A quantitative placebo controlled study of the efficacy of manipulation of acromioclavicular joint dysfunction in weight trainers

By

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Dissertation submitted in partial compliance with the requirements for the Master's Degree in Technology: Chiropractic at the Durban University of Technology.

I, **Warren Gray Jordan**, do solemnly declare that this dissertation is representative of my own work in both conception and execution.

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Signed: ____ Date:______________________

Dedication

To My Dad

Acknowledgments

My Lord and Saviour Jesus Christ for loving me and giving me the strength to keep going when I couldn't go any further.

Dr Micah Atkinson for his supervision and knowledge enabling me to complete this dissertation.

Dr Charmaine Korporaal for her unwavering support and dedication to the furthering of this noble profession and for all the help that she gave, "above and beyond the call of duty."

To all the patients who took part in the study, without whom this would not be possible.

Mom and Dad for all your love and support.

Mom and Dad Moses for taking me in as your son.

Pastor Martin and Vanya McCrory for all their love and prayers.

My family at Heartland, thanks for all the love and support over the years.

And Finally…

To my beautiful wife Claudette, I could never have gotten through this without you. You picked me up when I was down, you loved me when I wasn't worth loving and you gave me the most precious gift in our beautiful daughter Eden whom I love more and more everyday. Your wisdom, strength, beauty, humility, kindness, love and compassion are inconceivable and I thank God everyday for giving you to me. Words can never express the love I have for you. Here's to the future.

Abstract

Objective:

The efficacy of manipulation as compared to placebo in the treatment of two groups of weight trainers with Acromioclavicular (AC) Joint Dysfunction.

Methods:

Twenty patients (n=20), using randomised sampling were allocated to two intervention groups. Patients in each group received four treatments each over a two-week period and assessed at initial, one week, two weeks and one month follow ups. Objective measures included Algometer and Inclinometer readings. Numerical Pain Rating Scales (NRS), Shoulder Rating Questionnaire (SRQ) and the Shoulder Pain and Disability Index (SPADI) measured subjective outcomes.

Results:

Manipulation demonstrated significant improvement in objective findings. Subjective outcomes did not show significant difference between the manipulation and placebo groups.

Conclusion:

Manipulation, when compared to placebo, can be considered as an effective treatment intervention for the treatment of AC joint dysfunction with particular reference to objective outcomes. Although, caution needs to be utilised in accepting this outcome due to limitations in sample size, subjective measure sensitivity and specificity as well as the stringency of the inclusion and exclusion criteria.

Key indexing Terms:

Acromioclavicular joint, chiropractic, controlled clinical trial, manipulation, placebo, weight lifting.

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Abbreviations

- AC – Acromioclavicular
- NRS – Numerical Pain Rating Scale
- SRQ – Shoulder Rating Scale
- SPADI – Shoulder Pain and Disability Index

Definition of Terms

- **Chiropractic manipulation** – A successful adjustment for the purpose of this study will be classified as a Grade 5 mobilisation with/ without a cavitation, which improves range of motion as checked by motion palpation.

- **Close-packed position** – any position in which a joint is placed in order to obtain that position in the joint in which the least amount of movement is possible and the most amount of stability is attained (Moore and Dalley, 2006).

- **Dysfunction** – refers to a motion segment, in which alignment, movement integrity, and/ or physiological function are altered although contact between joint surfaces remains intact, incorporating the complex interaction of pathological changes in nerve, muscle, ligamentous, vascular, and connective tissues. (Leach, 1994)

- **Placebo** - Any dummy medication or treatment. Although placebos originally were medicinal preparations having no specific pharmacological activity against a targeted condition, the concept has been extended to include treatments or procedures, especially those administered to control groups in clinical trials in order to provide baseline measurements for the experimental protocol. In most studies, the patient does not know whether they are receiving an active medication or a placebo. Any effects seen as a result of taking the placebo are usually attributed to the expectations of the patient, known as the "placebo effect." (Ernst and Resch, 1995) Therefore in the context of this study placebo refers to the laser therapy that is turned off during application.

Chapter 1

Introduction

1.1 Introduction

As the acromioclavicular (AC) joint is the only bony connection between the shoulder and the rest of the body (Standing, 2005; Moore and Dalley, 2006; Sinnatamby, 2006). In this context, the AC joint stabilizes the shoulder in just about any weight-bearing manoeuvre of the arm. This makes it prone to injury in weight trainers, where weight bearing occurs consistently (Carr, 2004).

Although the amount of movement at the AC joint is small, it is integral in the mechanics of the shoulder girdle. Tasks (such as weight training) that require excessive abduction and external rotation cause repetitive axial clavicular rotation, resulting in abnormal sheer stress at the AC joint (Buchberger, 1999). Similarly, horizontal adduction is an AC joint close-packed position that creates pain when this joint is symptomatic (Buchberger, 1999). Both movements are utilised in common weight training manoeuvres such as the bench press and side lateral raisers (Horwitz, 1999, 2000).

Pain is expected during weight training and so is often ignored being attributed to a hard workout. However this pain may actually be a warning sign to a more sinister cause and professional care is often not sought (Weitz, 1997; Carr, 2004). Most training injuries involving the AC joint are overuse/ repetitive stress injuries unlike the sudden traumatic lesions reported with contact sports. This is why most AC joint problems start off as low dull aches that gradually build over time to a more substantial problem (Carr, 2004).

AC joint dysfunction is a common condition that is prevalent in weight trainers resulting in osteolysis of the distal clavicle. This is due to chronic micro-trauma that the AC joint experiences in this sporting activity as well as in those whose professions require the use of pneumatic drills or compete in gymnastics or judo (Weitz, 1997; Asano et al., 2002; Gajeski and Kettner, 2004; Mulari et al., 2006).

According to Zupancic (2000), osteolysis of the distal end of the clavicle, also called, “bench pressers' shoulder” mainly occurs in two ways, namely atraumatic or traumatic. The common precipitating factor is repetitive loading of the AC joint by either weight training or occupational requirements (ie labourers who use pneumatic drills). It can also occur after subluxations, dislocations, and fractures to the joint.

Current treatment is conservative in nature with a large variety of options being used (i.e. ice, sling immobilization, analgesics, cessation of provocative movements (rest), corticosteroid injections, oral anti-inflammatory agents, stretching, mobilization exercises), but it is not known what primary therapy is required for the restoration of the AC joint in terms of mobility and the reduction of pain as well as return to normal physical activity (Stoddard and Johnson, 2000; Mestan and Bassano, 2001; Mouhsine et al., 2003; Gajeski and Kettner, 2004; Kiner, 2004; McHardy et al., 2007).

It is thought that chiropractic manipulation may form an integral part in the management of AC joint dysfunction by promoting normal movement (Bergmann et al., 1993; Leach, 2004) to this area thereby decreasing the loading effects of weight training, as would be evident in a dysfunctional joint. Unfortunately, past research (Mestan and Bassano, 2001; Mouhsine et al., 2003; Gajeski and Kettner, 2004) does not show whether one treatment (e.g. rest, mobilizations, oral anti-inflammatory agents etc) is more viable than another. Therefore this study aims to determine the efficacy of manipulation of acromioclavicular joint dysfunction in weight trainers.

1.2 Aims of the Study

The aim of the study was to assess the efficacy of a chiropractic manipulation in the treatment of AC joint dysfunction in weight trainers.

The three main objectives were:

1.2.1 First Objective

To determine the efficacy of manipulation in terms of subjective clinical findings.

> The First Hypothesis:
>
> That the patient would not notice an improvement in normal day-to-day activities (including usual training) as evident in the subjective findings.

1.2.2 Second Objective

To determine the efficacy of manipulation in terms of objective clinical findings.

> The Second Hypothesis:
>
> That clinical improvement would not be noted through clinical measurements taken before, during and after the treatment protocol.

1.2.3 Third Objective

To determine any correlations between the objective and subjective clinical findings.

The Third Hypothesis:

To show that improvements noticed by the patient would not be correlated to the improvement observed through clinical measurements.

1.3 Rationale

1 Currently there is a paucity of literature in respect of treatment for the AC joint (Mohamed et al., 1996; McHardy et al., 2007; Hill et al., 2008). In a review performed by McHardy et al. (2007), it was observed that even though there are a number of studies that have been performed on the upper extremity, the AC joint had been largely overlooked, as is evident in the literature review as well as in the epidemiology. This study serves to broaden the understanding of this relatively inconspicuous joint through examining the efficacy of manipulation of the AC joint.

2 In the studies that have been performed on AC joint injuries, a wide variety of therapies have been used in its management and treatment (i.e. ice, sling immobilization, analgesics, cessation of provocative movements (i.e. movements that would provoke pain and discomfort), corticosteroid injections, oral anti-inflammatory agents, and surgical resection / amputation of the distal clavicle (Stoddard and Johnson, 2000; Mestan and Bassano, 2001; Kiner, 2003; Gajeski and Kettner, 2004)), but no definitive evidence has shown that one therapy is more beneficial than the other. This study therefore serves to determine whether chiropractic manipulation can be utilised as a primary treatment approach of this condition.

3 This is to aid in the furthering acceptance of chiropractic treatment by both the general public as well as sporting medical professionals and their administrative teams thereby increasing exposure of chiropractic as a primary health care approach.

1.4 Benefits

According to the hypothesis for the treatment, the patients in the treatment group are expected to improve with a reduction of their symptoms i.e. pain and an improvement in their functional ability (Bergmann et al., 1993), not only for day-to-day activities but also for their involvement in training in the gym. The benefits to the greater population will be that of knowledge in regard to the most appropriate and beneficial forms of therapy required for the treatment of this condition. For the chiropractic fraternity, this study will further the understanding of the importance of extremity manipulation in their patients.

1.5 Limitations

The compliance of the patients was a major restriction as there is no way to monitor the varying intensities of training that individuals may have engaged in.

1.6 Conclusion

The aim of this study therefore, was to assess the short-term effect of chiropractic manipulation on AC joint dysfunction in those participating in weight training.

Chapter Two consists of a brief review of literature, followed by the research methodology and materials used (Chapter Three). The results and interpretation thereof are covered in chapter four. And lastly, chapter five outlines the conclusions and recommendations.

Chapter Two

Literature Review

2.1 Introduction and overview of this chapter

The following chapter aims to review and describe the relevant anatomy of the shoulder girdle specifically the AC joint, the common pathologies related to the girdle, as well as the most current treatment methods available. Thereafter, the hypotheses will be presented on the effects of chiropractic manipulation on the AC joint dysfunction, in terms of objective and subjective findings.

2.2 Anatomy and function of the AC Joint

The pectoral (shoulder) girdle is comprised of the clavicles and the scapulae. This girdle connects the upper limb to the axial skeleton. The scapula is a flattened, triangular bone that is found on the posterolateral aspect of the thorax. It is a highly mobile bone with a number of distinguishing features, one of which is the spine of the scapula that projects from the posterior surface of the scapula separating the supraspinous fossa from the infraspinous fossa. The spine continues laterally to form the flattened process called the acromion, which projects anteriorly to articulate with the clavicle. The clavicle runs laterally across the root of the neck extending from the manubrium to the scapula providing the only articulation connecting the upper limb to the axial skeleton. The medial two-thirds of the shaft of the clavicle are convex anteriorly and the lateral one-third is concave anteriorly, which increase the clavicles resilience. The clavicle has three functions (Standing, 2005; Moore and Dalley, 2006; Sinnatamby, 2006):

1. Acting as a strut to hold the upper limb free from the body so that it may have maximum freedom of action.
2. Providing attachments for muscles.

3. Transmitting forces from the upper limb to the axial skeleton.

The articulation between the acromion and the clavicle is called the *Acromioclavicular (AC) Joint* (see Image 2.1) (Standing, 2005; Moore and Dalley, 2006; Sinnatamby, 2006).

