the shoulder girdle. It is important to prevent impingement, subluxation and tendinitis by ensuring that motion of the three joints about the shoulder is restored. Proprioceptive neuromuscular functions to correct strength deficiencies, provide flexibility and coordination (Fu et al. 1995).

The inflamed rotator cuff must be protected from further aggravation with modification (Fu et al. 1995). Brukner (1996) suggests that firstly the tendinitis be treated by avoiding the aggravating activity, applying ice and administering anti-inflammatory drugs to reduce inflammation. This can be combined with ultrasound, laser, and interferential stimulation. He states that limited success may be found and the next step may be corticosteroid injection. The second part of the treatment consists of correcting associated abnormalities including glenohumeral instability, muscle weakness or incoordination,

soft tissue tightness and training errors.

Green et al. (1998) designed a study where all randomised controlled trials of non-steroidal anti-inflammatory drugs, intra-articular and subacromial glucocoticosteroid injection, oral glucocorticosteroid treatment, physiotherapy, manipulation under anaesthesia, hydrodilatation, and surgery for shoulder pain that were identified by computerised and hand searches of the literature and had a blinded assessment of outcome were included. They concluded that there is little evidence to support or refute the efficacy of these common interventions for shoulder pain.

Since tendinitis has an inflammatory component many physicians commonly administer anti-inflammatory drugs. Many studies have been published regarding their use. According to Almekinders and Temple (1998) nine studies were prospective and contained a placebo group. Five of these nine showed improved pain scores at final follow-up in the patients using non-steroidal anti-inflammatory drugs.

2.9.2 Stage 2

Symptoms of the tendinitis become more evident in stage 2 and the same conservative measures as used in stage 1 are necessary to control these symptoms. Restoration of motion and flexibility become more important in this stage. Active strengthening of the tendon is recommended. Eccentric appear to have specific affect on tendon strength compared to concentric exercises. Surgery is occasionally indicated when conservative management has failed. This may involve stripping of paratendon, release of adhesions or removal of degenerative tissue (Brukner 1996).

### 2.9.3 Stage 3

In Stage 3 a rotator cuff tear is often present. Pain control is still prescribed as is maintenance of flexibility by stretching and strengthening (Fu et al. 1995). Surgery is often indicated and the approach involves arthroscopy to evaluate the tear, treatment of the associated pathology and subacromial decompression (Curtis and Wilson 1996).

Anterior acromioplasty can be performed and has been successful in selected patients. Less favorable results have been reported. The degree of rotator cuff pathology seen at surgery did not influence the outcome. Subacromial decompression showed excellent relief of pain, however very few athletes could return to the same level of activity (Arroyo et al. 1997).

## 2.10 SUMMARY

Rotator cuff tendinitis is a common problem, especially in athletes. Although most patients respond well to conservative treatment, professionals still disagree as to which treatment approach is most effective. There does not appear to be a study comparing the relative effectiveness of chiropractic adjustment in the treatment of rotator cuff tendinitis. The aim of this dissertation was to compare an adjustment versus placebo laser in the treatment of rotator cuff tendinitis, in an 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 disorder.

## CHAPTER 3: MATERIALS AND METHODS

### 3.1 INTRODUCTION

This study was designed as a comparative, clinical trial, involving two sample groups of 30 patients each. The objective was to compare two treatment groups (shoulder adjustment versus placebo laser) to assess for inter-group improvement. An intra-group statistical analysis was also performed. The purpose of the study was to determine whether shoulder adjustment is effective as a form of treatment for rotator cuff tendnitis. This treatment could then be used as either the primary treatment for rotator cuff tendinitis or as an adjunct to other treatment options.

### 3.2 THE SUBJECTS

Patients were obtained by means of consecutive convenience sampling, using advertisements posted around the Technikon Campus and in local sporting 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 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.

## 3.3 INCLUSION AND EXCLUSION CRITERIA OF PATIENTS

1) Patients could be of any age.

2) Only patients diagnosed by the researcher as having rotator cuff tendinitis 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 four of the following four physical findings:

- Palpable tenderness over the greater tuberosity of the humerus of the involved shoulder;
- Palpable tenderness along anterior edge of the acromion of the involved shoulder;
- A painful arc of abduction between 60 and 120 degrees; and
- A positive shoulder abduction stress test.

(Schafer and Faye 1990:334-352.)

6) Patients had to have fixations of the acromioclavicular joint and/or glenohumeral joint according to the motion palpation principles described in Schafer and Faye (1990:334-352).

7) Patients were excluded:

- If there was a history of traumatic shoulder dislocation, or instability of the shoulder, or if the physical findings which suggest instability, such as apprehension sign, were positive. Also if there was a positive drop arm test which could indicate a rupture of the rotator cuff.
- If there was any joint noise on examination, as this may signify a loose body, a labral defect, or other cartilage problems. Intra-articular pathology, such as glenohumeral arthritis also presents with bony crepitus.
- If pain radiated distally, below the elbow.
- If there was a history of shoulder surgery in the previous two years.
- If they had, or if the physical examination suggested they had, cardiac, pulmonary or systemic diseases, which may refer pain to the shoulder.
- If the diagnosis was not clinically clear and further investigative procedures, such as radiographs were needed.
- If there were no fixations of the acromioclavicular joint or glenohumeral joint.

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

## 3.4 THE SAMPLE GROUP

A sample of sixty patients was randomly divided into two groups of thirty according to the process of randomization as described by Scott-Dawkins (1995). Thirty labels representing shoulder adjustment and thirty representing placebo laser were folded such that they were obscured and then put into a hat. Each patient was asked to draw out a

label to determine which group they would be assigned to.

Patients who passed the initial screening test and inclusion criteria underwent a detailed case history (appendix B), physical examination (appendix C), and shoulder regional examination (appendix D). If, after this consultation the patient was still deemed acceptable, a series of six treatments within a two week period were booked.

## 3.5 INTERVENTIONS

Group 1 received shoulder adjustment while group 2 received placebo laser. The patients in group 1 and group 2 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 1 were required to sit or lie in a comfortable position with their shoulder girdle exposed. Their shoulder was adjusted in the direction of the fixation as described by Schafer and Faye (1990:332-352).

The patients in group 2 were required to sit in a comfortable position with their shoulder girdle exposed during the treatment. The laser unit was set on zero, and the time set to 5 minutes.

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

## 3.6 MEASUREMENTS

### 3.6.1 Subjective Measures

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

Each patient was required to fill out a patient consent form (appendix E) 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 Numerical Pain Rating Scale-101 (appendix F).

The allocated research treatment was performed on the patient. The subjective and objective measurements were performed at treatments one, three and six, so that any improvement during the treatment and the duration of that improvement could be assessed.

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 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 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 at the third and sixth treatments.

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 to zero.
- The algometer was placed on the point of maximum tenderness already located and documented at the first consultation.

- The pressure was gradually increased at a rate of one kilogram per second as recommended by Fischer (1986).
- The patient was told to express the point at which pain is first perceived.
- The reading on the dial was then recorded on the Data Sheet (appendix G).

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 ANALYSIS

The SPSS statistical package (as supplied by SPSS Inc. Marketing Department, 444 North Michigan Avenue, Chicago Illinois, 60611) was utilized for data analysis. The statistical evaluation was aimed at measuring any significant changes occurring between the initial and third consultation, the initial and sixth consultation, as well as the third and sixth consultations between the different study groups.

### 3.7.1 Comparison between Independent Samples

The two sample unpaired t-test (parametric test) was used to determine whether any significant difference occurred between the two groups at the time of the initial, third and sixth consultations. The subjective data tested was the NPRS-101. The objective data tested was the algometer and goniometer.

### 3.7.2 Comparison between related samples.

The Friedman's T-test was used to determine whether any significant change occurred between:

The initial, third and sixth consultations, within each study group.

The variables listed were the NPRS-101 as well as the algometer and goniometer readings.

Hypothesis testing and the decision rule:

The null hypothesis ($H_o$) stated that there was no improvement between treatments. The alternative hypothesis (H1) stated that there was an improvement between the treatments.

$\alpha = 0.05$ = level of significance

For a one tailed test,

Reject $H_o$ if $P < \alpha = 0.05$

Accept $H_o$ if $P \geq \alpha = 0.05$ where:

$P$ = (reported $p$-value) / 2 if H1 is of form < and z is negative

H1 is of form > and z is positive

$P$ = 1 – (reported $p$-value / 2 ) if H1 is of form < and z is positive

H1 is of form > and z is negative

If the null hypothesis $H_o$ is rejected for Friedman's T-test, then multiple comparison procedure (Dunn procedure) will have to be applied to determine which of the treatments are significantly

different.

Summary statistics including the mean, standard deviation and standard error were obtained to support the data from the various tests.

The results of these tests were used to discuss and draw conclusions as to the efficacy of shoulder adjustments in the treatment of rotator cuff tendinitis.

## 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. The results 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, internal rotation, horizontal abduction and horizontal adduction. The subjective findings to be statistically analyzed was the Numerical Pain Rating Scale-101.

### 4.2 DEMOGRAPHIC DATA

Figure 1: The ratio of males to females within the sample was 43:17

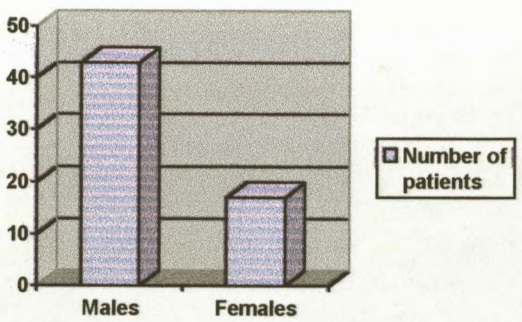


Table 1: The sport or activity the patients participate in.

| Sport or Activity | Group 1 Adjustment | Group 2 Placebo Laser | Total |
|---|---|---|---|
| Swimming | 1 | 0 | 1 |
| Tennis | 0 | 1 | 1 |
| Weight Training | 11 | 8 | 19 |
| Golf | 0 | 1 | 1 |
| Rugby | 0 | 2 | 2 |
| Waterpolo | 2 | 1 | 3 |
| Cricket | 3 | 1 | 4 |
| Bowling | 1 | 0 | 1 |
| VolleyBall | 1 | 1 | 2 |
| Dancing | 1 | 1 | 2 |
| Yoga | 0 | 1 | 1 |
| No Sport | 10 | 13 | 23 |

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

| | Group 1 Adjustment | Group 2 Placebo Laser | Total |
|---|---|---|---|
| Age Distribution | | | |
| Age Range: | 18 - 63 | 20 – 76 | 18 – 76 |
| Average Age: | 41.53 | 42.00 | 41.76 |
| Gender Distribution | | | |
| Male | 22 | 21 | 43 |
| Female | 8 | 9 | 17 |

## 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 |
| $\alpha$ | = The level of significance of the test |
| NPRS-101 | = The Numerical Pain Rating Scale-101 Questionnaire |
| Con 1 | = Consultation One |
| Con 3 | = Consultation Three |
| Con 6 | = Consultation Six |
| H. Abd | = Horizontal abduction |
| H. Add | = Horizontal adduction |
| E. Rota | = External rotation |
| I. Rota | = Internal rotation |

TABLES TO CHARACTERIZE JOINT FIXATIONS IN TERMS OF LOCATION (ACROMIOCLAVICULAR/ GLENOHUMERAL) AND DIRECTION IN PATIENTS WITH ROTATOR CUFF TENDINITIS.

Table 3: The number and direction of fixations found in the Acromioclavicular Joint.

| Direction of Fixation | Con 1 | Con 3 | Con 6 | TOTAL | Percentage |
|---|---|---|---|---|---|
| Superior to Inferior shear | 40 | 40 | 40 | 120 | 76.43% |
| Anterior to Posterior shear | 13 | 12 | 12 | 37 | 23.57% |

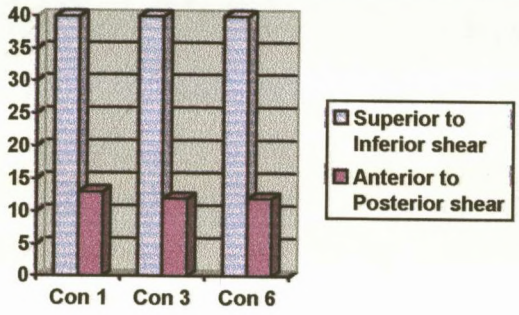



Figure 2: The no. and direction of fixations in the acromioclavicular joint.

Table 4: The number and direction of fixations found in the Glenohumeral Joint.

| Direction of Fixation | Con 1 | Con 3 | Con 6 | TOTAL | Percentage |
|---|---|---|---|---|---|
| Posterior to Anterior glide | 2 | 2 | 2 | 6 | 3.39% |
| Anterior to Posterior glide | 12 | 13 | 11 | 36 | 20.33% |
| External Rotation | 25 | 22 | 23 | 70 | 39.55% |
| Internal Rotation | 15 | 15 | 13 | 43 | 24.29% |
| Medial/Lateral to Anterior/Posterior | 1 | 0 | 0 | 1 | 0.56% |
| Superior/Inferior to Anterior to Posterior | 7 | 8 | 6 | 21 | 11.86% |

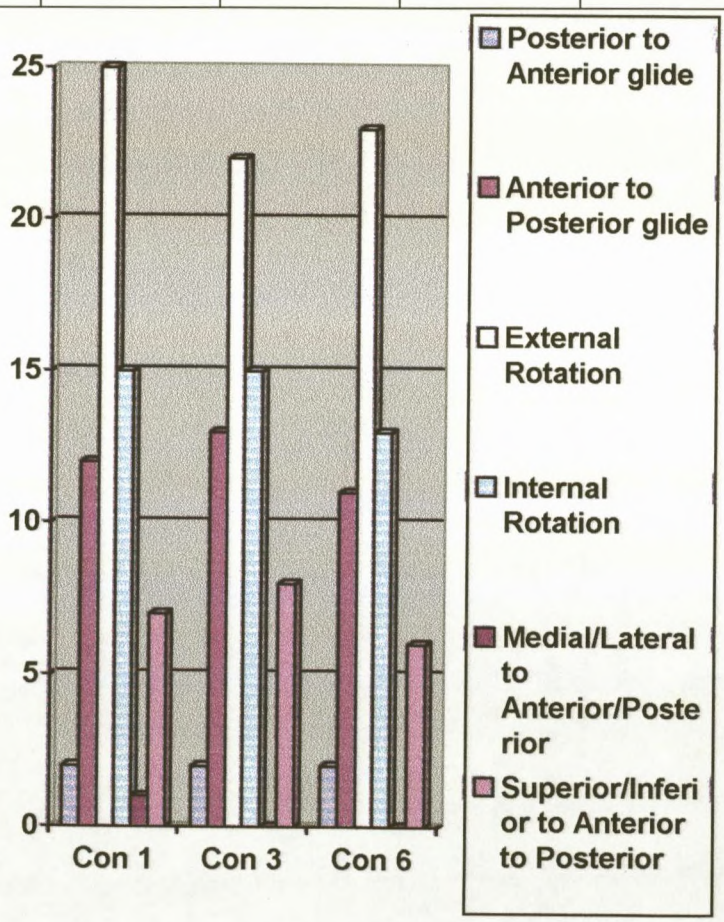



Figure 3: The no. and direction of fixations in the glenohumeral joint.

## 4.4 NON-PARAMETRIC HYPOTHESIS TESTING

### 4.4.1 INTERGROUP ANALYSIS: Unpaired T-Test

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

4.4.1.1 Analysis of **objective** findings.

Table 5: The results of the unpaired t-test comparing the algometer readings of groups 1 and 2 taken on the anterior acromion at the first consultation, third consultation and sixth consultation.

| GROUP ONE : ADJUSTMENT | | | | GROUP TWO : PLACEBO LASER | | | |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | S.E. | P-value | Mean | S.D. | S.E. |
| Con 1 | 2.5600 | 0.8803 | 0.1607 | 0.199 | 2.3733 | 0.8153 | 0.1489 |
| Con 3 | 2.9967 | 0.8716 | 0.1591 | **0.004** | 2.4133 | 0.8093 | 0.1478 |
| Con 6 | 3.3833 | 0.9685 | 0.1768 | **0.001** | 2.6233 | 0.8472 | 0.1547 |

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

The null hypothesis is rejected at the third and sixth consultation, which indicates that at $\alpha = 0.05$ level of significance there was statistically an improvement 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 consistent.

Table 6: The results of the unpaired t-test comparing the algometer readings of groups 1 and 2 taken on the greater tuberosity at the first consultation, third consultation and sixth consultation.

| | GROUP ONE : ADJUSTMENT | | | GROUP TWO : PLACEBO LASER | | | |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | S.E. | P-value | Mean | S.D. | S.E. |
| Con 1 | 3.0533 | 0.9134 | 0.1668 | 0.353 | 3.1400 | 0.8609 | 0.1572 |
| Con 3 | 3.3933 | 0.9762 | 0.1782 | **0.018** | 2.8967 | 0.8177 | 0.1493 |
| Con 6 | 3.8300 | 0.8230 | 0.1503 | **0.001** | 3.1767 | 0.8357 | 0.1526 |

The null hypothesis is accepted at the first consultation, which indicates that at $\alpha = 0.05$ level of significance there was statistically no improvement between group 1 and group 2.

The null hypothesis rejected at the third and sixth consultations, which indicates that at $\alpha = 0.05$ level of significance there is an improvement 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 consistent.

Table 7: The results of the unpaired t-test comparing the goniometer readings of flexion of groups 1 and 2 at the first consultation, third consultation and sixth consultation.

| GROUP ONE : ADJUSTMENT | | | | GROUP TWO : PLACEBO LASER | | | |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | S.E. | P-value | Mean | S.D. | S.E. |
| Con 1 | 152.6667 | 28.1539 | 5.1402 | 0.427 | 154.0000 | 27.6181 | 5.0423 |
| Con 3 | 163.6667 | 24.4573 | 4.4653 | 0.284 | 160.3333 | 20.2541 | 3.6979 |
| Con 6 | 170.5000 | 16.1004 | 2.9395 | 0.127 | 165.3333 | 18.5199 | 3.3813 |

The null hypothesis is accepted at the first, third and sixth consultation, which indicates that that at $\alpha = 0.05$ level of significance there was no improvement between group 1 and group 2.

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

Table 8: The results of the unpaired t-test comparing the goniometer readings of extension of groups 1 and 2 at the first consultation, third consultation and sixth consultation.

| GROUP ONE : ADJUSTMENT | | | | GROUP TWO : PLACEBO LASER | | | |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | S.E. | P-value | Mean | S.D. | S.E. |
| Con 1 | 64.6667 | 11.3664 | 2.0752 | 0.152 | 67.6667 | 11.0433 | 2.0162 |
| Con 3 | 71.6667 | 9.7674 | 1.7833 | 0.133 | 68.8333 | 9.7983 | 1.7889 |
| Con 6 | 74.0000 | 8.0301 | 1.4661 | **0.024** | 69.3333 | 9.8027 | 1.7897 |

The null hypothesis is accepted for the first and third consultation which indicates that at $\alpha = 0.05$ level of significance there was statistically no improvement between group 1 and group 2.

The null hypothesis is rejected at the sixth consultation which indicates that at $\alpha = 0.05$ level of significance there was statistically an improvement 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 consistent.

Table 9: The results of the unpaired t-test comparing the goniometer readings of abduction of groups 1 and 2 at the first consultation, third consultation and sixth consultation.

| | GROUP ONE : ADJUSTMENT | | | GROUP TWO : PLACEBO LASER | | | |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | S.E. | P-value | Mean | S.D. | S.E. |
| Con 1 | 129.1667 | 38.6426 | 7.0551 | **0.015** | 148.3333 | 26.9205 | 4.9150 |
| Con 3 | 145.1667 | 35.4402 | 6.4705 | 0.175 | 153.1667 | 30.0713 | 5.4902 |
| Con 6 | 159.0000 | 28.3269 | 5.1718 | 0.289 | 155.0000 | 27.2599 | 4.9770 |

The null hypothesis is rejected for the first consultation, and one can conclude that at $\alpha = 0.05$ level of significance there was an improvement between group 1 and group 2.

The null hypothesis is accepted for consultations three and six, and one can conclude that at $\alpha = 0.05$ level of significance there was no improvement between group 1 and group 2.

There was a slight difference between the S.D. values for treatment one. The adjustment group showed greater spread around the mean which makes this data less reliable than that of the placebo group.

Table 10: The results of the unpaired t-test comparing the goniometer readings of adduction of groups 1 and 2 at the first consultation, third consultation and sixth consultation.

| GROUP ONE : ADJUSTMENT | | | | GROUP TWO : PLACEBO LASER | | | |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | S.E. | P-value | Mean | S.D. | S.E. |
| Con 1 | 61.1667 | 13.8142 | 2.5221 | 0.165 | 64.5000 | 12.4810 | 2.2787 |
| Con 3 | 66.5000 | 11.8285 | 2.1596 | 0.160 | 63.3333 | 12.6854 | 2.3160 |
| Con 6 | 68.0000 | 11.5669 | 2.1118 | 0.124 | 64.3333 | 12.7802 | 2.3333 |

The null hypothesis is accepted for consultations one, three and six, which indicates that at $\alpha = 0.05$ level of significance there was statistically no improvement between group 1 and group 2.

The S.D. values, showing spread around the mean, were similar enough to render the data reliable and consistent.

Table 11: The results of the unpaired t-test comparing the goniometer readings of external rotation of groups 1 and 2 at the first consultation, third consultation and sixth consultation.

| GROUP ONE : ADJUSTMENT | | | | GROUP TWO : PLACEBO LASER | | | |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | S.E. | P-value | Mean | S.D. | S.E. |
| Con 1 | 70.3333 | 15.6983 | 2.8661 | 0.289 | 72.6667 | 16.5952 | 3.0299 |
| Con 3 | 77.0000 | 14.6570 | 2.6760 | 0.111 | 72.1667 | 15.7394 | 2.8736 |
| Con 6 | 78.0000 | 14.7157 | 2.6867 | 0.123 | 73.0000 | 18.2228 | 3.3270 |

The null hypothesis is accepted for consultations one, three and six, which indicates that at $\alpha = 0.05$ level of significance there was statistically no improvement between group 1 and group 2.

The S.D. values, showing spread around the mean, were similar enough to render the data reliable and consistent.