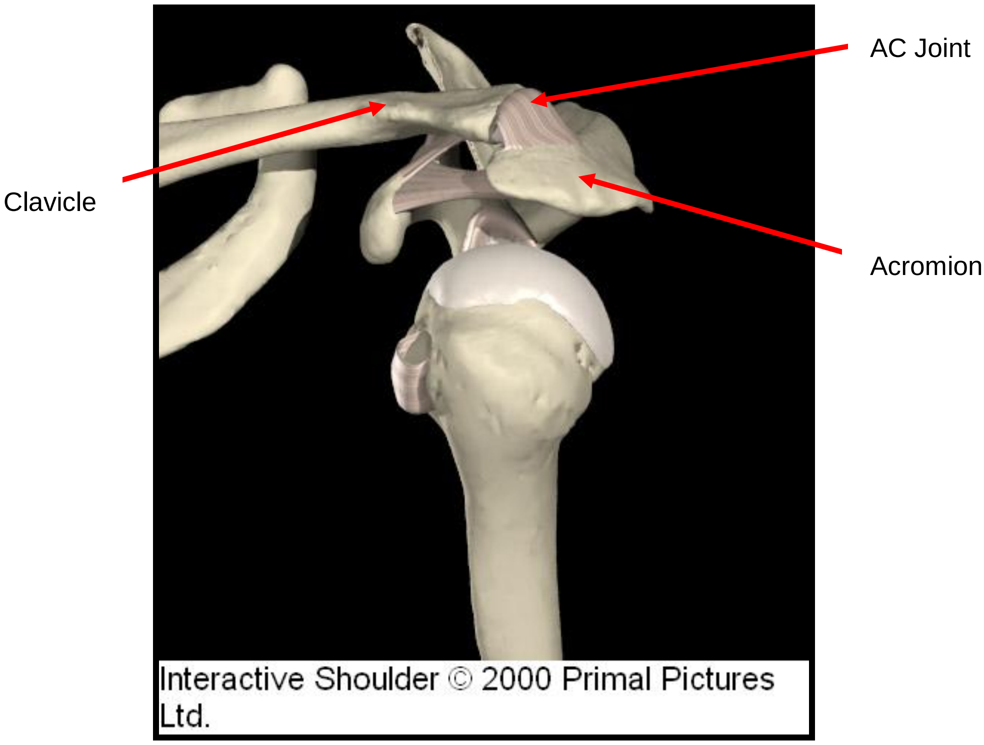

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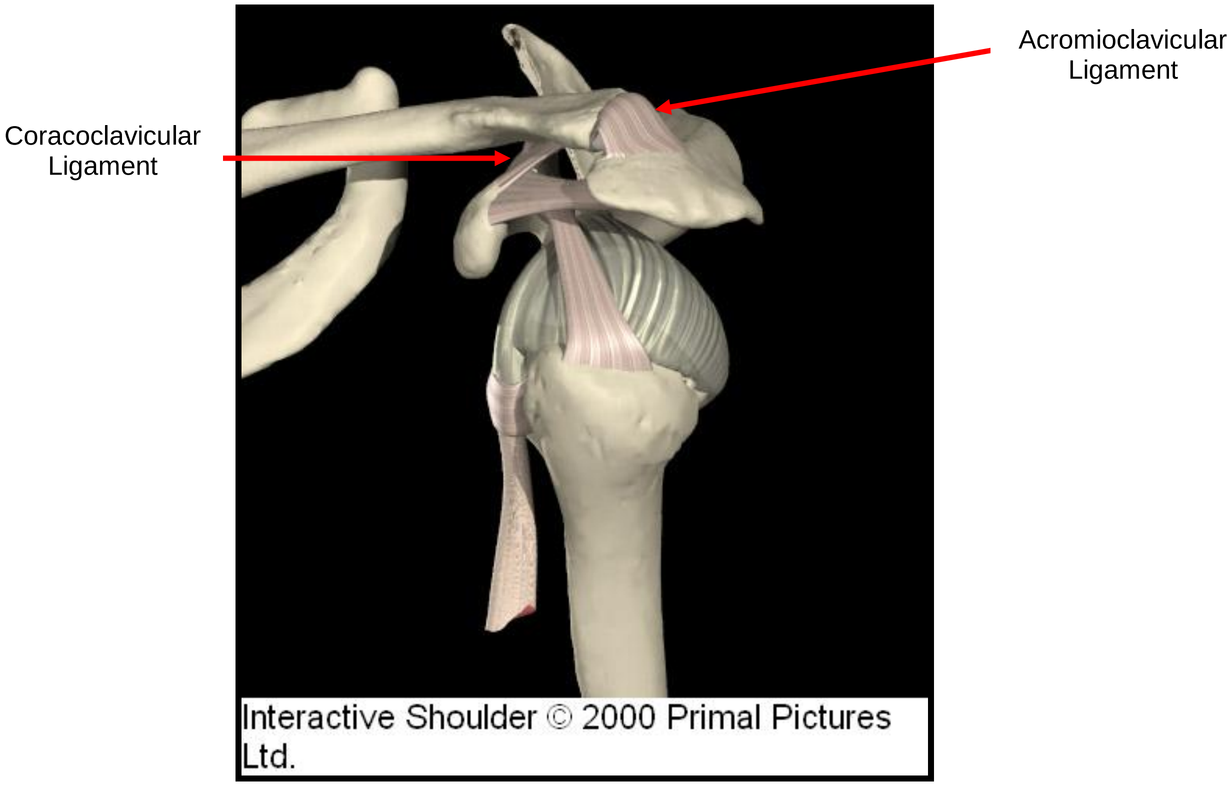
Image 2.1: Acromioclavicular joint

The AC joint is a synovial joint, which is enclosed by a fibrous capsule. Although this capsule is weak, it is reinforced by the above AC ligament (Image 2.2). Fibers of the trapezius muscle also provide secondary support. The superior AC ligament extends from the superior part of the lateral end of the clavicle to the superior surface of the acromion. The lateral part of the clavicle is anchored to the coracoid process by the coracoclavicular ligament (Image 2.2), which is the stronger of the two ligaments and it consists of two parts, the conoid and trapezoid ligaments. These ligaments make it possible for the clavicle to hold the scapula and upper limb laterally. The superior AC ligaments provide about two thirds of the constraining force against superior displacement of which the conoid ligament is the major constraint. The coracoclavicular ligament is largely responsible for providing stability to the joint, preventing the clavicle from losing contact with the acromion. With severe injury to the AC joint where dislocation has resulted, the coracoclavicular ligament may be torn allowing the scapula to fall away from the clavicle producing a visible step deformity (Buchberger, 1999; Standing, 2005; Magee, 2006; Moore and Dalley, 2006; Sinnatamby, 2006).



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Images 2.2: Ligaments surrounding the AC joint

The blood supply of the AC joint comes from branches of the suprascapular artery and thoracoacromial artery, both of which arise from branches of the brachiocephalic trunk (Image 2.3) (Standing, 2005; Moore and Dalley, 2006; Sinnatamby, 2006). Innervation of the AC joint is from branches of the supraclavicular, lateral pectoral and axillary nerves (Hengeveld and Banks, 2005; Standing, 2005; Magee, 2006; Moore and Dalley, 2006; Sinnatamby, 2006) (see Image 2.4).

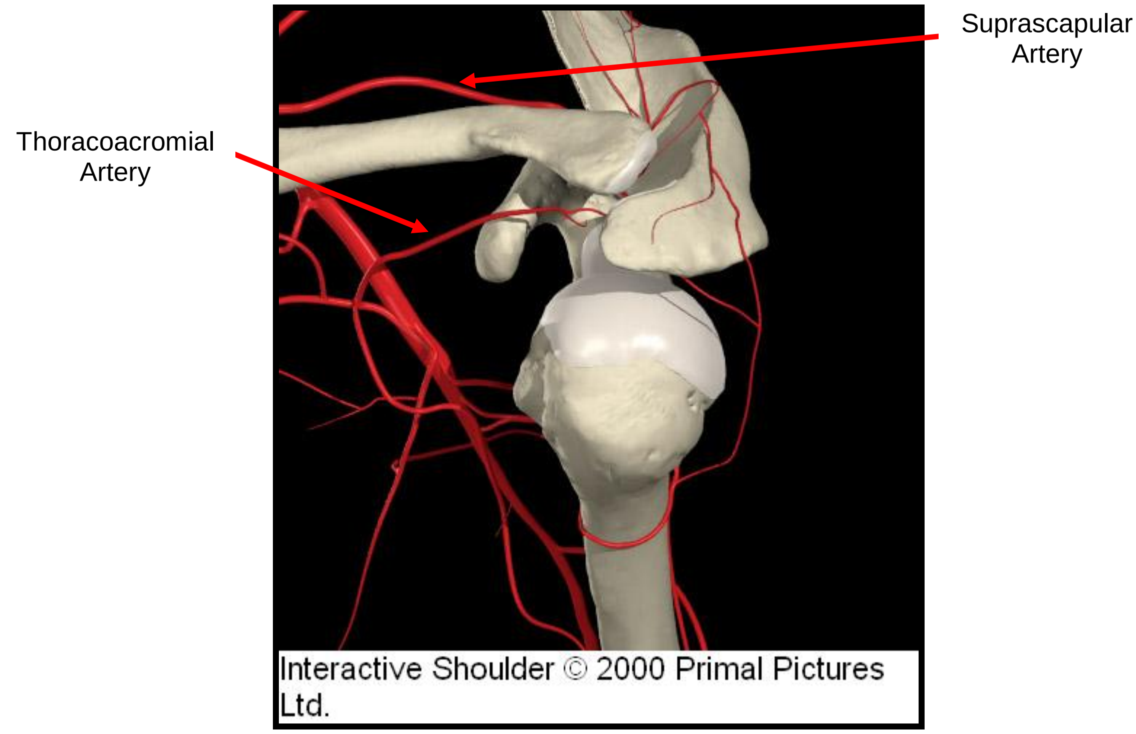

Image 2.3: Arterial supply of the AC joint

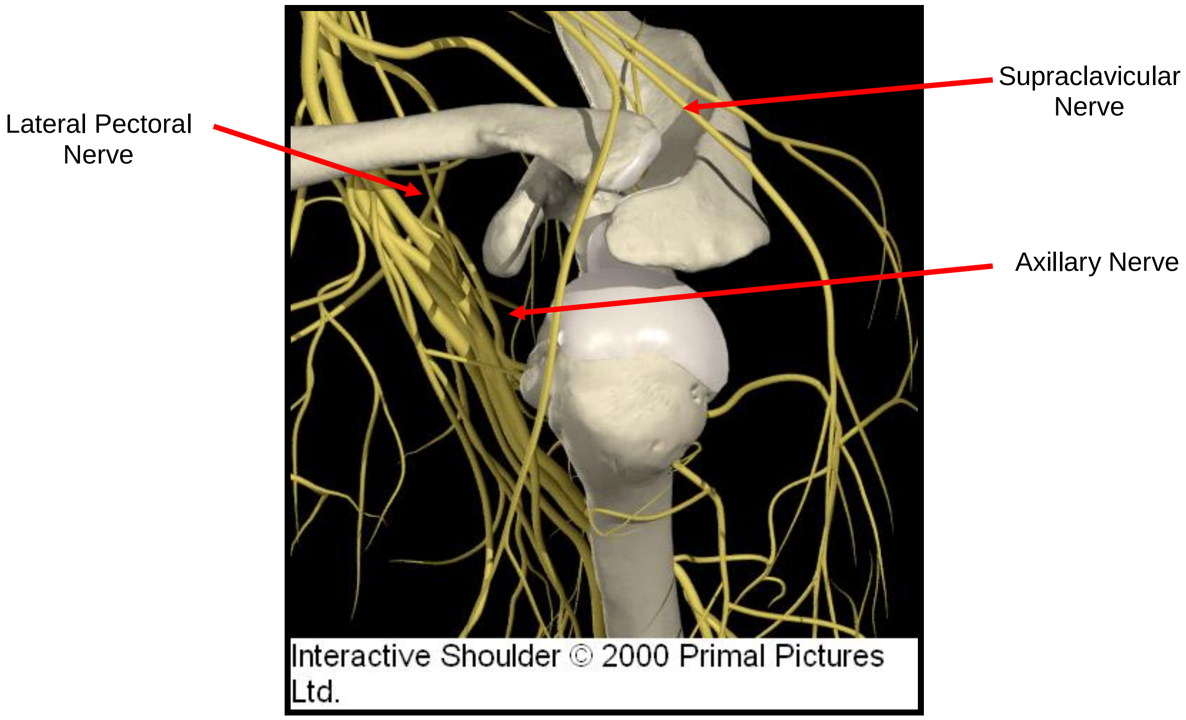

Image 2.4: Innervation of the AC joint

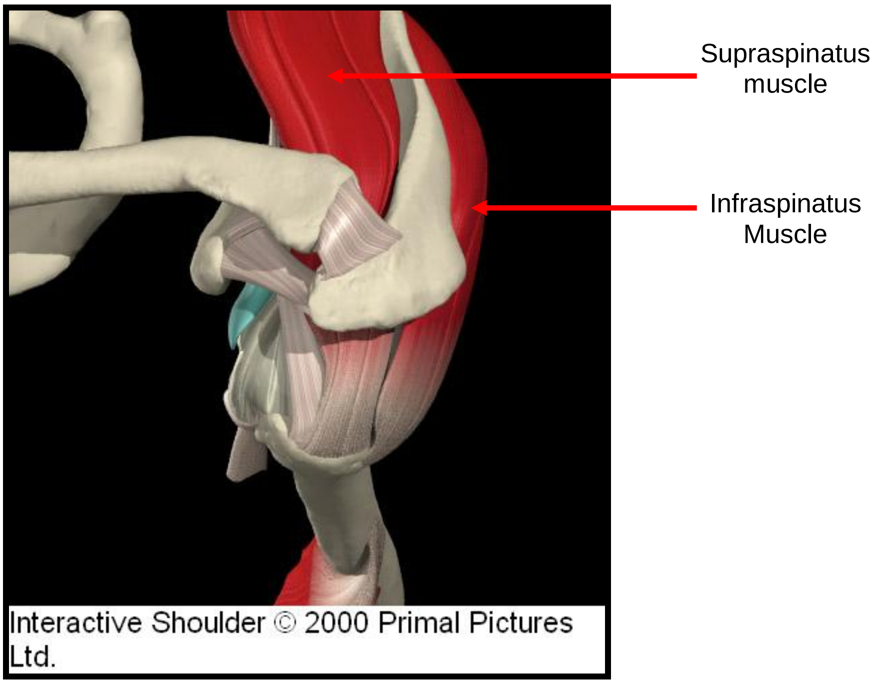

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Image 2.5: Muscles of the Shoulder Girdle