Table 12: the results of the unpaired t-test comparing the goniometer readings of internal rotation of groups 1 and 2 at the first consultation, third consultation and sixth consultation

| | GROUP ONE : ADJUSTMENT | | | GROUP TWO : PLACEBO LASER | | | |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | S.E. | P-value | Mean | S.D. | S.E. |
| Con 1 | 56.6667 | 8.7428 | 1.5962 | 0.378 | 57.3333 | 7.8492 | 1.4331 |
| Con 3 | 59.3333 | 8.2768 | 1.5111 | 0.141 | 57.0000 | 8.3666 | 1.5275 |
| Con 6 | 59.6667 | 7.1840 | 1.3116 | 0.128 | 57.0000 | 10.5536 | 1.9268 |

The null hypothesis is accepted for consultations one, three and six, which indicates that at $\alpha = 0.05$ level of significance there was statistically no improvement between group 1 and group 2.

The S.D. values, showing spread around the mean, were similar enough to render the data reliable and consistent.

Table 13: The results of the unpaired t-test comparing the goniometer readings of horizontal abduction of groups 1 and 2 at the first consultation, third consultation and sixth consultation.

| | GROUP ONE : ADJUSTMENT | | | GROUP TWO : PLACEBO LASER | | | |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | S.E. | P-value | Mean | S.D. | S.E. |
| Con 1 | 99.1667 | 24.9165 | 4.5491 | 0.327 | 96.3333 | 23.8506 | 4.3545 |
| Con 3 | 103.6667 | 27.6035 | 5.0397 | 0.190 | 98.0000 | 21.7192 | 3.9654 |
| Con 6 | 107.8333 | 24.5541 | 4.4829 | 0.060 | 98.3333 | 21.9848 | 4.0139 |

The null hypothesis is accepted for consultations one, three and six, which indicates that at $\alpha = 0.05$ level of significance there was statistically no improvement between group 1 and group 2.

The S.D. values, showing spread around the mean, were similar enough to render the data reliable and consistent.

Table 14: The results of the unpaired t-test comparing the goniometer readings of horizontal adduction of groups 1 and 2 at the first consultation, third consultation and sixth consultation.

| | GROUP ONE : ADJUSTMENT | | | GROUP TWO : PLACEBO LASER | | | |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | S.E. | P-value | Mean | S.D. | S.E. |
| Con 1 | 59.3333 | 14.1259 | 2.5790 | 0.458 | 59.0000 | 9.9481 | 1.8163 |
| Con 3 | 62.1667 | 12.8441 | 2.3450 | **0.041** | 57.0000 | 9.5231 | 1.7387 |
| Con 6 | 62.0000 | 13.7465 | 2.5098 | 0.222 | 59.3333 | 13.1131 | 2.3941 |

The null hypothesis is accepted for consultations one and six which indicates that at $\alpha = 0.05$ level of significance there was no improvement between group 1 and group 2.

The null hypothesis is rejected for consultation three which indicates that at $\alpha = 0.05$ level of confidence there was an improvement between group 1 and group 2.

The standard deviation, showing the spread of data around the mean, were similar enough to render the two sets of data reliable and consistent.

4.4.1.2. Analysis of **subjective** findings

Table 15: The results of the unpaired t-test comparing the Numerical Pain Rating Scale-101 values of groups 1 and 2 at the first consultation, third consultation and sixth consultation.

| | GROUP ONE : ADJUSTMENT | | | | GROUP TWO : PLACEBO LASER | | |
|---|---|---|---|---|---|---|---|
| | Mean | S.D. | S.E. | P-value | Mean | S.D. | S.E. |
| Con 1 | 43.1667 | 14.4874 | 2.6450 | 0.248 | 40.7167 | 13.2819 | 2.4249 |
| Con 3 | 35.7667 | 14.3285 | 2.6160 | 0.491 | 35.8500 | 14.1721 | 2.5875 |
| Con 6 | 23.3833 | 15.8319 | 2.8905 | 0.0629 | 30.0833 | 17.4589 | 3.1875 |

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

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

## 4.4 NON-PARAMETRIC HYPOTHESIS TESTING

### 4.4.2 INTRA-GROUP ANALYSIS: Friedman's Test

#### 4.4.2.1 Analysis of **objective** findings of GROUP 1 (chiropractic adjustment)

Table 16: The results of Friedman's test comparing all goniometer readings and algometer readings taken on the anterior acromion and greater tuberosity between the first, third and sixth consultations.

| GROUP ONE CHIROPRACTIC ADJUSTMENT | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Con One | | Con Three | | Con Six | | |
| Goniometer | | | | | | | |
| | Mean | S.D. | Mean | S.D. | Mean | S.D. | P-value |
| Flexion | 153.3333 | 27.6581 | 162.0000 | 22.3265 | 167.9167 | 17.4008 | **0.000** |
| Extension | 66.1667 | 11.2131 | 70.2500 | 9.8042 | 71.8333 | 9.2501 | **0.000** |
| Abduction | 138.7500 | 34.4032 | 149.3333 | 32.9157 | 157.1667 | 27.4999 | **0.000** |
| Adduction | 62.8333 | 13.1602 | 64.9167 | 12.2644 | 66.1667 | 12.2255 | **0.012** |
| E.Rota | 71.5000 | 16.0587 | 74.7500 | 15.3883 | 75.5000 | 16.6138 | **0.005** |
| I. Rota | 57.0000 | 8.2442 | 58.1667 | 8.3345 | 58.3333 | 9.0510 | 0.134 |
| H. Abd | 97.7500 | 24.2240 | 99.6667 | 13.2136 | 102.7500 | 23.3511 | **0.013** |
| H. Add | 59.1667 | 12.1141 | 59.2500 | 11.3431 | 60.6667 | 13.3869 | 0.146 |
| Algometer | | | | | | | |
| Ant. Acro | 2.4667 | 0.8465 | 2.7050 | 0.8842 | 3.0200 | 0.9799 | **0.000** |
| Grt. Tub | 3.0967 | 0.8811 | 3.1417 | 0.9292 | 3.4883 | 0.8927 | **0.000** |

For the goniometer readings of flexion, extension, abduction, adduction, external rotation, and horizontal abduction, and for both algometer readings, the null hypothesis is rejected and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and six.

For the goniometer readings of internal rotation and horizontal adduction, the null hypothesis is accepted and one can conclude that at the 5% significance level, there was no improvement between consultations one, three and six.

The standard deviation shows the spread of data around the mean value. In all instances above the S.D. values were similar enough to render the data reliable and consistent.

4.4.2.2 Analysis of **subjective** findings of GROUP 1 (chiropractic adjustment)

Table 17: The results of Friedman's test comparing the Numerical Pain Rating Scale-101 readings taken on consultations one, three and six.

| GROUP ONE CHIROPRACTIC ADJUSTMENT | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Con One | | Con Three | | Con Six | | |
| | Mean | S.D. | Mean | S.D. | Mean | S.D. | P-value |
| NPRS | 41.9417 | 13.8347 | 35.7417 | 14.1018 | 26.6500 | 16.8108 | **0.000** |

For the NPRS-101 readings, the null hypothesis is rejected which means that at the 5% significance level, there was significant improvement between consultations one, three and six.

The S.D. values show the spread of data around the mean. In the instance above the values are similar enough to render the data reliable and consistent.

4.4.2.3 Analysis of the **objective** findings of GROUP 2 (Placebo Laser)

Table 18: The results of Friedman's test comparing and all goniometer readings and algometer readings taken on the anterior acromion and greater tuberosity taken on the first, third and sixth consultations.

| GROUP TWO PLACEBO LASER | | | | | | | |
|---|---|---|---|---|---|---|---|
| Con One | | | Con Three | | Con Six | | |
| Goniometer | | | | | | | |
| | Mean | S.D. | Mean | S.D. | Mean | S.D. | P-value |
| Flexion | 154.5161 | 27.3055 | 160.9677 | 20.2245 | 165.8065 | 18.3982 | **0.002** |
| Extension | 67.7419 | 10.8657 | 69.1935 | 9.8401 | 70.0000 | 10.0000 | 0.085 |
| Abduction | 148.7097 | 26.5508 | 153.7097 | 29.7200 | 155.8065 | 26.6801 | **0.047** |
| Adduction | 64.3548 | 12.2978 | 63.8710 | 12.8264 | 64.5161 | 12.6065 | 0.469 |
| E.Rota | 72.2581 | 16.4742 | 72.7419 | 15.8029 | 72.9032 | 17.9246 | 0.980 |
| I. Rota | 57.4194 | 7.7321 | 57.0968 | 8.2436 | 57.4194 | 10.6357 | 0.758 |
| H. Abd | 97.0968 | 23.8318 | 98.7097 | 21.5626 | 98.7097 | 21.7167 | 0.880 |
| H. Add | 59.0323 | 9.7826 | 57.0968 | 9.3785 | 59.3548 | 12.8933 | 0.572 |
| Algometer | | | | | | | |
| Ant. Acro | 2.4129 | 0.8314 | 2.4645 | 0.8452 | 2.6677 | 0.8689 | **0.010** |
| Grt. Tub | 3.1548 | 0.8504 | 2.9161 | 0.8112 | 3.2065 | 0.8306 | **0.022** |

For the goniometer readings of flexion and abduction and for both algometer readings the null hypothesis is rejected, and one can conclude that at the 5% significance level, there was an improvement between consultations one, three and six.

For the goniometer readings of extension, adduction, external rotation, internal rotation, horizontal abduction and horizontal adduction the null hypothesis is accepted and one can conclude that at the 5% significance level there was no improvement between consultations one, three and six.

The S.D. values, which show the spread of data around the mean were similar enough to render the data reliable and consistent.

4.4.2.4 Analysis of the **subjective** findings of GROUP 2 (Placebo Laser)

Table 19: The results of Friedman's test comparing the NPRS-101 readings taken at consultations one, three and six.

| GROUP TWO PLACEBO LASER | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Con One | | Con Three | | Con Six | | |
| | Mean | S.D. | Mean | S.D. | Mean | S.D. | P-value |
| NPRS | 39.7258 | 14.1762 | 35.0484 | 14.6563 | 29.4355 | 17.5403 | **0.002** |

For the NPRS-101 readings, the null hypothesis is rejected, which means that at the 5% significance level, there was an improvement between consultations one, three and six.

Table 20: Ranking for Goniometer readings for Flexion.

| BLOCKS | ONE | THREE | SIX |
|---|---|---|---|
| 1 | 90 (1) | 95 (2) | 120 (3) |
| 2 | 140 (1) | 150 (2) | 160 (3) |
| 3 | 140 (1) | 150 (2) | 170 (3) |
| 4 | 160 (1) | 170 (2) | 180 (3) |
| 5 | 160 (1) | 170 (2.5) | 170 (2.5) |
| 6 | 90 (1) | 120 (2) | 135 (3) |
| 7 | 150 (1) | 170 (2) | 180 (3) |
| 8 | 100 (1.5) | 100 (1.5) | 150 (3) |
| 9 | 170 (1) | 180 (2.5) | 180 (2.5) |
| 10 | 160 (1) | 165 (2) | 180 (3) |
| 11 | 160 (1) | 170 (2) | 180 (3) |
| 12 | 180 (2) | 180 (2) | 180 (2) |
| 13 | 120 (1) | 140 (2) | 160 (3) |
| 14 | 150 (1) | 170 (2) | 180 (3) |
| 15 | 180 (2) | 180 (2) | 180 (2) |
| 16 | 170 (1.5) | 170 (1.5) | 180 (3) |
| 17 | 160 (1) | 170 (2) | 180 (3) |
| 18 | 90 (1) | 120 (2) | 150 (3) |
| 19 | 180 (2) | 180 (2) | 180 (2) |
| 20 | 150 (1) | 180 (2.5) | 180 (2.5) |
| 21 | 180 (1.5) | 180 (1.5) | 140 (3) |
| 22 | 170 (1) | 180 (2.5) | 180 (2.5) |
| 23 | 170 (1) | 180 (2.5) | 180 (2.5) |
| 24 | 180 (2) | 180 (2) | 180 (2) |
| 25 | 150 (1) | 170 (2.5) | 170 (2.5) |
| 26 | 180 (2) | 180 (2) | 180 (2) |
| 27 | 150 (1) | 170 (2.5) | 170 (2.5) |
| 28 | 150 (1) | 170 (2) | 180 (3) |
| 29 | 180 (2) | 180 (2) | 180 (2) |
| 30 | 170 (1) | 180 (2.5) | 180 (2.5) |
| | $R_1$=37.5 | $R_2$=62.5 | $R_3$=80 |

Table 21: Rankings for Goniometer readings for Extension

| BLOCKS | ONE | THREE | SIX |
|---|---|---|---|
| 1 | 55 (2) | 45 (1) | 60 (3) |
| 2 | 60 (1) | 80 (2.5) | 80 (2.5) |
| 3 | 55 (1) | 65 (2.5) | 65 (2.5) |
| 4 | 60 (1) | 70 (3) | 65 (2) |
| 5 | 70 (2) | 70 (2) | 70 (2) |
| 6 | 50 (1) | 60 (2.5) | 60 (2.5) |
| 7 | 50 (1) | 60 (2) | 70 (3) |
| 8 | 70 (2) | 70 (2) | 70 (2) |
| 9 | 80 (2) | 80 (2) | 80 (2) |
| 10 | 45 (1) | 60 (2) | 70 (3) |
| 11 | 80 (2) | 80 (2) | 80 (2) |
| 12 | 70 (1) | 80 (2.5) | 80 (2.5) |
| 13 | 60 (1) | 70 (2) | 80 (3) |
| 14 | 60 (1) | 80 (2.5) | 80 (2.5) |
| 15 | 70 (1) | 80 (2.5) | 80 (2.5) |
| 16 | 80 (2) | 80 (2) | 80 (2) |
| 17 | 70 (1.5) | 70 (1.5) | 80 (3) |
| 18 | 50 (1) | 70 (3) | 60 (2) |
| 19 | 90 (2) | 90 (2) | 90 (2) |
| 20 | 60 (1) | 70 (2) | 80 (3) |
| 21 | 55 (2) | 50 (1) | 60 (3) |
| 22 | 70 (2) | 70 (2) | 70 (2) |
| 23 | 50 (1) | 70 (2.5) | 70 (2.5) |
| 24 | 80 (2) | 80 (2) | 80 (2) |
| 25 | 60 (1) | 70 (2) | 80 (3) |
| 26 | 80 (2) | 80 (2) | 80 (2) |
| 27 | 60 (1) | 70 (2) | 80 (3) |
| 28 | 70 (2) | 70 (2) | 70 (2) |
| 29 | 60 (1) | 80 (2.5) | 80 (2.5) |
| 30 | 70 (1) | 80 (2.5) | 80 (2.5) |
| | $R_1$=42.5 | $R_2$=60 | $R_3$=73.5 |

Table 22: Rankings for Goniometer readings for Abduction

| BLOCKS | ONE | THREE | SIX |
|---|---|---|---|
| 1 | 90 (1) | 100 (2) | 130 (3) |
| 2 | 100 (1) | 110 (2) | 150 (3) |
| 3 | 130 (1.5) | 130 (1.5) | 180 (3) |
| 4 | 155 (1) | 170 (2.5) | 170 (2.5) |
| 5 | 160 (1) | 180 (2.5) | 180 (2.5) |
| 6 | 90 (1.5) | 90 (1.5) | 120 (3) |
| 7 | 160 (1) | 170 (2) | 180 (3) |
| 8 | 60 (2) | 60 (2) | 60 (2) |
| 9 | 170 (1) | 180 (2.5) | 180 (2.5) |
| 10 | 70 (1) | 110 (2) | 160 (3) |
| 11 | 110 (1) | 160 (2.5) | 160 (2.5) |
| 12 | 120 (1) | 180 (2.5) | 180 (2.5) |
| 13 | 100 (1) | 130 (2) | 140 (3) |
| 14 | 70 (1) | 170 (2.5) | 170 (2.5) |
| 15 | 170 (1) | 180 (2.5) | 180 (2.5) |
| 16 | 170 (1) | 180 (2.5) | 180 (2.5) |
| 17 | 180 (2) | 180 (2) | 180 (2) |
| 18 | 60 (1) | 100 (2) | 120 (3) |
| 19 | 180 (2) | 180 (2) | 180 (2) |
| 20 | 120 (1) | 130 (2) | 160 (3) |
| 21 | 110 (1) | 170 (2.5) | 170 (2.5) |
| 22 | 160 (1.5) | 160 (1.5) | 180 (3) |
| 23 | 140 (2.5) | 100 (1) | 140 (2.5) |
| 24 | 110 (1) | 120 (2) | 180 (3) |
| 25 | 150 (1) | 170 (2.5) | 170 (2.5) |
| 26 | 180 (2) | 180 (2) | 180 (2) |
| 27 | 150 (1) | 180 (2.5) | 180 (2.5) |
| 28 | 90 (1) | 150 (2.5) | 150 (2.5) |
| 29 | 180 (2) | 180 (2) | 180 (2) |
| 30 | 160 (1.5) | 160 (1.5) | 180 (3) |
| | $R_1$=38.5 | $R_2$=45 | $R_3$=54.5 |

Table 23: Rankings for Goniometer readings for Adduction

| BLOCKS | ONE | THREE | SIX |
|---|---|---|---|
| 1 | 55 (1) | 70 (3) | 60 (2) |
| 2 | 50 (1) | 60 (2.5) | 60 (2.5) |
| 3 | 60 (3) | 50 (1.5) | 50 (1.5) |
| 4 | 40 (1) | 60 (2.5) | 60 (2.5) |
| 5 | 80 (2) | 80 (2) | 80 (2) |
| 6 | 45 (2) | 40 (1) | 60 (3) |
| 7 | 70 (2) | 70 (2) | 70 (2) |
| 8 | 60 (1.5) | 60 (1.5) | 70 (3) |
| 9 | 60 (2) | 60 (2) | 60 (2) |
| 10 | 60 (2) | 60 (2) | 60 (2) |
| 11 | 80 (2) | 80 (2) | 80 (2) |
| 12 | 80 (2) | 80 (2) | 80 (2) |
| 13 | 50 (1) | 70 (2) | 80 (3) |
| 14 | 80 (2) | 80 (2) | 80 (2) |
| 15 | 80 (2) | 80 (2) | 80 (2) |
| 16 | 60 (1.5) | 60 (1.5) | 80 (3) |
| 17 | 60 (1) | 70 (2.5) | 70 (2.5) |
| 18 | 50 (2.5) | 50 (2.5) | 40 (1) |
| 19 | 80 (2) | 80 (2) | 80 (2) |
| 20 | 50 (1) | 60 (2) | 70 (3) |
| 21 | 45 (1.5) | 45 (1.5) | 50 (3) |
| 22 | 60 (2) | 60 (2) | 60 (2) |
| 23 | 40 (1) | 60 (2.5) | 60 (2.5) |
| 24 | 50 (1) | 60 (2) | 80 (3) |
| 25 | 70 (1.5) | 70 (1.5) | 80 (3) |
| 26 | 80 (2) | 80 (2) | 80 (2) |
| 27 | 80 (2) | 80 (2) | 80 (2) |
| 28 | 40 (1) | 60 (2.5) | 60 (2.5) |
| 29 | 60 (1) | 80 (2.5) | 80 (2.5) |
| 30 | 60 (1) | 80 (3) | 70 (2) |
| | $R_1$=45.5 | $R_2$=61 | $R_3$=64.5 |

Table 24: Rankings for Goniometer for External Rotation

| BLOCKS | ONE | THREE | SIX |
|---|---|---|---|
| 1 | 35 (1) | 50 (2) | 70 (3) |
| 2 | 40 (1) | 50 (2.5) | 50 (2.5) |
| 3 | 50 (1) | 60 (2.5) | 60 (2.5) |
| 4 | 60 (1) | 80 (2.5) | 80 (2.5) |
| 5 | 50 (2) | 50 (2) | 50 (2) |
| 6 | 60 (2.5) | 60 (2.5) | 50 (1) |
| 7 | 90 (2) | 90 (2) | 90 (2) |
| 8 | 70 (2) | 70 (2) | 70 (2) |
| 9 | 80 (1) | 90 (2.5) | 90 (2.5) |
| 10 | 70 (1) | 80 (2) | 90 (3) |
| 11 | 90 (2) | 90 (2) | 90 (2) |
| 12 | 90 (2) | 90 (2) | 90 (2) |
| 13 | 60 (1) | 70 (2.5) | 70 (2.5) |
| 14 | 70 (1) | 80 (2) | 90 (3) |
| 15 | 80 (1) | 90 (2.5) | 90 (2.5) |
| 16 | 90 (2) | 90 (2) | 90 (2) |
| 17 | 85 (1) | 90 (2.5) | 90 (2.5) |
| 18 | 70 (2) | 70 (2) | 70 (2) |
| 19 | 80 (2) | 80 (2) | 80 (2) |
| 20 | 80 (1) | 90 (2.5) | 90 (2.5) |
| 21 | 60 (3) | 50 (1.5) | 50 (1.5) |
| 22 | 90 (2) | 90 (2) | 90 (2) |
| 23 | 60 (2) | 60 (2) | 60 (2) |
| 24 | 80 (1) | 90 (2.5) | 90 (2.5) |
| 25 | 80 (2) | 70 (1) | 90 (3) |
| 26 | 80 (2) | 80 (2) | 80 (2) |
| 27 | 80 (1) | 90 (2.5) | 90 (2.5) |
| 28 | 60 (1) | 90 (2.5) | 90 (2.5) |
| 29 | 90 (2) | 90 (2) | 90 (2) |
| 30 | 60 (1) | 80 (3) | 70 (2) |
| | $R_1$=46.5 | R2=65.5 | $R_3$=68 |