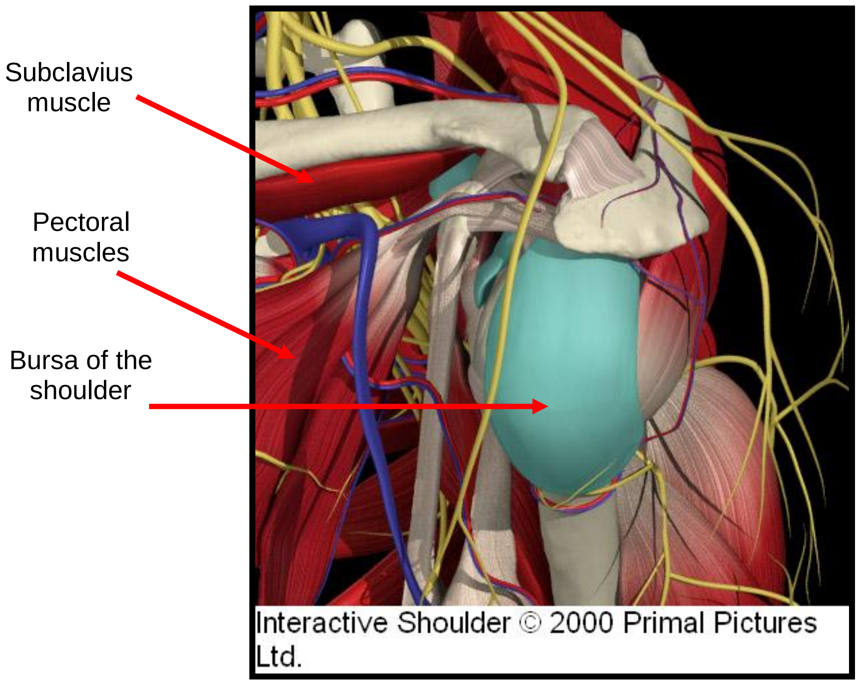

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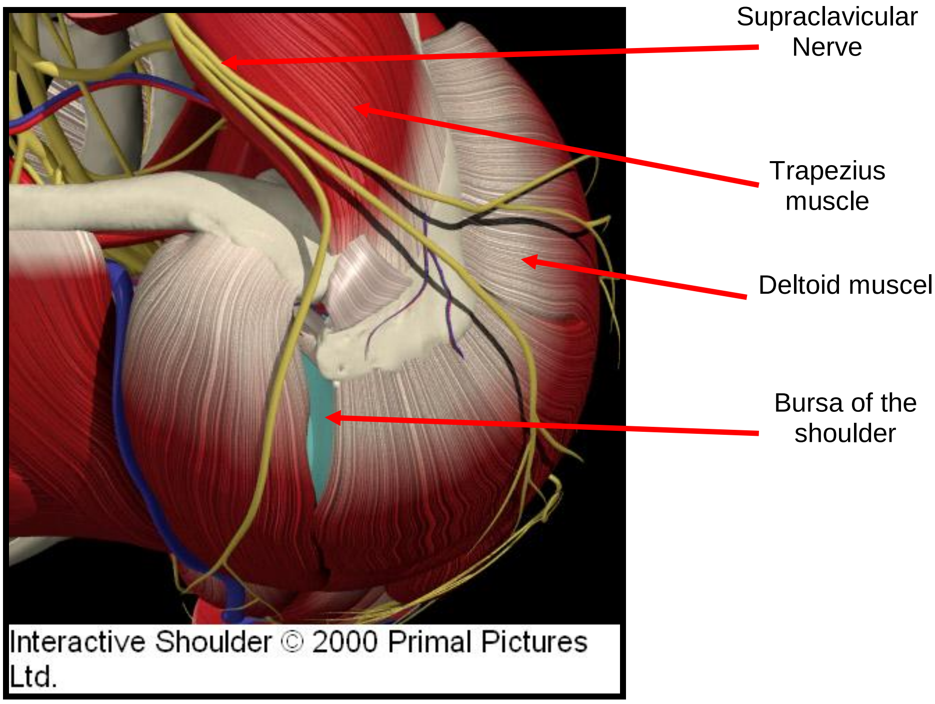
Image 2.6 Miscellaneous



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Images 2.7: Shoulder Girdle

2.3 Biomechanics

Research has found that the AC joint is the main stabilizing point for the shoulder girdle (Buchberger, 1999; Standing, 2005; Moore and Dalley, 2006; Sinnatamby, 2006). Since it is a joint of stability, the AC joint has limited motion, primarily about 15º in various planes (Carr, 2004); however at 180º of abduction, approximately 5º to 8º of motion has been detected at the AC joint (Buchberger, 1999; Sellards, 2004). The clavicle rotates approximately 40º to 50º during full overhead elevation but this movement is shared with scapula rotation rather than occurring only through the AC joint (Sellards, 2004). As mentioned in section 2.2, the AC joint is enveloped by a capsule, which is thickened superiorly, anteriorly and posteriorly, restricting rotation of this joint during elevation to about 20º (Hill et al., 2008). The AC joint allows the acromion to rotate on the clavicle as well as move anteriorly and posteriorly (Hengeveld and Banks, 2005; Moore and Dalley, 2006). Even though the amount of movement that occurs at the AC joint is very small, it plays an integral role in the functional mechanics of the shoulder girdle and as such is best measured by measuring limitation of activities of daily living (Yeomans, 2000; Paul et al., 2004).

The AC joint, along with the sternoclavicular joint, contributes 60º of the total 180º of shoulder abduction (the remaining 120° is from the glenohumeral joint) (Buchberger, 1999; Standing, 2005). Tasks that require excessive abduction and external rotation cause repetitive axial clavicular rotation, resulting in abnormal sheer stress at the AC joint. The AC joint is in the close-packed position when it is abducted to 90° (Magee, 2006), if the joint is involved then pain may result when the joint is stressed (Buchberger, 1999). Horizontal adduction is another AC close-packed position that creates pain when the joint is involved (Buchberger, 1999). Both movements mentioned are commonly utilised in weight training, in common manoeuvres such as bench press and side lateral raisers.

2.4 Weight Training

As weight training forms the major part of this study, a description of some of the aspects involved in weight training is stated as follows:

According to Weitz (1997), the bodybuilding-style of weight training is the most common of the three main types of weight training (the other two being Olympic and Power lifting) by both athletes and recreational trainers. It involves multiple sets of various exercises performed with multiple repetitions with the intention being to isolate particular muscle groups. The weight being used is moderate (60% to 80% maximal strength). Bodybuilding training also helps to provide balanced strength around joints by isolating weak areas that could allow excessive stress to the joint and subsequent injury.

Therefore the purpose of weight training as given by Weitz (1997) include,

(1) prevention of injuries by conditioning the muscles to act as secondary joint stabilizers;
(2) to increase strength, power, and muscular endurance to improve performance;

(3) to improve muscular bulk and to create an improved muscular shape; and
(4) injury rehabilitation.

As mentioned previous, the AC joint is the only bony connection of the shoulder to the rest of the body, it must therefore stabilize the shoulder in just about any weight training manoeuvre of the arm making it prone to injury in weight trainers. Pain is expected during weight training and so is often ignored being attributed to a hard workout and so professional care is not sought (Weitz, 1997; Carr, 2004). Some of the forces experienced include side-to-side compression (e.g. during bench press), and up and down shear (e.g. during dead lift). As clavicular rotation is present with the majority of shoulder movements, the AC joint is indeed stressed (Carr, 2004).

Research has found that most lifting injuries to the AC joint are overuse or repetitive stress injuries unlike the sudden traumatic lesions (i.e. dislocations, fractures) observed in contact sports. This is why most AC joint problems start off as low dull aches that gradually build over time to a more substantial problem as mentioned previously (Carr, 2004).

For the purpose of this study, the bench press will be the main focus in participants presenting in this study. The bench press was chosen due to its common occurrence in training routines (i.e. mainly used in the development and defining of the chest) as well as the common association with AC joint pain (Weitz, 1997; Horwitz, 1999, 2000; Carr, 2004).

2.4.1 Correct Bench Press Technique

The bench press can be broken into two sections, the down phase and the pressing phase.

In preparation for the lift, the lifter should be positioned in such a way that the bar is located above the eyes, the back and buttocks should be firmly placed on the bench and the feet should be placed flat on the floor. The grip should be centred on the bar with the arms positioned slightly wider than the shoulders. Correct breathing should also be implemented with the lifter inhaling as the bar is lowered to the chest and exhaling as the bar is pressed away from the chest (Edell, 2006).

2.4.1.1 The Down Phase

This phase begins as the lifter lowers the bar to the chest. The weight continues down until it gently touches the chest just below the level of the nipple. Lowering the bar too quickly causes a loss of control with the bar bouncing off the chest. This is harmful as it may result in fractures of the sternum or ribs. Also the bounce off of the rib cage produces upward momentum, this in turn results in less force required by the muscles to move the weight which leads to a reduction in strength gains by the primary movers of the chest (Edell, 2006).

2.4.1.2 The Pressing Phase

The pressing phase begins as the weight is pushed toward the starting position and concludes with the arms fully extended and the elbows locked. The muscles can only develop optimally if they exert controlled force through the entire range of motion (Edell, 2006).

2.5 Epidemiology

There has been a paucity of literature on establishing a set of results in the area of AC joint injuries, especially in terms of weight training. Most epidemiology that could be located was relating to the very broad topic of "shoulder pain" but very little was found to give a definitive answer regarding the AC joint and the injuries thereof. The shoulder joint is very frequently injured; statistical studies have shown that 8% – 13% of athletic related injuries involve the shoulder (Hill, n.d.). In another article (Preston, 2008), shoulder pain was reported to be the "third most common cause of musculoskeletal consultation in primary care" with 1% of adults consulting their doctor with new shoulder pain each year and self-reported prevalence of shoulder pain being between 16% and 26%. A common trend within the literature that has been found is that the AC joint is one of the major complaints that weight lifting athletes are seeing their doctors for (Carr, 2004). As reported by Rull (2007), "it is difficult to know how common such injuries are since there are no reliable population data, but they seem to be highly prevalent among players of high-impact contact sports", this statement is echoed by other authors (Saunders, 2001; Ponce et al., 2004). It was also reported that 41% American College Football players had suffered AC injury while 45% of first class rugby players reported some form of AC joint injury (Rull, 2007). This trend of injuries is also reflected in the patient profile, with more than half of all AC joint injuries occurring in the first three decades of life (Kiner, 2003). One possibly relevant piece of information is that the incidence of atraumatic osteolysis in America has matched the increase in number of athletes performing strength training. One report, based on a limited series, showed a prevalence of 27% in weight trainers (Auge and Fischer, 1998).

2.6 Clinical Presentation and Diagnosis

Most AC joint problems cause pain and stiffness in the area located by the hand, if it were to place your hand on top of the opposite shoulder (Gerber et al., 1998; Carr, 2004; Hengeveld and Banks, 2005). The pain is present when the joint is put under strain (Hengeveld and Banks, 2005) such as when lifting, and perhaps only with certain types of lifts (as is common with the bench press and is often one of the first to become symptomatic) (Carr, 2004). If ignored, a chronic stress injury can develop, and the pain becomes more frequent even with daily activities. The main finding is tenderness right over the AC joint itself. As this joint is prone to degenerative changes, subluxation and involvement in fractures of the clavicle, damage to the AC joint may also result in osteophyte formation or other forms of encroachment into the subacromial space which may contribute to the development of other acromiohumeral disorders such as impingement syndromes, rotator cuff pathology and subacromial bursitis (Hengeveld and Banks, 2005), all of which may complicate the outcome of treatment. Bringing the arm across the front of the body produces compression on the AC joint which easily reproduces the pain (Carr, 2004). Pain is also commonly felt whilst sleeping on the affected side (Horwitz, 1999, 2000; Hengeveld and Banks, 2005).

In order to facilitate clinical decision-making the clinical presentation is often graded according to the Rockwood classification (Lemos, 1998):

Injury type	Acromioclavicular ligament	Coracoclavicular ligament	Deltotrapezial fascia	Direction
I	Sprain	Intact	Intact	Nondisplaced
II	Complete disruption	Sprain	Intact	<25% Superior
III	Complete disruption	Complete disruption	Injury	25%–100% Superior
IV	Complete disruption	Complete disruption	Detached	Posterior through the trapezius
V	Complete disruption	Complete disruption	Detached	100%–300% Superior
VI	Complete disruption	Complete disruption	Detached	Inferior to acromion or coracoid

This classification is however further complicated in that the shoulder girdle complex (of which the AC joint forms part) is also made up of the sternoclavicular, glenohumeral, and scapulothoracic joints. Therefore, a primary disorder in one articulation invariably has its effects on all other joints in this complex kinematic chain (Buchberger, 1999).

2.7 Differential Diagnosis

There are a number of possibilities to consider when facing pain around the AC joint and distal clavicle. A few are given below:

2.7.1 Repetitive stress injury

This is the more common injury involving the AC joint due to repetitive stress/overuse (i.e. over training) of the AC joint. Pain is felt over the top of the affected shoulder, which is made worse whilst straining the joint (e.g. during weight lifting). Due to the repetitive micro-trauma that the joint is subject to, this condition can progress to osteolysis of the distal clavicle (Weitz, 1997; Gajeski and Kettner, 2004). Early recognition is therefore important to prevent further progression (Carr, 2004).

2.7.2 Arthritis of the AC joint

The articular bodies of the AC joint develop degenerative changes with increasing age (this point is negated due to the lower age group of the participants for inclusion into the study), comparable to osteoarthritis of the large joints (Prescher, 2000). Symptoms are similar to those described above, but tend to have been present for a greater period of time often progressing to trouble the patient during day-to-day activities. There may also be osteophyte formation causing other conditions such as impingement syndrome (Prescher, 2000; Carr, 2004; Mulyadi et al., 2008). The development of arthritis can also be attributed to osteolysis, a dislocation or repetitive stress of the AC joint (Alberta et al., 2004).

2.7.3 Dislocation of the AC joint

This is a very common injury in contact sports such as football & rugby (Kiner, 2003; Carr, 2004) and is mainly due to a direct blow to the shoulder (Kiner, 2003). Apart from the pain that is present, a very noticeable lump can be present on the top of the shoulder (Carr, 2004). Dislocations can result in osteolysis of the distal clavicle (Alberta et al., 2004; Gajeski and Kettner, 2004; Mulari et al., 2006).

2.7.4 Clavicular Fractures

These, like dislocations, are common in contact sports, normally caused by some impact to the shoulder girdle or falling on the out stretched hand (e.g. soccer, rugby, cycling, running, martial arts) (Moon et al., 2007). The patient is unable to raise the involved arm above shoulder level and the involved shoulder may be lower than the unaffected shoulder. They may also support the elbow of the involved side with the opposite hand. The most common site of fracture is midshaft of the clavicle but both ends should be carefully examined. The majority of outer-third fractures of the clavicle present with intact ligaments and no significant displacement (Schafer, 1998). Fractures of the inner-third are uncommon, but if seen in younger patients, often represent an epiphyseal injury. This is due to the fact that there are growth centres at either end of the clavicle that can be injured due to chronic stress as they only fuse around 25 years of age (Schafer, 1998; Carr, 2004).

2.7.5 Osteolysis of the distal clavicle

This condition, also known as “bench pressers' shoulder” (Zupancic, 2000), is characterized by severe AC joint pain with x-ray images that shows the end of the clavicle literally fragmenting and “dissolving” (Carr, 2004). It is mainly due to repetitive micro trauma, leading to subchondral stress fractures with synovial hyperaemia and subsequent bone resorption (Carr, 2004; Gajeski and Kettner, 2004). Such injuries are frequently seen in manual labourers (those using pneumatic drills), weight trainers, and athletes involved in throwing activities (Asano et al., 2002; Alberta et al., 2004; Gajeski and Kettner, 2004; Mulari et al., 2006). As the area gets overused repetitively, it sets up an inflammatory response that starts to fragment and weaken the bone (Carr, 2004).