Table 25: Rankings for Goniometer readings for Horizontal Abduction

| BLOCKS | ONE | THREE | SIX |
|---|---|---|---|
| 1 | 110 (1) | 120 (2.5) | 120 (2.5) |
| 2 | 110 (2.5) | 100 (1) | 110 (2.5) |
| 3 | 55 (3) | 50 (1.5) | 50 (1.5) |
| 4 | 50 (2) | 50 (2) | 50 (2) |
| 5 | 100 (2) | 100 (2) | 100 (2) |
| 6 | 40 (1) | 60 (2.5) | 60 (2.5) |
| 7 | 110 (2) | 110 (2) | 110 (2) |
| 8 | 80 (1.5) | 80 (1.5) | 100 (3) |
| 9 | 120 (2) | 120 (2) | 120 (2) |
| 10 | 110 (2) | 100 (1) | 120 (3) |
| 11 | 110 (1) | 120 (2.5) | 120 (2.5) |
| 12 | 110 (2) | 110 (2) | 110 (2) |
| 13 | 90 (1) | 110 (2.5) | 110 (2.5) |
| 14 | 100 (2) | 100 (2) | 100 (2) |
| 15 | 100 (1) | 110 (2) | 120 (2) |
| 16 | 120 (2) | 120 (2) | 120 (2) |
| 17 | 110 (2) | 110 (2) | 110 (2) |
| 18 | 90 (2) | 70 (1) | 100 (3) |
| 19 | 130 (2) | 130 (2) | 130 (2) |
| 20 | 120 (2) | 120 (2) | 120 (2) |
| 21 | 70 (1) | 100 (2.5) | 100 (2.5) |
| 22 | 100 (1) | 110 (2) | 120 (3) |
| 23 | 90 (2) | 90 (2) | 90 (2) |
| 24 | 130 (3) | 110 (1) | 120 (2) |
| 25 | 110 (2) | 110 (2) | 110 (2) |
| 26 | 130 (2) | 130 (2) | 130 (2) |
| 27 | 120 (2) | 120 (2) | 120 (2) |
| 28 | 100 (1) | 130 (2) | 160 (3) |
| 29 | 120 (1) | 130 (2.5) | 130 (2.5) |
| 30 | 120 (1.5) | 120 (1.5) | 130 (3) |
| | $R_1$=46.5 | $R_2$=57.5 | $R_3$=69 |

Table 26: Rankings for Algometer readings taken on the Anterior Acromion

| BLOCKS | ONE | THREE | SIX |
|---|---|---|---|
| 1 | 3.7 (1.5) | 3.7 (1.5) | 6 (3) |
| 2 | 2.5 (1) | 3.5 (2) | 3.7 (3) |
| 3 | 4.7 (2) | 4.0 (1) | 4.9 (3) |
| 4 | 2.5 (1) | 2.6 (2) | 3.0 (3) |
| 5 | 2.0 (1) | 3.5 (2) | 4.0 (3) |
| 6 | 2.3 (1) | 3.2 (3) | 3.0 (2) |
| 7 | 2.0 (1) | 2.5 (2) | 3.0 (3) |
| 8 | 1.6 (1.5) | 1.6 (1.5) | 1.7 (3) |
| 9 | 3.2 (1) | 3.8 (2.5) | 3.8 (2.5) |
| 10 | 2.4 (1) | 2.5 (2) | 3.0 (3) |
| 11 | 3.0 (2.5) | 2.5 (1) | 3.0 (2.5) |
| 12 | 3.4 (1) | 4.0 (2) | 4.5 (3) |
| 13 | 1.2 (1) | 1.5 (2) | 2.0 (3) |
| 14 | 2.0 (1.5) | 2.0 (1.5) | 2.5 (3) |
| 15 | 2.0 (1) | 2.5 (2) | 3.0 (3) |
| 16 | 3.0 (1.5) | 3.0 (1.5) | 3.5 (3) |
| 17 | 2.0 (1) | 3.0 (2) | 4.0 (3) |
| 18 | 4.5 (1) | 5.0 (2.5) | 5.0 (2.5) |
| 19 | 2.0 (1.5) | 2.0 (1.5) | 4.0 (3) |
| 20 | 2.0 (1) | 3.5 (2) | 4.0 (3) |
| 21 | 3.9 (2) | 4.6 (3) | 3.2 (1) |
| 22 | 2.0 (1) | 3.0 (2.5) | 3.0 (2.5) |
| 23 | 2.3 (1) | 3.0 (2.5) | 3.0 (2.5) |
| 24 | 1.5 (1) | 2.5 (2) | 3.5 (3) |
| 25 | 2.7 (2) | 3.2 (3) | 2.5 (2) |
| 26 | 2.2 (2) | 2.2 (2) | 2.2 (2) |
| 27 | 3.1 (1) | 3.5 (2) | 4.0 (3) |
| 28 | 1.5 (1) | 2.0 (2) | 2.5 (3) |
| 29 | 2.0 (2) | 2.0 (2) | 2.0 (2) |
| 30 | 3.6 (1) | 4.0 (2.5) | 4.0 (2.5) |
| | $R_1$=39 | $R_2$=52 | $R_3$=80 |

Table 27: Rankings for Algometer readings taken on the Greater Tuberosity

| BLOCKS | ONE | THREE | SIX |
|---|---|---|---|
| 1 | 5.7 (1) | 7.4 (3) | 6 (2) |
| 2 | 2.6 (1) | 4.2 (2) | 4.5 (3) |
| 3 | 3.5 (1.5) | 3.5 (1.5) | 4.2 (3) |
| 4 | 3.0 (2.5) | 3.0 (2.5) | 2.5 (1) |
| 5 | 3.4 (1) | 3.5 (2) | 4.0 (3) |
| 6 | 3.5 (3) | 3.0 (1) | 3.2 (2) |
| 7 | 2.5 (1) | 3.0 (2) | 3.5 (3) |
| 8 | 4.0 (1.5) | 4.0 (1.5) | 4.5 (3) |
| 9 | 3.7 (1) | 4.0 (2.5) | 4.0 (2.5) |
| 10 | 2.3 (1) | 2.5 (2) | 3.5 (3) |
| 11 | 3.0 (1) | 3.5 (2) | 4.0 (3) |
| 12 | 1.5 (1) | 4.0 (2) | 4.5 (3) |
| 13 | 2.2 (1) | 3.0 (2) | 3.5 (3) |
| 14 | 3.0 (1.5) | 3.0 (1.5) | 3.5 (3) |
| 15 | 3.0 (1) | 3.2 (2) | 4.0 (3) |
| 16 | 3.0 (1.5) | 3.0 (1.5) | 3.3 (3) |
| 17 | 3.0 (1) | 3.5 (2) | 5.0 (3) |
| 18 | 5.0 (1.5) | 5.0 (1.5) | 5.5 (3) |
| 19 | 3.1 (1) | 3.5 (2.5) | 3.5 (2.5) |
| 20 | 2.4 (1) | 3.0 (2) | 4.0 (3) |
| 21 | 4.1 (2) | 3.6 (1) | 5.0 (3) |
| 22 | 2.0 (1) | 2.5 (2) | 3.0 (3) |
| 23 | 3.0 (2) | 3.0 (2) | 3.0 (2) |
| 24 | 1.7 (1) | 2.5 (2) | 3.5 (3) |
| 25 | 2.8 (2) | 2.7 (1) | 3.5 (3) |
| 26 | 3.0 (2) | 3.0 (2) | 3.0 (2) |
| 27 | 3.3 (1) | 3.7 (2.5) | 3.7 (2.5) |
| 28 | 1.5 (1) | 2.0 (2) | 3.0 (3) |
| 29 | 3.2 (3) | 2.5 (1.5) | 2.5 (1.5) |
| 30 | 3.6 (2) | 3.5 (1) | 4.0 (3) |
| | $R_1$=43 | $R_2$=56 | $R_3$=81 |

Table 28: Rankings for Numerical Pain Rating Scale-101.

| BLOCKS | ONE | THREE | SIX |
|---|---|---|---|
| 1 | 50 (2.5) | 35 (1) | 50 (2.5) |
| 2 | 30 (3) | 20 (1.5) | 20 (1.5) |
| 3 | 40 (2) | 45 (3) | 35 (1) |
| 4 | 30 (2.5) | 30 (2.5) | 15 (1) |
| 5 | 40 (3) | 30 (2) | 10 (1) |
| 6 | 50 (2.5) | 50 (2.5) | 40 (1) |
| 7 | 55 (3) | 50 (2) | 35 (1) |
| 8 | 50 (1.5) | 50 (1.5) | 57.5 (3) |
| 9 | 35 (2.5) | 25.5 (1) | 35 (2.5) |
| 10 | 50 (2.5) | 50 (2.5) | 40 (1) |
| 11 | 55 (3) | 35 (2) | 15 (1) |
| 12 | 35 (3) | 5 (2) | 0 (1) |
| 13 | 40 (3) | 35 (2) | 15 (1) |
| 14 | 80 (3) | 60 (2) | 25 (1) |
| 15 | 55 (3) | 25 (2) | 17.5 (1) |
| 16 | 15 (3) | 5 (2) | 0 (1) |
| 17 | 45 (3) | 30 (2) | 10 (1) |
| 18 | 52.5 (3) | 45 (2) | 35 (1) |
| 19 | 40 (3) | 35 (2) | 7.5 (1) |
| 20 | 35 (3) | 20 (2) | 4 (1) |
| 21 | 37.5 (1.5) | 42.5 (3) | 37.5 (1.5) |
| 22 | 45 (3) | 30 (2) | 15 (1) |
| 23 | 35 (1) | 40 (2.5) | 40 (2.5) |
| 24 | 75 (3) | 35 (2) | 12.5 (1) |
| 25 | 55 (2) | 60 (3) | 25 (1) |
| 26 | 35 (1) | 50 (3) | 45 (2) |
| 27 | 40 (2) | 50 (3) | 20 (1) |
| 28 | 50 (3) | 25 (2) | 5 (1) |
| 29 | 30 (2) | 40 (3) | 20 (1) |
| 30 | 10 (2) | 10 (2) | 10 (2) |
| | $R_1$=73.5 | $R_2$=65 | $R_3$=36.5 |

### 4.4.3 THE DUNN'S PROCEDURE (MULTIPLE COMPARISON TEST)

The null hypothesis was rejected for the goniometer readings of flexion, extension, abduction, adduction, external rotation and horizontal abduction. It was also rejected for the algometer readings taken on the anterior acromion and greater tuberosity and the numerical pain rating scale-101 in group one. Multiple comparison procedure was performed to determine the significance of each treatment.

Let $R_j$ and $R_{j'}$ be the *jth* and *j'th* consultation rank totals.

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

(Experimentwise error rate is usually higher than $\alpha$ and it depends on the sample size.)

**Decision Rule:**

$$| R_j - R_{j'} | \geq z \sqrt{\frac{bk(k+1)}{6}}$$

In the above formula:

$b$ = the number of blocks

$k$ = the number of consultations

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

In order to compute the consultation rank totals, the values in each block were ranked and then the sum of the ranks for each consultation was computed

In this case $k = 3$, $\alpha = 0.10$, $z = 2.12$, $b = 30$

**Dunn's procedure for the goniometer readings for flexion.**

$$|R_j - R_{j'}| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|R_1 - R_2| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|37.5 - 62.5| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$25 \geq 16.42$$

- for $j = 1$ and $j' = 2$, the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and three.

$$|R_1 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|37.5 - 80| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$42.5 \geq 16.42$$

- for $j = 1$ and $j' = 3$, the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and six.

$$|R_2 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|62.5 - 80| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$17.5 \geq 16.42$$

- for $j = 2$ and $j' = 3$, the above inequality is true, hence the result is declared significant, which indicates improvement between consultations three and six.

**Dunn's procedure for the goniometer readings for extension.**

$$|R_1 - R_2| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|42.5 - 60| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$17.5 \geq 16.42$$

- for $j = 1$ and $j' = 2$ the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and three.

$$|R_1 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|42.5 - 73.5| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$31 \geq 16.42$$

- for $j = 1$ and $j' = 3$ the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and six.

$$|R_2 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|60 - 80| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$20 \geq 16.42$$

- for $j = 2$ and $j' = 3$ the above inequality is true, hence the result is declared significant, which indicates improvement between consultations three and six.

**Dunn's procedure for the goniometer readings for abduction.**

$$|R_1 - R_2| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|38.5 - 45| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$6.5 \geq 16.42$$

- for $j = 1$ and $j' = 2$ the above inequality is not true, hence the result is declared insignificant, which indicates no improvement between consultations one and three.

$$|R_1 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|38.5 - 54.5| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$16 \geq 16.42$$

- for $j = 1$ and $j' = 3$ the above inequality is not true, hence the result is declared insignificant, indicating no improvement between consultations one and six.

$$|R_2 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|45 - 54.5| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$9.5 \geq 16.42$$

- for $j = 2$ and $j' = 3$ the above inequality is not true, hence the result is not significant, indicating no improvement between consultations three and six.

**Dunn's procedure for the goniometer readings for adduction.**

$$|R_1 - R_2| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|45.5 - 61| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$15.5 \geq 16.42$$

- for $j = 1$ and $j' = 2$ the above inequality is not true, hence the result is not significant, indicating no improvement between consultations one and three.

$$|R_1 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|45.5-64.5| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$19 \geq 16.42$$

- for $j = 1$ and $j' = 3$ the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and six.

$$|R_2 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|61-80| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$19 \geq 16.42$$

- for $j = 2$ and $j' = 3$ the above inequality is true, hence the result is declared significant, indicating improvement between consultations three and six.

**Dunn's procedure for the goniometer readings for external rotation.**

$$|R_1 - R_2| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|46.5-65.5| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$19 \geq 16.42$$

- for $j = 1$ and $j' = 2$ the above inequality is true, hence the result is declared significant, indicating improvement between consultations one and three.

$$|R_1 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|46.5 - 68| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$21.5 \geq 16.42$$

- for $j = 1$ and $j' = 3$ the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and six.

$$|R_2 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|65.5 - 68| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$2.5 \geq 16.42$$

- for $j = 2$ and $j' = 3$ the above inequality is not true, hence the result is declared insignificant, indicating no improvement between consultations three and six.

**Dunn's procedure for the goniometer readings for horizontal abduction.**

$$|R_1 - R_2| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|46.5 - 57.5| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$11 \geq 16.42$$

- for $j = 1$ and $j' = 2$ the above inequality is not true, hence the result is declared insignificant, indicating no improvement between consultations one and three.

$$|R_1 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|46.5 - 69| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$22.5 \geq 16.42$$

- for $j = 1$ and $j' = 3$ the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and six.

$$|R_2 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|57.5 - 69| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$11.5 \geq 16.42$$

- for $j = 2$ and $j' = 3$ the above inequality is not true, hence the result is declared insignificant, indicating no improvement between consultations three and six.

**Dunn's procedure for the algometer readings taken on the anterior acromion.**

$$|R_1 - R_2| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|39 - 52| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$13 \geq 16.42$$

- for $j = 1$ and $j' = 2$ the above inequality is not true, hence the result is declared insignificant, indicating no improvement between consultations one and three.

$$|R_1 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|39 - 80| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$41 \geq 16.42$$

- for $j = 1$ and $j' = 3$ the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and six.

$$|R_2 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|52 - 80| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$28 \geq 16.42$$

- for $j = 2$ and $j' = 3$ the above inequality is true, hence the result is declared significant, which indicates improvement between consultations three and six.

**Dunn's procedure for the algometer readings taken on the greater tuberosity.**

$$|R_1 - R_2| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|43 - 56| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$13 \geq 16.42$$

- for $j = 1$ and $j' = 2$ the above inequality is not true, hence the result is declared insignificant, indicating no improvement between consultations one and three.

$$|R_1 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|43 - 81| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$38 \geq 16.42$$

- for $j = 1$ and $j' = 3$ the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and six.

$$|R_2 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|56 - 81| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$25 \geq 16.42$$

- for $j = 2$ and $j' = 3$ the above inequality is true, hence the result is declared significant, indicating improvement between consultations three and six.

**Dunn's procedure for the numerical pain rating scale-101 readings.**

$$|R_1 - R_2| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|73.5 - 65| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$8.5 \geq 16.42$$

- for $j = 1$ and $j' = 2$ the above inequality is not true, hence the result is declared insignificant, indicating no improvement between consultations one and three.

$$|R_1 - R_3| \geq z\sqrt{\frac{bk(k+1)}{6}}$$

$$|73.5 - 36.5| \geq 2.12\sqrt{\frac{30x3(3+1)}{6}}$$

$$37 \geq 16.42$$

- for $j = 1$ and $j' = 3$ the above inequality is true, hence the result is declared significant, which indicates improvement between consultations one and six.

$$| R_2 - R_3 | \geq z \sqrt{\frac{bk(k+1)}{6}}$$

$$| 65 - 36.5 | \geq 2.12 \sqrt{\frac{30x3(3+1)}{6}}$$

$$28.5 \geq 16.42$$

- for $j = 2$ and $j' = 3$ the above inequality is true, hence the result is declared significant, indicating improvement between consultations three and six.

## CHAPTER FIVE: DISCUSSION

### 5.1 INTRODUCTION

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

**Intergroup Analysis** – The evaluation of the first consultations 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 third and sixth consultations confirms which treatment is more effective.

**Intragroup Analysis** – The assessment of the intragroup results from the first, third and sixth consultations represents the relative effectiveness of the treatment protocol in the treatment of rotator cuff tendinitis.

### 5.2 DEMOGRAPHIC DATA

As already discussed, the throwing and overhead motion involved in various sporting activities can predispose certain athletes and individuals to rotator cuff tendinitis. (Arroyo et al. 1997). Only nine of the sixty patients participated in some activity that involved overhead movement such as, tennis, swimming or waterpolo (Table 1). Arroyo et al. (1997) also mentioned that many middle-aged and elderly people may not know the cause of their tendinitis. This is evident in that 23 of the sixty patients participated in no sporting activities and could not attribute any cause to their shoulder pain. Nineteen of the sixty patients associated their shoulder pain with weight training, which may indicate the prevalence of incorrect training techniques used by many people.

The males to females ratio in this study was 43:17 (Figure 1). This indicates that rotator cuff tendinitis maybe more common in men than women. Previous studies on rotator cuff tendinitis have not been consistent with regards to male : female ratios (Van der Windt et al. 1995). The type of sport or activity is of greater importance than the gender of the patient.

No restrictions were placed on patient age, therefore the average age of 41.76 and the age range of 18-76 can be regarded as a fairly accurate reflection of the population with rotator cuff tendinitis. This supports data by Arroyo et al. (1997), stating that age is no barrier to the development of shoulder pain and in fact that the older the patient gets the more persistent the problem.

## 5.3 OBJECTIVE MEASUREMENTS

### 5.3.1 **Algometer**

The algometer was used to measure the amount of force that first caused the patient any pain. Improvement would be signified by a decrease in the sensitivity followed by an increase in the amount of pressure the patient would allow.

Figure 4: The various values for the algometer readings taken on the anterior acromion, for both groups, over the study period.

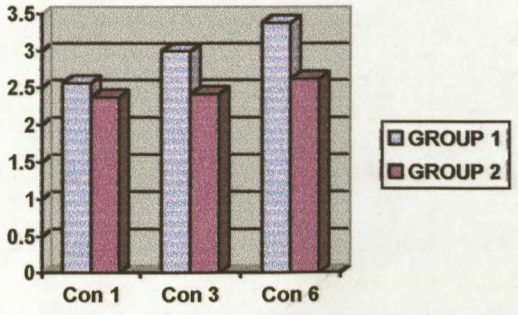
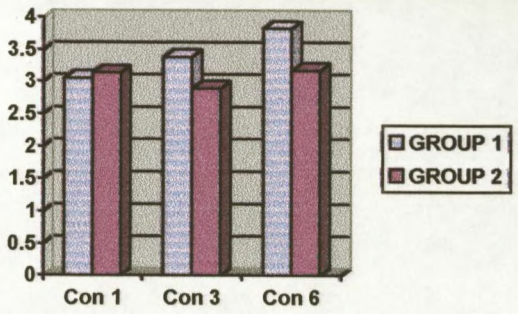


Figure 5: The various values for algometer readings taken on the greater tuberosity, for both groups, over the study period.




5.3.1.1 Discussion of the Intergroup Analysis

At the initial consultation there was no significance difference between the two groups. With the readings taken on the anterior acromion there was a mean difference of 0.19 between the two groups (adjustment: 2.56; placebo: 2.37). Therefore the placebo group started off more severe than the adjustment group. With the readings taken on the greater tuberosity there was a mean difference of 0.09 (adjustment: 3.05; placebo: 3.14). Therefore in this case the adjustment group started out more severe. At the third and sixth consultations, there was a significant difference between the two groups for both anterior acromion and greater tuberosity readings. At the third consultation for the anterior acromion readings there was a mean difference of 0.58 (adjustment: 2.99; placebo: 2.41) and with the greater tuberosity readings there was a mean difference of 0.50 (adjustment: 3.39; placebo: 2.89). This shows that the adjustment group's pain decreased in sensitivity. At the sixth consultation for the anterior acromion readings there was a mean difference

of 0.76 (adjustment: 3.38; placebo: 2.62) and for the greater tuberosity readings there was a mean difference of 0.66 (adjustment: 3.83; placebo: 3.17). This shows that both group's pain decreased in sensitivity, however the adjustment group improved more so than the placebo group.

5.3.1.2 Discussion of the Intragroup Analysis

In **Group 1**, Friedman's test was performed and showed a significant difference between the first, third and sixth consultation for algometer readings taken on both the anterior acromion and the greater tuberosity.

For the readings taken on the anterior acromion there was a mean difference of 0.24 between the first and third consultations (consultation 1: 2.46; consultation 3: 2.70). Dunn's procedure was then performed and proved this difference to be statistically insignificant. Between consultations 1 and 6 there was a mean difference of 0.56 (consultation 1: 2.46; consultation 6: 3.02) and between consultations 3 and 6 there was a mean difference of 0.32 (consultation 3: 2.70; consultation 6: 3.02). Dunn's procedure showed a statistically significant improvement between consultations 1 and 6 and consultations 3 and 6.

For the readings taken on the greater tuberosity there was a mean difference of 0.05 between the first and third consultations (consultation 1: 3.09; consultation 3: 3.14). Dunn's procedure proved this difference to be statistically insignificant. Between consultations 1 and 6 there was a mean difference of 0.39 (consultation 1: 3.09; consultation 6: 3.48) and between consultation 3 and 6 there was a mean difference of

0.34 (consultation 3: 3.14; consultation 6: 3.48). Dunn's procedure showed a statistically significant improvement between consultations 1 and 6 and consultations 3 and 6.

Friedman's test showed that in **Group 2** there was a significant difference between the first, third and sixth consultation for both the readings on the anterior acromion and those on the greater tuberosity.

For the readings taken on the anterior acromion, between consultations 1 and 3 there was a mean difference of 0.05 (consultation 1: 2.41; consultation 3: 2.46) and a mean difference of 0.25 between consultations 1 and 6 (consultation 1: 2.41; consultation 6: 2.66) and a mean difference of 0.20 between consultations 3 and 6.(consultation 3: 2.46; consultation 6: 2.66). Dunn's procedure was not performed for the placebo group and the slight differences noted were attributed to the placebo affect.