Other, more sinister causes of osteolysis, both local and systemic, are rheumatoid arthritis, gout, Gorham's disease, infection, hyperparathyroidism, myeloma, and systemic sclerosis (Asano et al., 2002; Mulari et al., 2006; Rull, 2007). All the above-mentioned conditions may lead to locally restricted bone destruction (Mulari et al., 2006).

2.7.6 Impingement Syndromes

These are a common cause of shoulder pain (Boyles et al., 2008; Mulyadi et al., 2008). The rotator cuff (of which the supraspinatus is one (Moore and Dalley, 2006)) may be encroached upon by the coracoacromial arch producing pain (Boyles et al., 2008). The supraspinatus tendon and the subacromial subdeltoid bursa pass through the narrow supraspinatus outlet (Mulyadi et al., 2008), which may be encroached upon by the formation of osteophytes in arthritis (Prescher, 2000; Renfree et al., 2003). The supraspinatus outlet is bound superiorly by the coracoacromial arch (Mulyadi et al., 2008). Other causes of impingement are anatomical variations of the acromion and trauma (Boyles et al., 2008). Supraspinatus or bicipital tendonitis, which can arise from impingement syndromes, may be isolated conditions, or as mentioned previously, be aggravated due AC joint restriction or osteophyte formation causing impingement of these tendons.

2.7.7 Other Differential Diagnoses

Other differential diagnoses that should also be considered due to the presence of shoulder pain within the area of the AC joint are:

1. Labral injuries – whose symptoms are similar to those of an impingement syndrome and AC joint arthritis (Munro and Healy, 2008).
2. Cervical spine pathology e.g. fracture
3. Surgical – possible failure to rehabilitate the shoulder after any form of surgery may lead to residual pain and restriction.

2.8 Treatment

Current treatment is conservative in nature with the focus being on the cessation of the offending manoeuvre (i.e. rest), cryotherapy, initial immobilisation, physiotherapeutic modalities (i.e. acupuncture, ultrasound), stretching and strengthening the shoulder and scapular muscles, massage and mobilisation exercises (Zupancic, 2000; Mestan and Bassano, 2001). Another procedure that is used when conservative treatment has not given the desired outcome or if the patient is not willing to take the required recovery time, is surgical amputation of the distal end of the clavicle (called acromioplasty) has been shown to be a viable treatment option (Mestan and Bassano, 2001; Asano et al, 2002; Renfree et al, 2003; Alberta et al, 2004; Carr, 2004; Hengeveld and Banks, 2005) as it reduces painful bony contact in the AC joint, and as a result, high loads (compression and translation) are transferred to the surrounding intact soft tissue (Sellards, 2004). Although many of the weight trainers who have undergone this procedure do not return to their pre-injury level of lifting (Mestan and Bassano, 2001). This reinforces the need to find an effective alternative therapy for the treatment of AC joint injuries.

2.9 The Purpose of this Study

With such a wide variety of treatments available, it is not known what the primary therapy required for the restoration of the AC joint should be. Therefore this research aims to focus on restoring movement to the AC joint through manipulation to allow for less restricted functioning and possibly aid in the resolution of the problem that may be present in the joint. As there is such a paucity of research with regard to shoulder injuries, particularly concerning the AC joint in the Chiropractic field this research dissertation aims to fill the gap in literature with regards to manipulation as well as the effect of manipulation on the AC joint.

The questionnaires used in this dissertation methodology focuses solely on the functional ability (e.g. due to decreased range of movement and pain) of the shoulder before, during and after the treatment protocol being followed. As mentioned above, there is a paucity of literature on the AC joint and the effects of manipulation of this joint, so it is necessary to ascertain whether this form of treatment brings about any functional improvement with regard to the patients performance of daily activities. The outcomes of this research can then be further enhanced to promote a more specific outcome regarding the degree of improvement.

Chapter Three

Materials & Methods

3.1 Introduction

This chapter aims to describe the research methodology as well as the materials used in collecting data and their analysis. Participants were assessed and both subjective and objective measurements were recorded at four separate intervals over a seven-week period. In addition the subjects' improvement was noted with regard to the concomitant number, and type of associated clinical findings.

3.2 Research Design

Prospective, randomised, placebo controlled trial

3.3 Sampling

Advertisements were posted around the Durban University of Technology (DUT) campus and at Weight Training Gymnasiums around the Durban area (Appendix A). Meetings were arranged both with personal trainers and gym instructors who had the study explained to them so that they may refer clients for treatment. An editorial was also done by a local newspaper briefly explaining the study and the patient inclusion criteria inviting participants to phone and take part (i.e. male, 18 – 40 years of age, weight training).

3.3.1 Randomisation

The method was that of self-selection as subjects responded to the advertisements and the sample group was filled consecutively until there were a total of 20 subjects who fitted the study's criteria. Random allocation was utilised to allocate the participants into two equal groups of 10 participants each. Participants were placed either into a manipulation group, receiving an active treatment in the form of a manipulation or into a placebo group, receiving a placebo treatment in the form of inactive laser therapy.

3.3.2 Patient Screening

The evaluation and selection process began with all possible subjects undergoing a cursory telephonic interview with the researcher to exclude any unsuitable candidates.

Questions asked:

- How old are you?
- How often do you perform bench press a week?
- With reference to the pain: Location? How long have you been experience pain? Is it aggravated with bench press?
- Do you have a history of fracture, dislocation, surgery, nerve root entrapment or any other condition causing shoulder pain?

Subjects suitable for the study were then evaluated at an initial consultation, at which they received a Letter of Information (Appendix B) and an Informed Consent Form (Appendix C) to sign. These explained the study and the right of the participant to withdraw from the study at any time.

At this consultation the subjects were further assessed for inclusion based on a case history (Appendix F), relevant physical examination (Appendix G) and shoulder regional examination (Appendix H) to determine suitability for this study.

3.4 Inclusion and Exclusion Criteria

3.4.1 Inclusion Criteria

1. Male –improved sample homogeneity (Mouton, 2002).

2. 18 – 40 years of age (Weitz, 1997).

3. Participants must be involved in weight training, performing bench press at least once a week (Weitz, 1997).

4. Pain over the AC joint (Gerber et al., 1998; Carr, 2004; Hengeveld and Banks, 2005) as well as radiating over the deltoid and trapezius muscles on abduction and/ external rotation as well as during most shoulder girdle exercises (e.g. bench press), must be present as a dysfunctional AC joint that is worsened by weight training. The pain may radiate to the deltoid, trapezius and supraspinatus muscles as well as the anterolateral neck (Gerber et al., 1998).

5. The pain is relieved by rest but frequently is reported as disturbing sleep (Hengeveld and Banks, 2005).

6. Pain present for at least two weeks duration (this episode) (i.e. acute in nature) (Weitz, 1997; Carr, 2004)

7. Decreased functional capacity while training as measured by pain during bench press.

8. Occasionally a lump is palpable over the affected AC joint, which can be tender. Deformity is sometimes visualised and there is a decrease in range of motion of the shoulder particularly on abduction and crepitus may be felt. (Buchberger, 1999; Horwitz, 1999, 2000; Gajeski and Kettner, 2004).

9. Restriction in motion as evident by manual palpation of the AC joint.

10. Pain occurring at the AC joint on active or passive abduction, beginning at approximately 90º of elevation and continuing to the 180º end range may indicate an AC joint lesion (Buchberger, 1999).

11. At least 4 of the following test must be positive:
    - AC Differential Test
    - Adduction Stress Test (Buchberger, 1999; Ombregt et al., 1999; Carr, 2004; Magee, 2006)
    - Impingement Sign of Neer
    - Schultz's Test
    - Shrug Test (Buchberger, 1999)
    - Tenderness over the AC joint (Carr, 2004)
    - AC tender to palpation (Ombregt et al., 1999; Zupancic, 2000)
    - Pain with abduction greater than 90º (Zupancic, 2000)
    - AC Shear Test (Magee, 2006)
    - Upward displacement of clavicle
    - Pain on passive elevation and medial and lateral rotation (Ombregt et al., 1999)

12. The clinician on duty must confirm the presence of a fixation in the AC joint for the participant to be included.

3.4.2 Exclusion Criteria

1. No previous surgery to the area (Bergmann et al., 1993).

2. No direct trauma to the area – fractures, dislocations, etc (Bergmann et al., 1993).

3. If the participant is on any pain medication.

4. If the participant does not sign the Consent Form.

5. If the participant is illiterate and cannot speak or read English:
   - This is to ensure that the questionnaires will be filled in and the questions asked will be answered accurately. This is to ensure the validity of the responses given and that they are not compromised by any language barrier (Scollen and Scollen, 1995).

6. Female – as including only male participants will promote homogeneity (Mouton, 2002).

7. Any contra-indications to manipulation relevant to the area being treated:
   - Anticoagulant therapy
   - Advanced Osteoarthritis
   - Inflammatory Arthritis
   - Joint Instability
   - Fractures
   - Dislocations
   - Severe Sprains and Strains
   - Bone Tumours
   - Bone Infections (e.g. tuberculosis)
   - Osteomyelitis
   - Osteoporosis, Osteomalacia
   - Severe Pain, Patient Intolerance
   - Associated neck / thoracic pain
   - Pain down the arm
   - Neurological dysfunction
   - Cardiac/ gall bladder signs and symptoms (Bergmann et al., 1993)

8. Other excluding conditions:
   - Impingement syndrome
   - Rotator cuff tear
   - Proximal biceps tear

- Brachial plexus neuropathy
- Suprascapular nerve impingement
- Pectoralis major tears
- Osteolysis of the distal clavicle (Weitz, 1997)

9. If the participant requires further clinical testing in order to confirm or refute a differential diagnosis they will be excluded.

10. If the clinician on duty finds no AC joint fixation.

Those subjects who had not met the inclusion criteria were referred to other interns at the Chiropractic Day Clinic for treatment of their condition, as paying outpatients.

3.5 Intervention

3.5.1 Intervention Type

Of the two groups being studied, one group was an active group receiving a manipulation to remove any fixation found in that joint. The other group was the control group receiving a placebo laser treatment.

3.5.1.1 AC joint manipulation

- The patient is supine with the affected arm abducted to 90º.

- The researcher stands at the head of the table, facing foot ward off to the side of the affected arm.

- Establish an index contact with the inside hand over the superior aspect of the distal clavicle/ proximal acromion.

- With your outside hand, grasp the humerus at midshaft.

- As the indifferent hand draws the humerus into long axis distraction and abduction, apply a superior to inferior impulse thrust with the contact hand (Bergmann et al., 1993).

- A successful manipulation for the purpose of this study will be classified as a Grade 5 mobilisation with/ without a cavitation, which improves range of motion as checked by motion palpation.

3.5.1.2 Placebo laser therapy for control group

- This is a good example of a placebo as the participant is requested to look away to prevent eye exposure from the beam and then the laser is not turned on. As there is no heat emitted by the laser the participant will not know whether the laser is functioning or not.

- Please note that the scanning method of application will be used to minimise mechanical stimulation by preventing any physical contact of the laser unit with the participant, which could improve the condition via the gate control system (Bazin and Kitchen, 1996).

3.5.2 Intervention Frequency

There were a total of four treatments over a two-week period. Subjects underwent a clinical assessment consisting of objective and subjective findings in weeks one, two, three and seven.

Table 3.1: Treatment Frequency

WEEK	VISIT	GROUP 1 Manipulation	GROUP 2 Placebo
1	1	Allocation Assessment 1 Treatment	Allocation Assessment 1 Treatment
	2	Treatment	Treatment
2	3	Assessment 2 Treatment	Assessment 2 Treatment
	4	Treatment	Treatment
3	5	Assessment 3	Assessment 3
4	-	-	-
5	-	-	-
6	-	-	-
7	6	Assessment 4	Assessment 4

3.6 Data Collection

3.6.1 Data Collection Tools

3.6.1.1 Objective Readings

1. An **Algometer** reading was taken at the point of maximum tenderness over the AC joint to determine the degree of pain/tenderness in this region and to note any improvements with regard to treatment (Fischer, 1986). This was done by slowly increasing the pressure until the participant indicated they were starting to feel pain or discomfort (i.e. the Algometer measures the degree to which patients can absorb pressure before pain is experienced).

2. The participant's pain free range of movement of their shoulder was taken to note any improvement with regard to treatment. Below is the method that the researcher implemented using the **Dualar Inclinometer** (The Dualar Life. Manufacturer: J. Tech. Medical Industries, 357 West 910 South Heber City, Utah, USA).

    - *Shoulder Flexion & Extension*
        - Place a strap on the upper arm one palm's width distal from the elbow crease
        - Place the slave unit on the strap parallel to the sagital plane
        - Place the master unit on the scapula parallel to the sagital plane – not flat against the back
        - Zero the unit at neutral
        - Flex and extend the arm without rotating the wrist and take the reading

- *Shoulder Abduction & Adduction*
    - Attach a strap to the upper arm one palms width distal from the elbow crease
    - Place the slave unit on the front of the arm
    - The master unit is placed firmly against the upper torso parallel to the range of movement
    - The arm must be vertical and the unit zeroed
    - Abduct and adduct the arm without rotating the wrist and take the reading

- *Shoulder Internal & External Rotation*
    - Place a strap on the forearm one palm's width proximal to the elbow crease
    - Position the arm and forearm parallel to the floor with the elbow bent to 90°
    - Place the master unit on the strap
    - Zero the unit at neutral

- Internally and externally rotate the shoulder keeping the upper arm parallel to the floor and take the reading
- If torso movement is involved, attach the slave unit and place it on the sternum (The Dualar Range Of Movement System Training Video, n.d.).

3.6.1.2 Subjective Readings

1. The **Shoulder Pain And Disability Index** (**SPADI**) as well as the **Shoulder Rating Questionnaire** (**SRQ**) was used to ascertain any perceived improvement in pain and the functional abilities of the participants (Yeomans, 2000; Paul et al., 2004).

    - The first question, pain rating using the Visual Analogue Scale, has been omitted due to difficulty in scoring an accurate result.

2. The **Numerical Pain Rating Scale** (**NRS**) was used to determine the subjective pain intensity experienced by the participant whilst performing a set of bench press. The participant was asked to rate the intensity of their pain between 0 and 10, with 0 representing no pain at all and 10 representing pain at its worst (Jenson et al., 1986).