For the readings taken on the greater tuberosity there was a mean difference of 0.24 between consultations 1 and 3 (consultation 1: 3.15; consultation 3: 2.91), this indicated that the placebo group actually regressed slightly. There was a mean difference of 0.05 between consultations 1 and 6 (consultation 1: 3.15; consultation 6: 3.20) and a mean difference of 0.29 between consultation 3 and 6 (consultation 3: 2.91; consultation 6: 3.20). According to Friedman's test there was significant improvement however the differences were slight and Dunn's procedure was not performed and the difference was attributed to the placebo affect.

Therefore, statistically the adjustment group was shown to have more improvement than the placebo group. Both groups did show improvement and this may be attributed to the placebo affect as well as the natural course of the condition.

5.3.2 **Range of Motion – The Goniometer**

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

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

This study supports the values in Magee. In some cases, example extension, there was increased range of motion. This could be explained by the fact that some athletes have varying degrees of instability at the shoulder and hence poor control and positioning of the humeral head in the glenoid (Reid 1992: 934).Any decreased range of motion could be attributed to a tight posterior capsule, which could also be associated with rotator cuff impingement (Reid 1992: 934).

Figure 6: The various values for the goniometer for **Group 1**, over the study period.

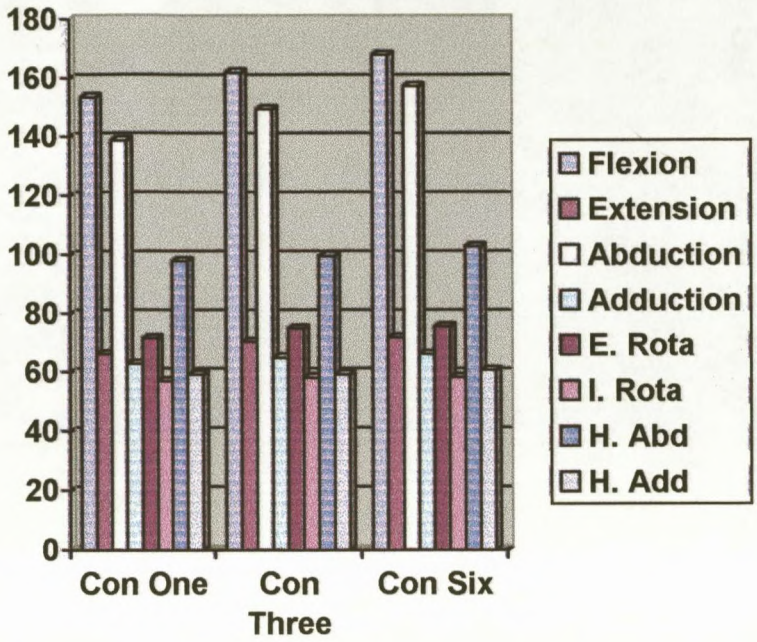
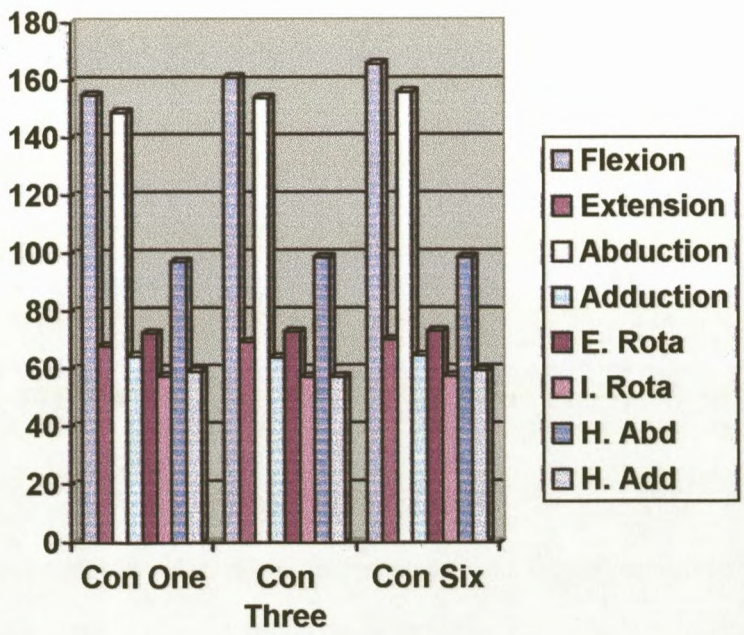



Figure 7: The various values for the goniometer for **Group 2**, over the study period.



5.3.2.1 Discussion of Intergroup Analysis

Analysis of the goniometer readings throughout the study showed that for flexion, adduction, external rotation, internal rotation and horizontal abduction there was no

significant difference between the two groups at the initial, third and sixth consultations. For extension, there was no significant difference between the first and third consultations, however a significant difference was noted at the sixth consultation. Group 1 showed a mean improvement of 9.43° (consultation 1 – 64.66°; consultation six – 74.00°), whereas Group 2 only showed a mean improvement of 1.67° (consultation 1 – 67.66°; consultation 6 – 69.33°). For abduction there was a significant difference at the initial consultation, with a mean difference of 19.17° between the two groups. This indicates that the adjustment group started out more severe/restricted. For horizontal adduction there was a significant difference at the third consultation. Group 1 showed a mean improvement of 2.83° (consultation 1 – 59.33°; consultation 3 – 62.16°) and group 2 showed a mean difference of 2.00° (consultation 1 – 59.00°; consultation 3 – 57.00°), indicating further decrease in movement and therefore regression.

The intergroup analysis shows that the adjustment group showed greater significant improvement than the placebo group, although both groups showed improvement over the study period.

5.3.2.2 Discussion of the Intragroup Analysis

Within **Group 1**, Friedman's test showed significant improvement for the movements of flexion, extension, abduction, adduction, external rotation and horizontal abduction. The Dunn procedure was performed to demonstrate which of these results were truly statistically significant.

For flexion, between consultations 1 and 3, there was a mean difference of 8.67° (consultation 1: 153.33°; consultation 3: 162.00°). Between consultations 1 and 6 there was a mean difference of 14.58° (consultation 1: 153.33°; consultation 6: 167.91°) and a mean difference of 5.91° between consultations 3 and 6 (consultation 3: 162.00°; consultation 6: 167.91°). Dunn's procedure showed all these improvements to be statistically significant.

For extension, there was a mean difference of 4.09° between consultations 1 and 3 (consultation 1: 66.16°; consultation 3: 70.25°), a mean difference of 5.67° between consultations 1 and 6 (consultation 1: 66.16°; consultation 6: 71.83°) and a mean difference of 1.58° between consultations 3 and 6 (consultation 3: 70.25°; consultation 6: 71.83°). Dunn's procedure showed all these improvements to be statistically significant.

For abduction, there was a mean difference of 10.58° between consultation 1 and 3 (consultation 1: 138.75°; consultation 3: 149.33°), a mean difference of 18.41° between consultation 1 and 6 (consultation 1: 138.75°; consultation 6: 157.16°) and a mean difference of 7.83° between consultation 3 and 6 (consultation 3: 149.33°; consultation 6:

157.16°). Dunn's procedure showed all theses improvements to be statistically insignificant.

For adduction, there was a mean difference of 2.08° between consultation 1 and 3 (consultation 1: 62.83°; consultation 3: 64.91°), a mean difference of 3.33° between consultation 1 and 6 (consultation 1: 62.83°; consultation 6: 66.16°) and a mean difference of 1.25° between consultation 3 and 6 (consultation 3: 64.91°; consultation 6: 66.16°). The Dunn procedure showed no statistical improvement between consultation 1 and 3, but significant improvement between consultation 1 and 6 and consultation 3 and 6.

For external rotation there was a mean difference of 3.25° between consultation 1 and 3 (consultation 1: 71.50°; consultation 3: 74.75°), a mean difference of 4.00° between consultation 1 and 6 (consultation 1: 71.50°; consultation 6: 75.50°) and a mean difference of 0.75° between consultation 3 and 6 (consultation 3: 74.75°; consultation 6: 75.50°). The Dunn procedure showed statistically significant improvement between consultation 1 and 3 and consultation 1 and 6, but no statistically significant improvement between consultation 3 and 6.

For horizontal abduction there was a mean difference of 1.91° between consultation 1 and 3 (consultation 1: 97.75°; consultation 3: 99.66°), a mean difference of 5.00° between consultation 1 and 6 (consultation 1: 97.75°; consultation 6: 102.75°) and a mean difference of 3.09° between consultation 3 and 6 (consultation 3: 99.66°; consultation 6: 102.75°). The Dunn procedure showed the improvement between consultation 1 and 3

and consultation 3 and 6 to be statistically insignificant and the improvement between consultation 1 and 6 to be statistically significant.

Within **Group 2**, Friedman's test showed a significant improvement for the movements of flexion and abduction. For flexion there was a mean difference of 6.45° between consultation 1 and 3 (consultation 1: 154.51°; consultation 3: 160.96°), a mean difference of 11.29° between consultation 1 and 6 (consultation 1:154.51°; consultation 6: 165.80°) and a mean difference of 4.84° between consultation 3 and 6 (consultation 3: 160.96°; consultation 6: 165.80°).

For abduction there was a mean difference of 5.00° between consultation 1 and 3 (consultation 1: 148.70°; consultation 3: 153.70°), a mean difference of 7.10° between consultation 1 and 6 (consultation 1: 148.70°; consultation 6: 155.80°) and a mean difference of 2.10° between consultation 3 and 6 (consultation 3: 153.70°; consultation 6: 155.80°).

Only these two movements showed improvement that was very slight and the improvement was attributed to the placebo affect.

5.3.3 Conclusion of Objective Measurements

When analyzing the algometer readings, the adjustment group showed more statistically significant improvements than the placebo group. There was no significant difference between the first and third consultation, however between the third and sixth and first and sixth consultation there was significant improvement. This improvement was seen within

both groups but more so in the adjustment group. Therefore although both groups showed decreased pain sensitivity, the adjustment group seemed to have improved more than the placebo group.

Within the range of motion analysis, statistically significant improvements were seen in the adjustment group for flexion, extension, external rotation and horizontal abduction.

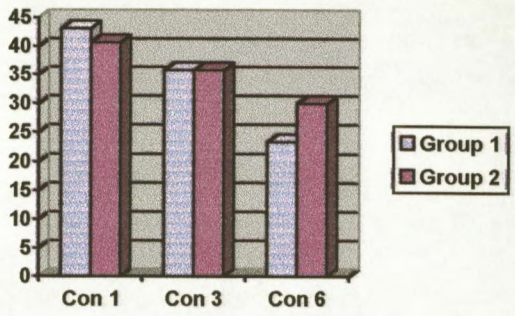
The placebo group only showed slight differences for flexion and abduction. The intergroup comparison showed differences in extension, abduction and horizontal adduction. The improvement seen in the adjustment group is therefore far more significant than the improvement seen in the placebo group.

## 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.

Figure 8: The mean percentages of pain perception of group 1 and group 2 at the first, third and sixth consultation.