3.6.2 **Data Collection Frequency**

The above mentioned ***(i.e. Algometer, Inclinometer, NRS, SPADI and SRQ)*** were administered as follows.

1. At the first consultation a clinical assessment consisting of a full case history, an abbreviated physical examination and a shoulder regional examination were completed.

2. The SPADI and SRQ were administered at the first consultation as well as the Algometer reading and Inclinometer measurement of pain free shoulder movement. NRS specifically focused at pain during bench press was also taken.

3. The Algometer and Inclinometer measurements were repeated after 2nd and 4th treatments.

4. The SPADI and NRS were repeated after 4th treatment.

5. The SPADI, SRQ and NRS were completed at the seven-week follow up by telephonic interview.

Table 3.2: Data Collection Frequency

WEEK	VISIT	GROUP 1 Manipulation	GROUP 2 Placebo
1	1	Clinical Assessment SPADI SRQ Algometer Inclinometer NRS	Clinical Assessment SPADI SRQ Algometer Inclinometer NRS
	2	-	-
2	3	Algometer Inclinometer	Algometer Inclinometer
	4	-	-
3	5	Algometer Inclinometer SPADI NRS	Algometer Inclinometer SPADI NRS
4	-	-	-
5	-	-	-
6	-	-	-
7	6	SPADI SRQ NRS	SPADI SRQ NRS

The researcher recorded the results on the same record sheet to prevent the participant seeing their previous results and so giving a true answer as opposed to the participant basing their current answers on their previous information / comparison to a previous result.

3.7 Statistical Analysis

SPSS version 15 was used to analyse the data (SPSS Inc., Chicago, Ill, USA). A p value <0.05 was considered as statistically significant. Allocation into the two treatment groups was via randomization, thus it was assumed that baseline outcomes were similar in both groups. However, this assumption was tested using independent t-tests for all the baseline outcomes measured as well as Pearson's chi square tests or Fisher's exact tests for some demographic variables to ensure equality of groups at the outset.

Repeated measures ANOVA was used to assess the effect of the treatment on each outcome measure over time. A significant time by group interaction ($p<0.005$) was taken to indicate a significant treatment effect. Profile plots were generated to assess the direction of the treatment effect, and to examine trends in the results if statistical significance was not reached. There were no missing data.

Intra-group correlation between changes over time in objective and subjective outcome measurements was done by means of Pearson's correlation coefficients.

Chapter 4

Results

4.1 Introduction

The statistical findings and results obtained from the data will be discussed in this chapter.

Demographic data consisting of age, race, gender, height and weight was analysed. Objective and subjective findings were also analysed, and the correlation between findings evaluated. These analyses were drawn from twenty participants who met eligibility criteria were randomised into two equal groups: an “manipulation group” and a “placebo group.”

The manipulation group received four treatments comprising of a Chiropractic manipulation to the fixated shoulder, whereas the placebo group received four treatments with a non-operational laser unit.

Key of symbols

%	=	percentage
Grp	=	group
N	=	number
NRS	=	Numerical Pain Rating Scale
p-value	=	probability value
SD	=	standard deviation
SPADI	=	Shoulder Pain and Disability Index
SRQ	=	Shoulder Rating Questionnaire

4.1.1 Dropouts and replacements

Two participants dropped out of the study for reasons of time availability, cost (i.e. in terms of transport to and from the Chiropractic Day Clinic where the study took place), family commitments, work commitments or due to inability to maintain the research protocol (holidays, work related absences and illness).

These drop out participants occurred equally between the treatment groups.

In terms of the methodology, the participants that did drop out where replaced by new participants that met the study inclusion and exclusion criteria and the data gleaned from the drop out candidates was not included in the final analysis to avoid the use of incomplete data on an already small population of participants in this study.

Review of the SOAPE notes and post treatment calls indicated that there where no participants that dropped out of the trial either due to mild adverse reactions such as increased stiffness, pain and / or weakness or to serious adverse reactions (defined as increased and persistent pain that was more severe than the original participant complaint).

One of the factors that may have influenced the recruitment of the participants for this study, is the perception of the general population that tends to support the perception that the prime role of the Chiropractor is that of a spine care specialist (Rubens, 1996; Hunter, 2004; Carey et al., 2005; Louw, 2005; van As, 2005; Gaumer and Gemmen, 2006; Kew, 2006; Rattan, 2007; Butt, 2008; Cloete, 2008; Naidoo, 2008; Palmer, 2008) as opposed to a practitioner that could and is able to specialise in treatment of extremity dysfunctions.

4.2 Demographics

4.2.1 Age

There was a slight difference in mean age between the two groups. Table 4.1 shows that the mean age of the manipulation group was slightly lower than that of the placebo group, however, the difference was not statistically significant (p=0.515).

Table 4.1: Comparison of mean age between manipulation and placebo groups (N=20).

	Treatment Group	***N***	***Mean***	***SD***	***Std. Error Mean***	***p-value***
Age	Manipulation	10	24.80	6.563	2.075	0.515
	Placebo	10	27.10	8.774	2.775	

In terms of the age of these presenting participants, it would seem that the participants in this study are according to Carr (2004), Mouhsine et al (2003) and Schafer (1998), in the same age bracket of patients who are more likely to have an increased susceptibility to AC joint dysfunction, although literature also reports higher age ranges for this condition (Shaw et al, 2003). This range of age seems to be related to the degree of injury and thus the classification of the injury (e.g. Rockwood classification (Lemos, 1998)). In this context the older participants tend to sustain higher-grade types of injury (Lin et al., 2006; Erol et al., 2008) and often present with greater numbers or severity of concomitant conditions (Liebenson, 2005b; Clayton and Court-Brown, 2008). These require increased surgical intervention as opposed to the lower Rockwood grade types, which are treated more conservatively (Mouhsine et al., 2003). The only modifier to this general norm is traumatic injury, which could result in a higher-grade classification even for younger individuals (Jeon et al., 2007).

Therefore it is possible to state that the presenting participants were representative of the norms of AC joint dysfunction grade I of non-traumatic origin, which indicates that they are also the participants that are most likely to benefit from conservative care.

4.2.2 Ethnicity

There was also no significant difference between the groups in terms of ethnicity (p=0.513). Table 4.2 shows that although the proportion of White participants was greater in the manipulation group and the inverse held true of the Black participants in the placebo group, this difference was not statistically significant.

Table 4.2: Ethnicity by treatment group

			Treatment Group		***Total***
			Adjustment	***Placebo***	
Ethnicity	***White***	Count	7	5	12
		% within Ethnicity	58.3%	41.7%	100.0%
	Black	Count	1	3	4
		% within Ethnicity	25.0%	75.0%	100.0%
	Indian	Count	2	2	4
		% within Ethnicity	50.0%	50.0%	100.0%
Total		Count	10	10	20
		% within Ethnicity	50.0%	50.0%	100.0%

Pearson's chi square 1.333, p=0.513

With respect to the demographic profile, it does not reflect the race distribution of South Africa, and in particular the province of Kwa-Zulu Natal (KZN) (Manpower Survey, 1995). This lack of representivity may be due to a number of different reasons, which may include one or more of the following:

> Firstly, the Black population of KZN may not be as familiar with Chiropractic as the White or the Indian population groups (Rattan, 2007), which is derived from a western culture (Haldeman, 2005).

Secondly, participants in this study were required to make a number of trips to the Chiropractic Day Clinic, where the treatments and objective measurements were completed. This may have resulted in a sample that is representative of only the highly mobile portion of the population, rather than the population in general.

Thirdly and lastly it should also be considered that the majority of the manual labour (unskilled population) in the past were Black people, whereas the employers that have a higher mobility (as discussed above) were more likely to be White or Indian (Man Power Survey, 1995). Although the demographic population has changed since this Survey was published, the trends are still evident.

No literature comparisons were possible as no literature was found to have documented ethnicity.

4.2.3 Hand Dominance

There was only one left handed participant, thus the distribution of dominant hand was equal in the two groups (p=1.000) (Table 4.3).

Table 4.3: Dominant hand by treatment group

			Treatment Group		***Total***
			Adjustment	***Placebo***	
Dominant Hand	***Right***	Count	9	10	19
		% within Dominant Hand	47.4%	52.6%	100.0%
	Left	Count	1	0	1
		% within Dominant Hand	100.0%	.0%	100.0%
Total		Count	10	10	20
		% within Dominant Hand	50.0%	50.0%	100.0%

Fisher's exact p =1.000

Relevance commented on in section 4.2.4

4.2.4 Shoulder Injured

There was also absolutely no difference in the side of the injured shoulder between the groups (p=1.000) (Table 4.4). Figure 4.1 also shows the similarity of the percentages in each group.

Table 4.4: Injured shoulder by treatment group

<table>
<tr><th colspan="2" rowspan="2"></th><th rowspan="2"></th><th colspan="2">Treatment Group</th><th rowspan="2">Total</th></tr>
<tr><th>Adjustment</th><th>Placebo</th></tr>
<tr><td rowspan="4">Injured Shoulder</td><td rowspan="2">Right</td><td>Count</td><td>3</td><td>4</td><td>7</td></tr>
<tr><td>% within Injured Shoulder</td><td>42.9%</td><td>57.1%</td><td>100.0%</td></tr>
<tr><td rowspan="2">Left</td><td>Count</td><td>7</td><td>6</td><td>13</td></tr>
<tr><td>% within Injured Shoulder</td><td>53.8%</td><td>46.2%</td><td>100.0%</td></tr>
<tr><td colspan="2" rowspan="2">Total</td><td>Count</td><td>10</td><td>10</td><td>20</td></tr>
<tr><td>% within Injured Shoulder</td><td>50.0%</td><td>50.0%</td><td>100.0%</td></tr>
</table>

Fisher's exact p =1.000

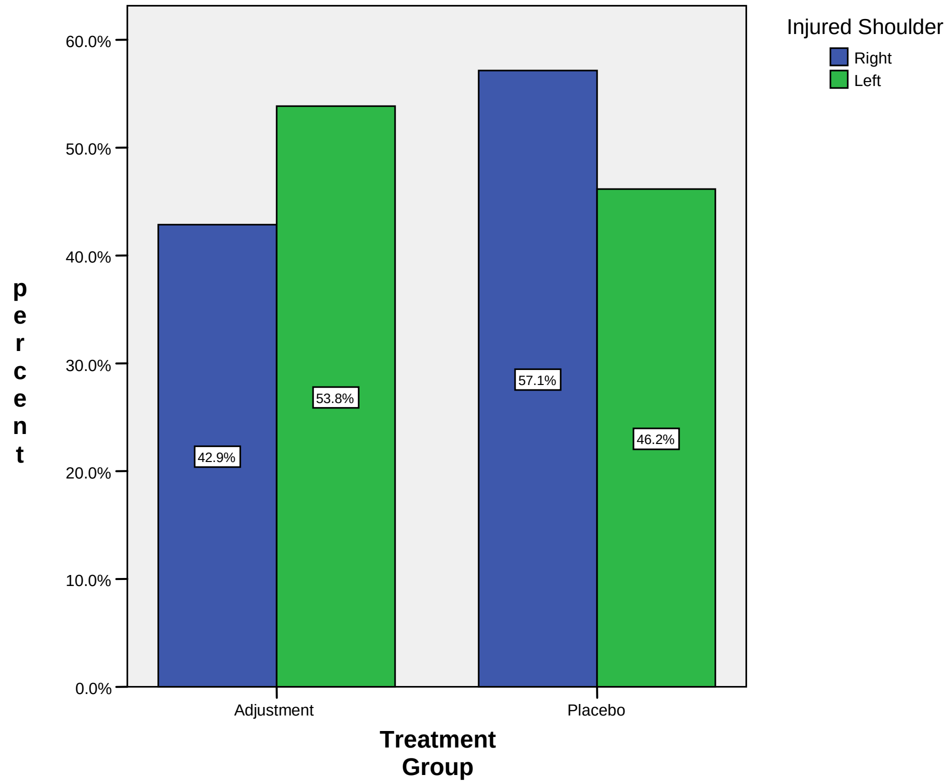


Figure 4.1: Injured shoulder by treatment group

It is noted from Table 4.3 and Table 4.4 that although there were more participants that presented with right hand dominance, a larger proportion of participants presented with left sided symptoms and were diagnosed AC joint dysfunction. This seems to be consistent with the work of Bilodeau et al. (2007) who indicated that dominance seems to be protective of increased likelihood of tremor presentation on the side of dominance and therefore also pathology related to tremors. The suggested reason for this was related to the strength connections within the specific structures of the central nervous system that is utilised to affect, co-ordinate and determine rate, manner and strength required in movement (Amunts et al., 1996; Triggs et al., 1999; Beuter et al., 2000; Bilodeau et al., 2007). Similarly this rationale based on functional anatomy and physiology could also be the reason for the particular presentation of the participants in this study. Only one study could be found that documented the handedness of the participants to that of their injury (Jeon et al., 2007). In this study, the researchers reported that handedness is not inversely proportional to the side of the injury, therefore it is suggested that further research should be completed to confirm the handedness-side of dysfunction relationship. However as both Jeon et al (2007) and this study had small participant samples, which may bias the outcomes.

4.2.5 Summary in terms of the demographics:

It is noted that there are few differences between the groups at the beginning of the study in terms of demographics factors. This is important, especially in terms of a study in which a small sample size is noted, as the homogeneity of the groups allows for a greater ability to compare clinical outcomes (Mouton, 2002). This increases the ability to draw conclusions more categorically than would have been possible if the groups did have significant differences between them.

4.3 Baseline Outcome Comparison

Table 4.5 shows that there was only a statistically significant difference in baseline outcomes between the groups in terms of NRS (p=0.026). The manipulation group had a higher NRS score than the placebo group. None of the other measures differed at baseline between the groups.

<u>Table 4.5: Comparison of mean baseline outcome measures between groups</u>

	Treatment Group				***p-value***
	Manipulation		***Placebo***		
	Mean	***SD***	***Mean***	***SD***	
Algometer baseline	4.3	1.2	4.3	1.5	0.910
NRS baseline	7.7	1.5	6.3	1.1	0.026
Flexion baseline	110.3	21.5	127.9	25.9	0.116
Extension baseline	30.4	14.5	42.7	20.8	0.143
Abduction baseline	132.6	34.1	132.4	19.4	0.987
Adduction baseline	37.5	16.2	47.9	13.2	0.133
Internal Rotation baseline	70.4	22.8	66.0	20.7	0.656
External Rotation baseline	92.7	20.8	89.0	14.5	0.649
SPADI pain score baseline	4.9	1.5	4.4	1.4	0.479
SPADI disability score baseline	2.3	1.1	1.6	0.8	0.139
SPADI total score baseline	3.6	1.1	3.0	0.8	0.220
SRQ pain baseline	2.1	0.4	2.0	0.6	0.425
SRQ daily activities baseline	1.0	0.6	1.0	0.4	0.876
SRQ athletic activities baseline	2.0	0.9	1.9	0.4	0.601
SRQ work baseline	0.7	0.7	0.6	0.9	0.789
SRQ satisfaction baseline	3.4	0.5	3.3	0.5	0.660
SRQ total baseline	1.5	0.5	1.4	0.4	0.594

The results from Table 4.5 indicates that for the most part there were slight differences between the groups at baseline measurements.

These baseline measurements are important to consider in terms of sample homogeneity between the groups, as a congruent set of baseline readings allows for a greater ability to compare clinical outcomes at the conclusion of the clinical trial (Mouton, 2002) and therefore increases the ability to conclude the results more categorically than would have been possible if the groups did have significant differences between them from the outset.

It is therefore important in this study to acknowledge the effect that the presence of a higher pain reading (i.e. NRS) may have had on the overall outcome of the study. This will therefore be discussed as pertinent to the discussion of the clinical outcomes that are presented in this section.

Interestingly, there is no difference between the Algometer readings for the two groups as one would expect, with a higher NRS (reported pain) reading in the manipulation group. The manipulation group should have had lower (or at least significantly lower) Algometer reading when compared to the placebo group. This is however not evident from the statistical data presented and it therefore seems that the origin of the perceived pain as reported on the NRS is not related to the anterior part of the AC joint (by default also the AC dysfunction) where the Algometer was placed for the Algometer readings.

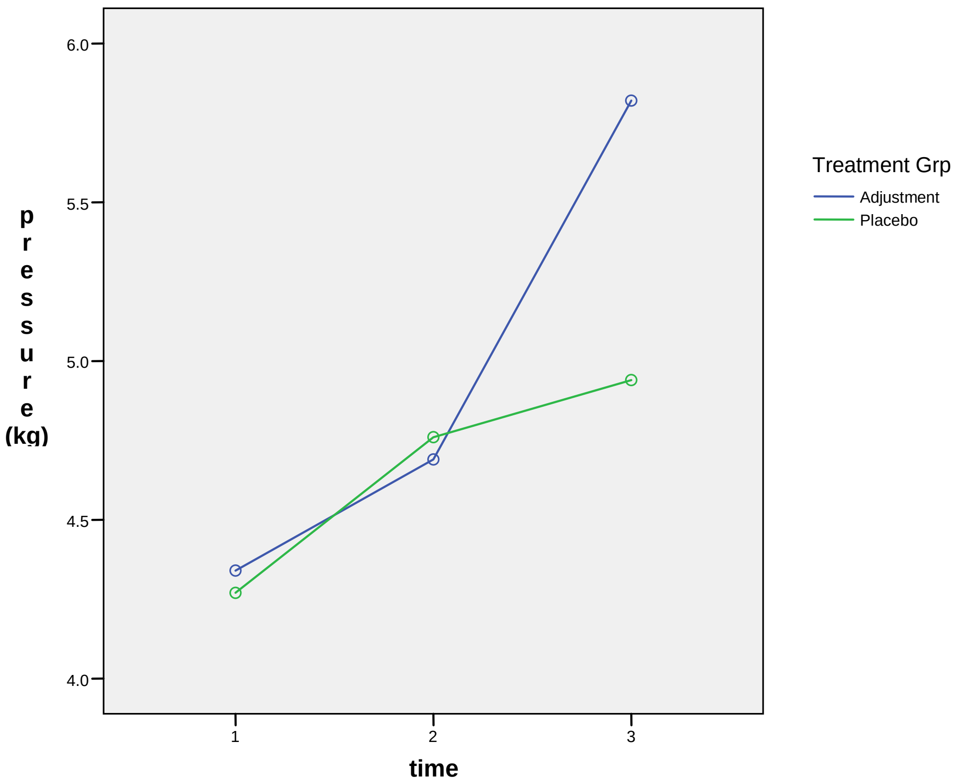
4.4 Analysis of the treatment effect

4.4.1 Algometer

Table 4.6 shows that there was a statistically significant time effect (p=0.014), meaning that both groups showed a significant increase in pressure capacity (decreased pain experienced) over time (2 week period). However, there is no significant treatment effect (time*group p = 0.273), which indicates that the rate of change over time was no different between the groups. This is certainly true for the period between time 1 and 2 (see Key below), but Figure 4.2 shows that there is a suggestion that after time 2, the adjustment group showed a steep increase in Algometer measurement while the placebo group continues to increase at a steady rate. This suggests a non-significant trend towards a treatment effect in the later follow up period. More long-term data would be necessary to confirm this trend statistically.

Table 4.6: Within and between – subjects effects for Algometer

Effect	***Statistic***	***p-value***
Time	Wilk’s lambda=0.607	0.014
Time*group	Wilk’s lambda=0.858	0.273
Group	f = 0.386	0.542



Key:	
Time	***Value***
1	Initial
2	1 Week
3	2 Weeks

Figure 4.2: Profile plot of mean Algometer by treatment group and time

It would seem from the results achieved above, that the manipulation group improved more over the initial 2-week period as compared to the placebo group. This was more evident after the second time point for clinical assessment. This trend should be followed in future research, with follow up readings at 3 weeks, 4 weeks and potentially a month follow up to establish whether this trend continues or plateaus.

Possible factors that could have increased the gradient of the manipulation group over that of the placebo group include:

1. The increased range of motion as imparted by manipulation (Bergmann et al., 1993; Haldeman, 2005), which resulted in increased stimulation on an ongoing basis of Wyke receptors I, II and III with daily activity (Leach,

2004). This stimulation causes the activation of the gating control of pain (Gate Control theory) (Melzack and Wall, 1965), therefore facilitating a positive feedback cycle, which includes increased movement → decreased pain → further increases in movement → and further decreases in pain.

2. Increased range of movement within the joint is also thought to decrease abnormal formation of scar tissue which would facilitate an increase in the activation of the Wyke receptors type I, II and III (Leach, 2004) and a decrease in the activation of Wyke receptors type I (Leach, 2004).
3. In addition to the above, the presence of subclinical (asymptomatic) and clinical (symptomatic) inflammatory processes also need to be considered (Erol et al., 2008). In this study the participants were required to have an acute exacerbation of a non-traumatic injury of the AC joint. This implies that the participants were most likely to have had the AC joint dysfunction that they presented with as a result of repetitive strain injuries and thus the likelihood of subclinical (asymptomatic) and clinical (symptomatic) inflammatory processes being present are good. In this instance, the presence of oedema in the synovial AC joint can lead to two things (Gatterman and Goe, 1990; Leach, 2004):
    a. Increased fluid in the joint results in painful distension of the capsule.
    b. Increased inflammatory markers (e.g. bradykinin, interleukins) increase the likelihood of pain perception as a result facilitated nerve endings.

   The application manipulation would result in a decrease in inflammation (Coetzer, 1999) resulting in an alleviation of the pain due to the decreased fluid present in the joint (Gatterman and Goe, 1990; Leach, 2004).

The only factor that would need to be addressed with the explanations for increased Algometer readings (Figure 4.2) would be why the manipulation group only evidences change after the second set of clinical readings. This may well be as a result of the fact that the first treatment, broke down a large number of adhesions that resulted in a reflex inflammatory cycle (Vernon and Mrozek, 2005), with subsequent manipulative procedures breaking down fewer adhesions adding to the increased movement that would not have allowed the adhesions to form haphazardly, but rather along stress lines (Wolf's law) (Bergmann et al., 1993).

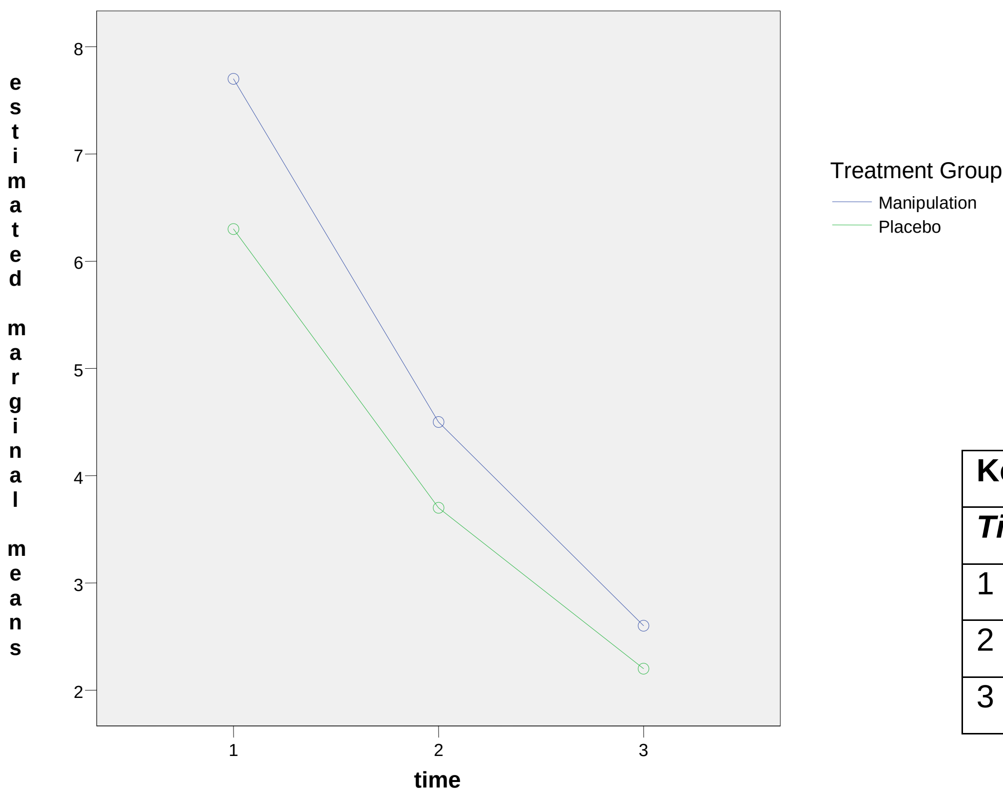
Notwithstanding the above explanations, the researcher would be presumptuous in not also considering that the increase in Algometer readings, that occurred in both groups, may be accounted for by natural history, which involves the natural resolution of an injury over time (Lachmann and Jenner, 1994).

4.4.2 Numerical Pain Rating Scale (NRS) – Bench Press

NRS showed a highly significant decrease over the seven-week time period in both groups (p<0.001) but no differential treatment effect (p=0.687). Thus there was a very strong placebo effect for this outcome, which equalled the manipulation effect. Figure 4.3 shows almost parallel profiles over time of the two groups. Therefore there is no evidence to suggest that the chiropractic manipulation has an effect on this outcome.

Table 4.7: Within and between – subjects effects for NRS

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.204	<0.001
Time*group	Wilk's lambda=0.957	0.687
Group	f = 2.007	0.174



Key:	
Time	***Value***
1	Initial
2	1 Week
3	2 Weeks

Figure 4.3: Profile plot of mean NRS by treatment group and time

Interestingly and as noted prior to this point, the NRS readings do not correlate with the Algometer readings, thus re-emphasising the likelihood that the pain rated by the participants is not of AC joint origin whilst the participants complete their bench press. One possible reason could be that the participants reported the pain related to a concomitant impingement (e.g. bicipital or supraspinatus) as opposed to AC joint dysfunction. This is possible as the literature cites a high likelihood of concomitant pathology of the shoulder in the presence of an AC joint dysfunction (Liebenson, 2005a; Lin et al., 2006; Erol et al., 2008).

Significantly and as noted in Table 4.7 and Figure 4.3, there seems to be a large Hawthorne effect/ observer effect (Draper, 2005) on the participants in the placebo group. This may be another factor that could be responsible for masking the pain changes between the groups more accurately.

4.4.3 Inclinometer

According to Magee (2006), the average ranges of motion are as follows:

Flexion	160° - 180°
Extension	50° - 60°
Abduction	170° - 180°
Adduction	50° - 75°
Internal Rotation	60° - 100°
External Rotation	80° - 90°

The reason for the choice of global shoulder range of motion, is that:

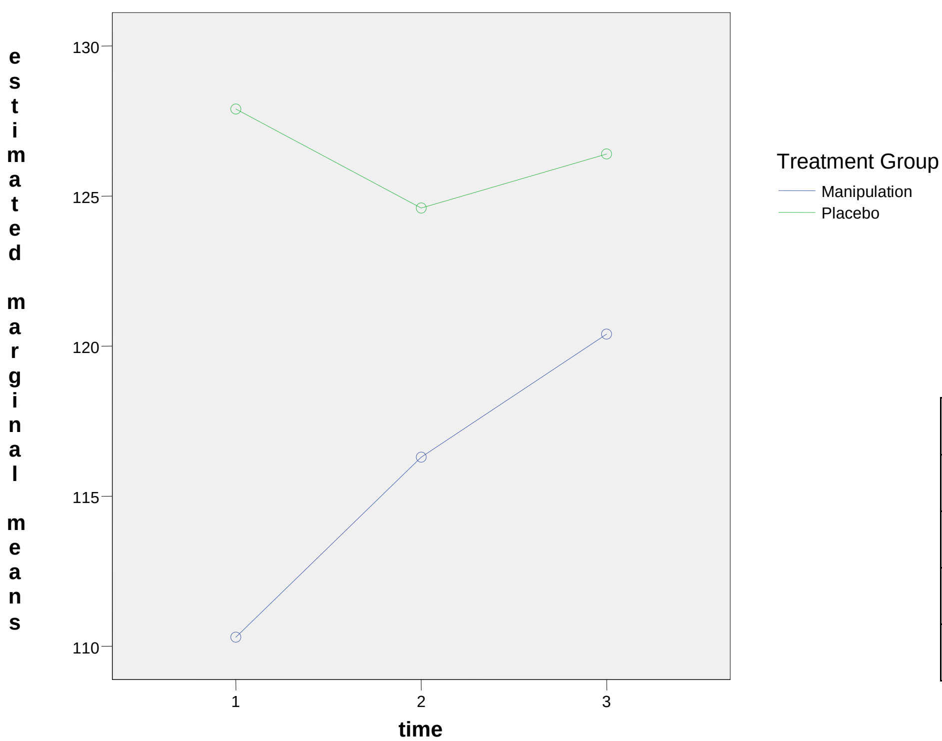
1. It has been noted that restricted AC joint motion as in AC joint dysfunction is responsible in part for a decrease in global shoulder range of motion (Buchberger, 1999; Standing, 2005; Hengeveld and Banks, 2005; Moore and Dalley, 2006).
2. It is impractical in a clinical context to measure the small and sometimes imperceptible changes in range of movement that are possible around the AC joint.