5.4.1.1 Discussion of the Intergroup Analysis

There was a mean difference of 2.45 between the two groups at the initial consultation (adjustment: 43.16; placebo: 40.71) which indicates that the adjustment group started out slightly more severe than the placebo group. Statistically this difference was not significant. At the third and sixth consultation there was still no significant difference between the two groups. There was a mean difference of 0.09 between the two groups at the third consultation (adjustment: 35.76; placebo: 35.85) and a mean difference of 6.70 between the two groups at the sixth consultation (adjustment: 23.38; placebo: 30.08). This shows that both group's perceived level of pain decreased, there was a slight difference with the adjustment showing greater improvement.

5.4.1.2 Discussion of the Intragroup Analysis

Within **Group 1**, there was a mean difference of 6.20 between the first and third consultation (consultation 1: 41.94; consultation 3: 35.74), a mean difference of 15.29

between the first and sixth consultation and a mean difference of 9.09 (consultation 3: 35.74; consultation 6: 26.65) between the third and sixth consultation. The Dunn procedure was performed and showed that there was no statistically significant improvement between consultation 1 and 3, however the improvement between consultation 1 and 6 and consultation 3 and 6 was statistically significant.

Within **Group 2**, there was a mean difference of 4.68 between consultation 1 and 3 (consultation 1: 39.72; consultation 3: 35.04), a mean difference of 10.29 between consultation 1 and 6 (consultation 1: 39.72; consultation 6: 29.43) and a mean difference of 5.61 between consultation 3 and 6 (consultation 3: 35.04; consultation 6: 29.43). These differences were very slight.

### 5.4.2 Conclusion of the Subjective Measurements

When analyzing the NPRS-101, both groups showed significant improvement between the first, third and sixth consultations. The intergroup analysis showed the difference between the two group's improvement to be statistically insignificant. The intragroup analysis showed that the decreased in the perceived level of pain in the adjustment group was more than that of the placebo group.

## 5.5 CONCLUSION

We can therefore conclude that overall the adjustment treatment seemed to show greater improvement with the algometer, goniometer and NPRS-101, as there was statistically significant difference between the groups throughout the study period.

## CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

The results of this study over the two week period indicate that adjustments appear to be more effective than placebo laser in the treatment of rotator cuff tendinitis. There was statistically a 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 could be taken from when the patient first feels the pain. This would allow improvement to be more accurately noted.

In order for the findings to have a higher level of validity, a larger sample size would be recommended.

The experience and reliability of the examiner should also be taken into account. 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 adjustments in the treatment of rotator cuff tendinitis.

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 practice time is an important factor. Motion palpation and chiropractic adjustment take about five to ten minutes. This technique is also cost effective and can easily be incorporated into any treatment regime. Figures 9 and 10 summarise the approach that

can be adopted when treating rotator cuff tendinitis. Each joint can be examined in the relevant directions, listed in figure 9, and the most restricted ranges of motion should be noted. Figure 10 shows which technique the researcher found were most beneficial in treating each joint.

Considering the results within the study, it seems that the chiropractic adjustment is more effective than placebo. Larger sample sizes will help to validate these findings.

Figure 9: Joints of the Shoulder Girdle and their affected fixation directions.

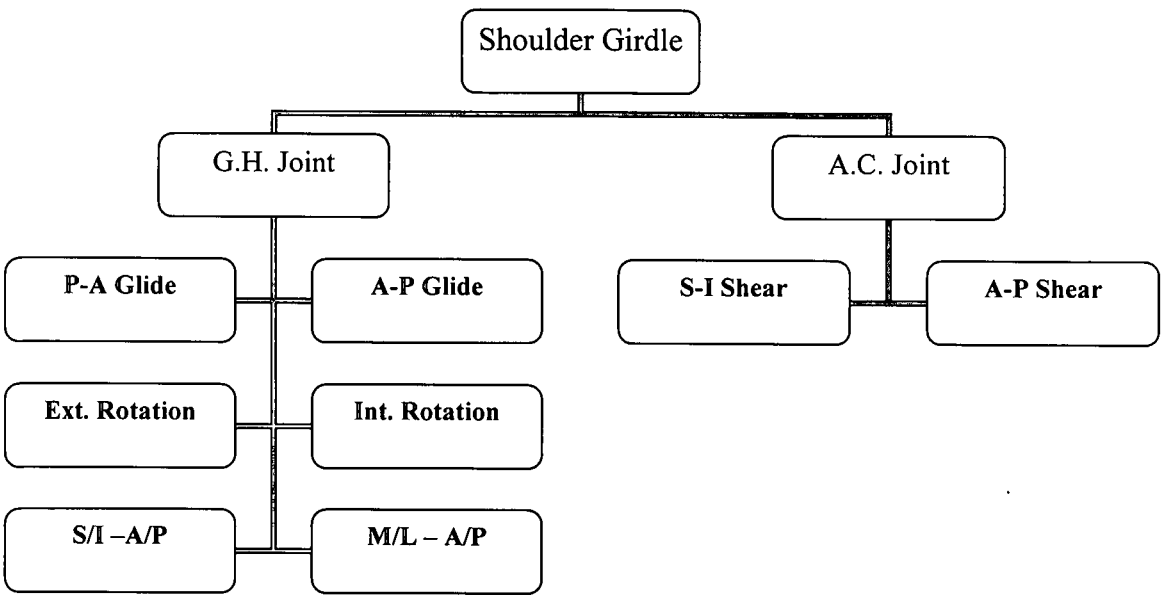
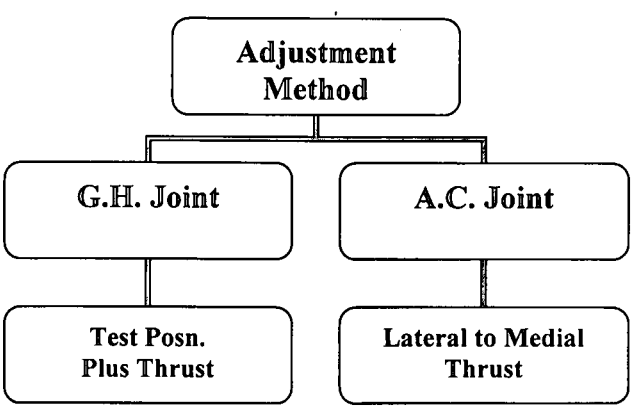



Figure 10: Most effective Technique used to adjust the respective joints.



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## APPENDIX A – TREATMENT GROUP ALLOCATION

| Patient Number | Treatment |
|---|---|
| 1 | ADJUSTMENT |
| 2 | PLACEBO LASER |
| 3 | ADJUSTMENT |
| 4 | ADJUSTMENT |
| 5 | ADJUSTMENT |
| 6 | ADJUSTMENT |
| 7 | PLACEBO LASER |
| 8 | PLACEBO LASER |
| 9 | PLACEBO LASER |
| 10 | ADJUSTMENT |
| 11 | ADJUSTMENT |
| 12 | PLACEBO LASER |
| 13 | ADJUSTMENT |
| 14 | ADJUSTMENT |
| 15 | PLACEBO LASER |
| 16 | PLACEBO LASER |
| 17 | PLACEBO LASER |
| 18 | ADJUSTMENT |
| 19 | ADJUSTMENT |
| 20 | ADJUSTMENT |
| 21 | ADJUSTMENT |
| 22 | PLACEBO LASER |
| 23 | ADJUSTMENT |
| 24 | PLACEBO LASER |
| 25 | PLACEBO LASER |
| 26 | ADJUSTMENT |
| 27 | ADJUSTMENT |
| 28 | PLACEBO LASER |
| 29 | ADJUSTMENT |
| 30 | PLACEBO LASER |
| 31 | ADJUSTMENT |
| 32 | ADJUSTMENT |
| 33 | PLACEBO LASER |
| 34 | ADJUSTMENT |
| 35 | ADJUSTMENT |
| 36 | ADJUSTMENT |
| 37 | PLACEBO LASER |
| 38 | ADJUSTMENT |
| 39 | PLACEBO LASER |
| 40 | PLACEBO LASER |
| 41 | PLACEBO LASER |
| 42 | PLACEBO LASER |

| | |
|---|---|
| 43 | PLACEBO LASER |
| 44 | ADJUSTMENT |
| 45 | PLACEBO LASER |
| 46 | PLACEBO LASER |
| 47 | ADJUSTMENT |
| 48 | PLACEBO LASER |
| 49 | PLACEBO LASER |
| 50 | ADJUSTMENT |
| 51 | PLACEBO LASER |
| 52 | ADJUSTMENT |
| 53 | PLACEBO LASER |
| 54 | ADJUSTMENT |
| 55 | PLACEBO LASER |
| 56 | PLACEBO LASER |
| 57 | PLACEBO LASER |
| 58 | ADJUSTMENT |
| 59 | ADJUSTMENT |
| 60 | PLACEBO LASER |

# 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

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:**

I Any loss of smell/taste:
Nose examination:

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

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

III Ocular Muscles:
Eye opening strength:

IV Inferior and Medial movement of eye:

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

VI Lateral movement of eyes

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

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

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

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

XII Inspection of tongue (deviation):

**Motor System:**

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

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

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

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

**Sensory System:**

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

b. Joint position sense
- Finger:
- Toe:

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

**Cerebellar function:**

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

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

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

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

## 9. BREAST EXAMINATION:

Summon female chaperon.

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

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

# APPENDIX D

## SHOULDER REGIONAL EXAMINATION

TECHNIKON NATAL

**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 E**

# INFORMED CONSENT FORM

(To be completed by patient / subject )

**Date** :

---

**Title of research project** :

---

**Name of supervisor** :

---

**Name of research student** :

---

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

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

**Please Print in block letters:**

Patient /Subject Name:_____Signature:_____

Parent/ Guardian:_____Signature:_____

Witness Name:_____Signature:_____

Research Student Name:_____Signature:_____

# APPENDIX F – NUMERICAL PAIN RATING SCALE-101

Numerical Pain Rating Scale-101

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, when it is at its WORST. A zero (0) would mean "no pain at all" and one hundred (100) would mean "pain as bad as it could be".

Please write only one number:

0_____100

Please indicate on the line below the number between 0 and 100 that best describes the pain of your major problem at this point, when it is at its LEAST. A zero (0) would mean "no pain at all" and one hundred (100) would mean "pain as bad as it could be".

Please write only one number:

0_____100

# APPENDIX G – DATA SHEET

Patient Name: _____

Age: _____ Sex: _____

Occupation: _____ Shoulder Involved: _____

Cause of shoulder injury: _____

| Treatment Group | Shoulder Adjustment | Placebo Laser |
|---|---|---|

1. Direction of fixation:

| Shoulder Joint | Treatment One | Treatment Three | Treatment Six |
|---|---|---|---|
| Acromioclavicular | | | |
| Glenohumeral | | | |

2. Algometer Readings:

| Point of Reading | Treatment One | Treatment Three | Treatment Six |
|---|---|---|---|
| Acromion | | | |
| Greater Tuberosity | | | |

3. Goniometer Readings:

| Direction | Treatment | One | Treatment | Three | Treatment | Six |
|---|---|---|---|---|---|---|
| Shoulder | Left | Right | Left | Right | Left | Right |
| Flexion | | | | | | |
| Extension | | | | | | |
| Abduction | | | | | | |
| Adduction | | | | | | |
| Ext. Rot | | | | | | |
| Int. Rot | | | | | | |
| Hor Abd | | | | | | |
| Hor Add | | | | | | |

If the patient received shoulder adjustment, was there joint cavitation?:

| Treatment One | Treatment Three | Treatment Six |
|---|---|---|
| | | |