4.4.3.1 Flexion

There was no significant time effect or treatment effect for this outcome (Table 4.8). Figure 4.4 shows that while the manipulation group showed an increase over the initial 2-week time period, the mean values in the placebo group remained relatively stable over time. This seems to suggest a non-significant trend towards a differential treatment effect in favour of the manipulation group. However, a larger study would be necessary to confirm this trend as the results could have happened by chance.

Table 4.8: Within and between – subjects effects for flexion

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.948	0.637
Time*group	Wilk's lambda=0.924	0.512
Group	f = 2.318	0.145



Key:	
Time	***Value***
1	Initial
2	1 Week
3	2 Weeks

Figure 4.4: Profile plot of mean Flexion by treatment group and time

It is of interest to note in Figure 4.4, that there is a rather large although insignificant (Table 4.8) difference between the two groups.

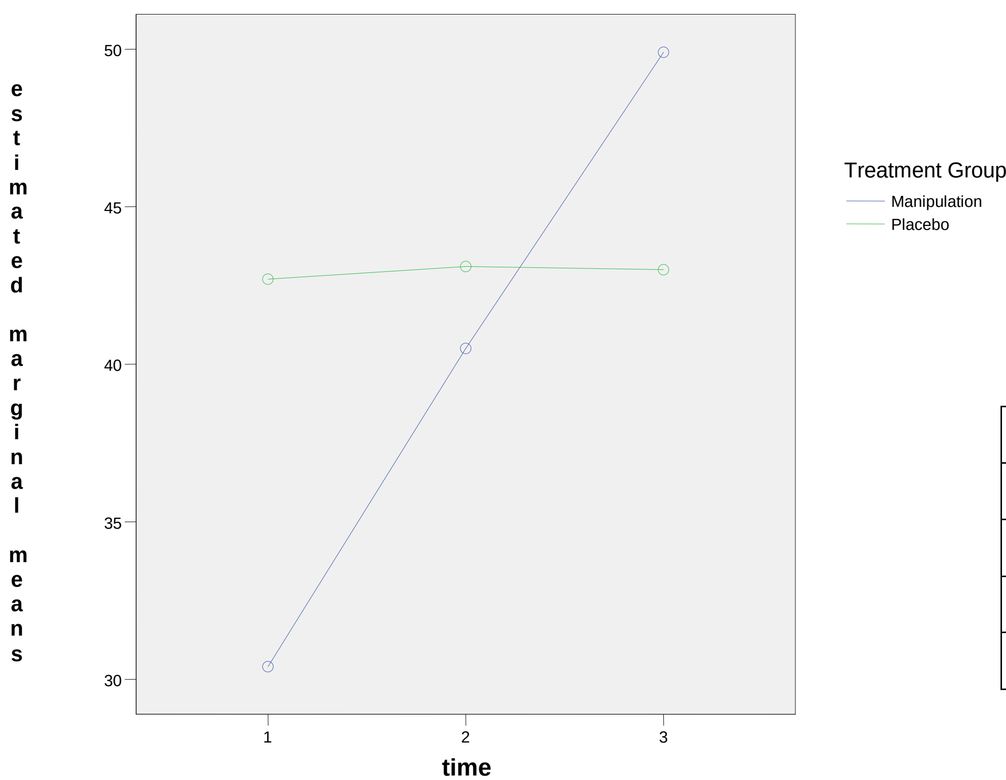
The course of the trajectory for the manipulation group supports the outcomes for the Algometer as discussed in section 4.4.1, where manipulation is seen as having been able to affect the AC joint dysfunction positively through increased range of motion (Bergmann et al., 1993; Haldeman, 2005), decreased oedema in the joint (Gatterman and Goe, 1990; Coetzer, 1999; Leach, 2004) and a reduction in adhesions (Vernon and Mrozek, 2005).

4.4.3.2 Extension

There was a borderline non-significant time effect (p=0.056) and a borderline non-significant intervention effect (p=0.059) for extension. Figure 4.5 shows that the manipulation group showed a marked increase in extension over the initial 2-week time period while the placebo group did not change over time. This suggests a beneficial effect of the manipulation, but there is not quite enough evidence statistically to reject the null hypothesis. Further studies are necessary with larger sample sizes to confirm this trend.

Table 4.9: Within and between – subjects effects for extension

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.713	0.056
Time*group	Wilk's lambda=0.717	0.059
Group	f = 0.300	0.591



Key:	
Time	***Value***
1	Initial
2	1 Week
3	2 Weeks

Figure 4.5: Profile plot of mean Extension by treatment group and time

This result again supports sections 4.4.1 and 4.4.3.1.

The results suggest that the difference manifests in a cross over pattern and to a significant extent, possible reasons for this could include the following:

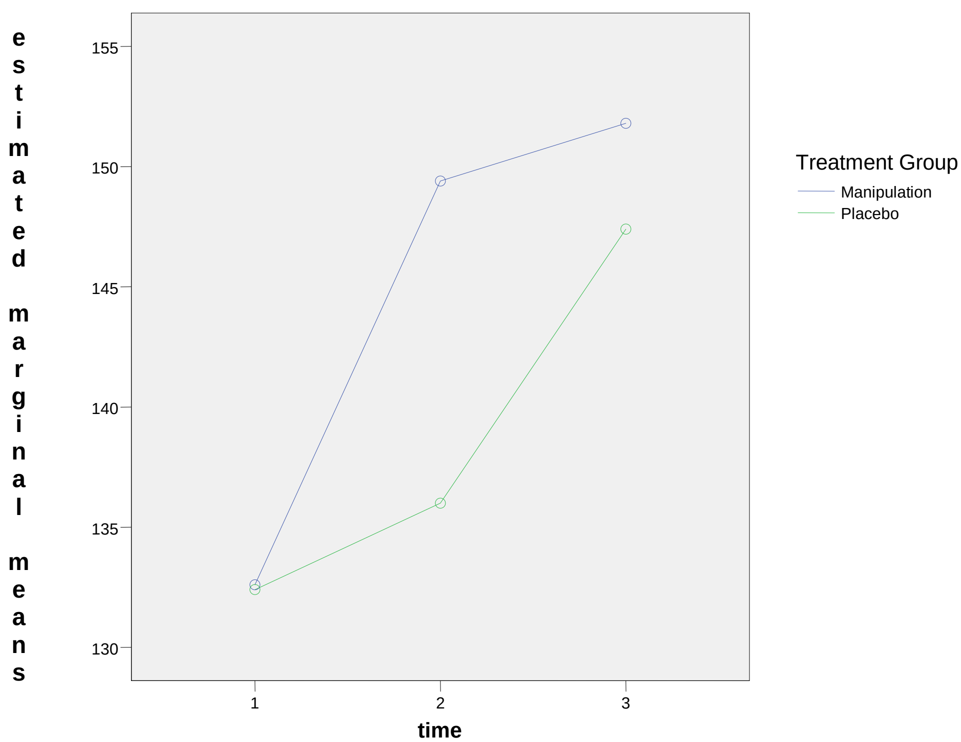
1. When a participant forward flexes the arm, in an attempt to move around the x-axis of the shoulder joint, several accommodating factors are taken into account. One of these is the external rotation of the humeral head, with increased forward flexion in order to allow a decrease in the opposition of the humeral tubercle with the acromial arch (Buchberger, 1999) as well as the likelihood for tendon impingement under the acromial arch (Buchberger, 1999). This mechanism therefore decreases the need for clavicular rotation in order to obtain maximal forward flexion of the shoulder joint.
2. Further to the explanation above, it stands to reason that the degree to which the AC joint has a negative effect on forward flexion (when dysfunctional) is limited to end range of motion in forward flexion. Thus it is possible that to obtain significance in the change of findings is more difficult in forward flexion, than in extension - where the humerus plays a lesser role in enabling or disabling the movement (Buchberger, 1999).

4.4.3.3 Abduction

Abduction increased statistically significantly over the initial 2-week time period in both groups (p=0.024) but there was no differential treatment effect (p=0.432) thus both groups improved at the same rate.

Table 4.10: Within and between – subjects effects for Abduction

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.645	0.024
Time*group	Wilk's lambda=0.906	0.432
Group	f = 0.431	0.520



Key:	
Time	***Value***
1	Initial
2	1 Week
3	2 Weeks

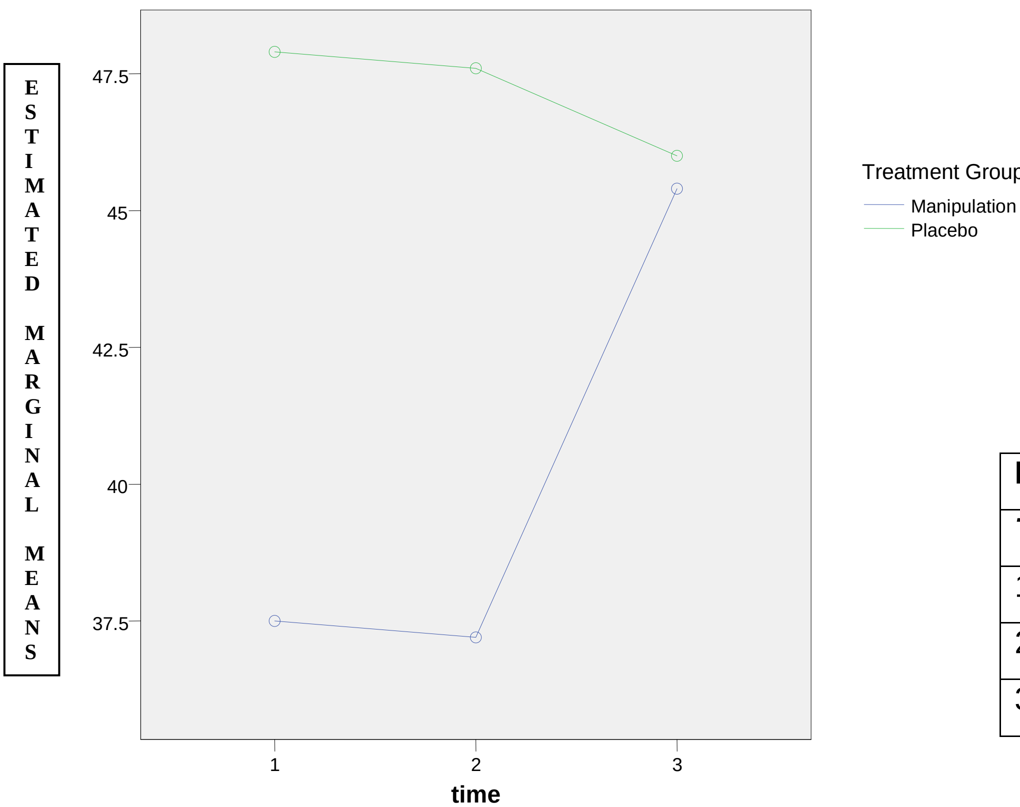
Figure 4.6: Profile plot of mean Abduction by treatment group and time

4.4.3.4 Adduction

Overall there was no significant change over the initial 2-week time period (p=0.302) but there was a borderline non-significant trend towards a treatment effect (p=0.077), which is indicated in Figure 4.7. The manipulation group showed a steep increase in adduction after time 2 whilst the placebo group did not show much change over the same time period. In fact they showed a slight decrease.

Table 4.11: Within and between – subjects effects for adduction

Effect	***Statistic***	***p-value***
Time	Wilk’s lambda=0.869	0.302
Time*group	Wilk’s lambda=0.739	0.077
Group	f = 1.262	0.276



Key:	
Time	***Value***
1	Initial
2	1 Week
3	2 Weeks

Figure 4.7: Profile plot of mean Adduction by treatment group and time

It should be noted that the abduction and adduction parameters were measured from the anatomical position, where the arm is alongside the body with the palm of the hand facing anteriorly (Moore and Dalley, 2006). From this position abduction would have constituted movement away from the body around the z-axis and adduction would have constituted movement towards the body (or just anterior to/ across the body) also around the z-axis (Moore and Dalley, 2006).

With these movements, the abduction movement would have required compression and tilt of the AC joint (Buchberger, 1999) to achieve a large amount of movement, whereas adduction would have required distraction and tilt of the AC joint (Buchberger, 1999), but to achieve a lesser degree of movement when compared to abduction. This correlates well with the literature where it is indicated that the abductory movement has a greater aggravating capability than the adduction movement (at least with movement around the z-axis) (Lin et al., 2005; Jeon et al., 2007).

From the results noted in Table 4.10 and Table 4.11, and Figure 4.6 and Figure 4.7, it is evident that the degree of change in the movement parameters is higher in the adduction movement as opposed to the abduction movement. This seems a contradiction in terms, as it would be expected that parameter with the greater possibility for change should have improved more over time.

The results are however in keeping with the discussion in section 4.4.1, where we noted that the manipulation was responsible for increasing movement (Bergmann et al., 1993; Haldeman, 2005), which is required for allowing distraction in abduction and would not affect the approximation or compression required in adduction. Furthermore the removal of adhesions (Bergmann et al., 1993; Vernon and Mrozek, 2005) would facilitate an adduction improvement and not an abduction improvement, although oedema would allow for a greater improvement in abduction (i.e. there would be less fluid to compress during compression of the AC joint) than in adduction.

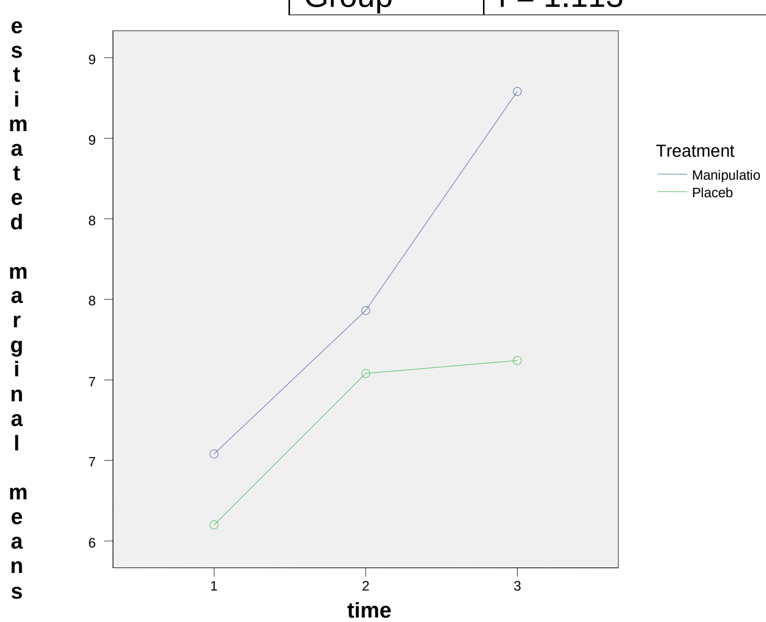
Therefore, in conclusion it would seem that the level of swelling (oedema) is limited within the small dysfunctional AC joint when the presence of joint locking and adhesion restriction is greater. Therefore in terms of clinical presentation it seems that manipulation is required as part of the management of AC joint dysfunction to restore the movement rather than to address oedema or secondary clinical effects.

4.4.3.5 Internal Rotation

It should be noted that the measures for internal and external rotation of the glenohumeral joint, was taken with the shoulder in 90º abducted position (i.e. around the z-axis), with the elbow flexed to 90º, with the palm of the hand facing anteriorly. Movement was then affected around the x-axis in internal and external rotation. Overall the effect of time was statistically significant (p=0.003), which means that both groups showed a significant increase over time. There was a non-significant intervention effect (p=0.135). However, Figure 4.8 shows that there was a trend towards the manipulation group showing a beneficial treatment effect over the placebo group after time 2, when the mean values increased steeply in the manipulation group and levelled off in the placebo group. However, more data is necessary to confirm this trend statistically as it could have happened by chance.

Table 4.12: Within and between – subjects effects for Internal Rotation

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.512	0.003
Time*group	Wilk's lambda=0.790	0.135
Group	f = 1.113	0.305



Key:	
Time	***Value***
1	Initial
2	1 Week
3	2 Weeks

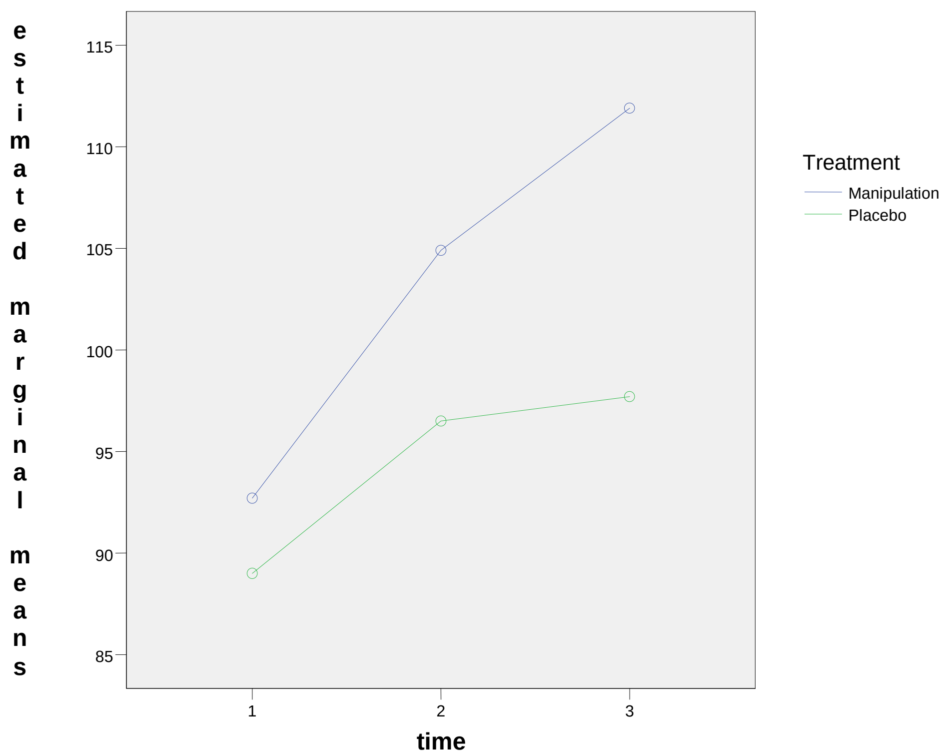
Figure 4.8: Profile plot of mean Internal Rotation by treatment group and time

4.4.3.6 External Rotation

Similarly for this outcome there was a significant increase in both groups (p=0.002) but no statistical evidence of a treatment effect (p=0.305), although the profile plot (Figure 4.9) showed suggestion of a beneficial treatment effect of the manipulation.

Table 4.13: Within and between – subjects effects for External Rotation

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.468	0.002
Time*group	Wilk's lambda=0.870	0.305
Group	f = 1.490	0.238



Key:	
Time	***Value***
1	Initial
2	1 Week
3	2 Weeks

Figure 4.9: Profile plot of mean External Rotation by treatment group and time

In both instances (i.e. internal and external rotation), there was an increase in the range of motion noted for the manipulation group, whereas the placebo group showed some gains which then gave rise to plateaud results.

These results fall in line with the discussions that have been presented in flexion and extension as well as abduction and adduction; where the movement required at the AC joint in terms of shoulder rotation is principally AC joint rotation (rotary shear) (Hengeveld and Banks, 2005; Moore and Dalley, 2006). Manipulation would affect the changes in the joint to allow for increased movement (Bergmann et al., 1993; Leach, 2004; Haldeman, 2005) over the placebo treatment.

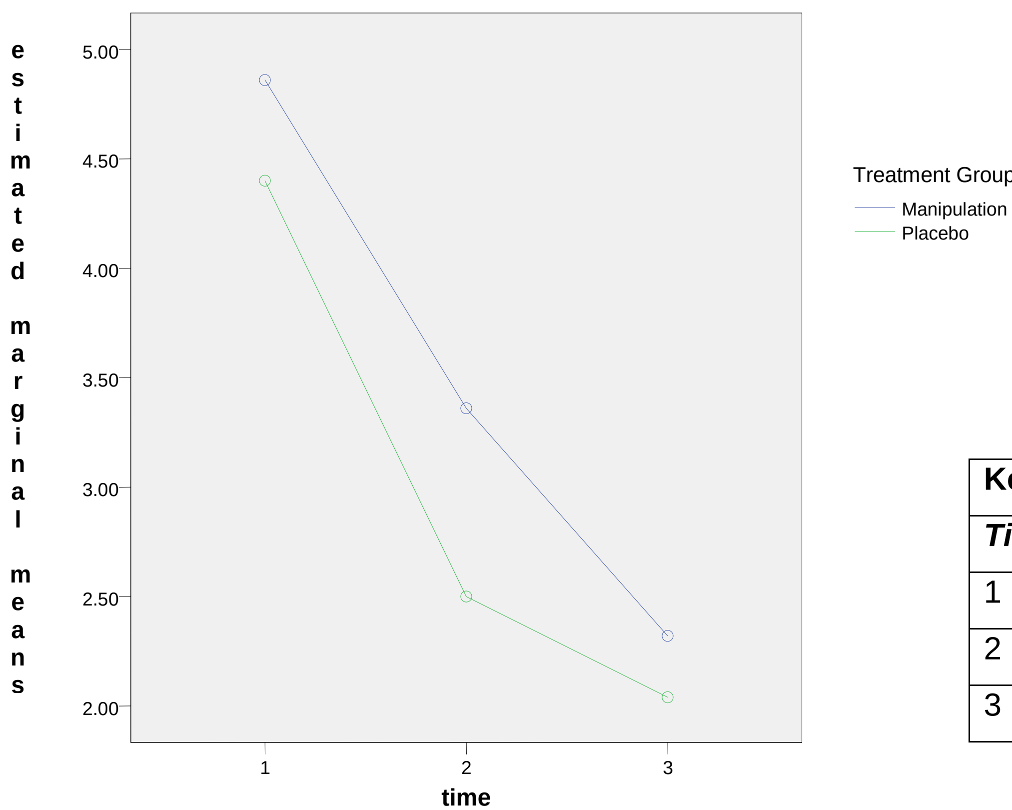
4.4.4 Shoulder Pain and Disability Index (SPADI)

4.4.4.1 SPADI pain score

Overall there was a highly significant decrease in pain score over the seven-week time period in both groups ($p<0.001$). There was no evidence of a differential treatment effect ($p=0.282$) and the profiles appear relatively parallel in Figure 4.10. Therefore for this outcome placebo was as effective as manipulation.

Table 4.14: Within and between – subjects effects for SPADI pain score

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.268	<0.001
Time*group	Wilk's lambda=0.862	0.282
Group	f = 0.769	0.392



Key:	
Time	***Value***
1	Initial
2	2 Weeks
3	6 Weeks

Figure 4.10: Profile plot of mean SPADI pain score by treatment group and time

The SPADI pain score, reflects the same pattern and trend as recorded by the NRS (discussed in section 4.4.2) and thereby increased the reliability of the results obtained as the participants were not aware of the correlation that should exist between the SPADI pain score (accumulative subtotal) and the NRS.

However, of concern is the fact that the SPADI seems to reinforce the issues of:

1. The Hawthorne Effect (Draper, 2005), where it seems that the placebo group has an outcome nearly equivalent to that of the manipulation group.
2. That participants are reporting pain from a different origin – i.e. not the AC joint, as the SPADI and NRS do not correlate with the Algometer changes (as taken over the AC joint).

The implications that arise out of the above are:

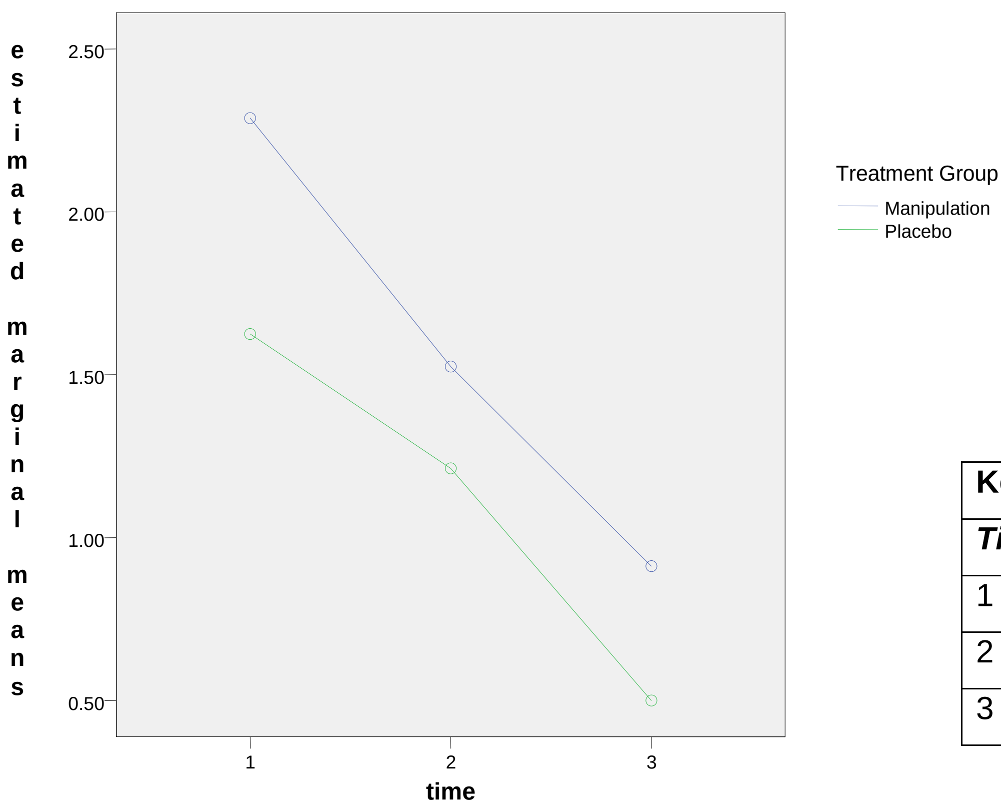
1. In clinical trials and/ or general clinical assessments of participants researchers/ practitioners should be wary to utilise pain scores (NRS, SPADI or any other such tool) when assessing AC joint dysfunction in participants, as the reported pain does not necessarily reflect the AC joint pathology.
2. Future research should consider diagnosing and documenting concomitant pathologies that may be present in the shoulder girdle complex. This may be a complex undertaking as the inclusion / exclusion criteria for the future studies would need to be considered carefully so as not to exclude these concomitant pathologies; however in order to be able to generate reliable results if there are multiple concomitant pathologies, the studies would require large sample sizes to actuate the ability to generate reliable statistical data.

4.4.4.2 SPADI disability score

Overall there was a highly significant decrease in disability score over the seven-week time period in both groups ($p<0.001$). There was no evidence of a differential treatment effect ($p=0.773$) and the profiles appear relatively parallel in Figure 4.11. Therefore, for this outcome, the placebo treatment was as effective as manipulation.

Table 4.15: Within and between – subjects effects for SPADI disability score

Effect	***Statistic***	***p-value***
Time	Wilk’s lambda=0.407	<0.001
Time*group	Wilk’s lambda=0.970	0.773
Group	f = 1.70	0.209



Key:	
Time	***Value***
1	Initial
2	2 Weeks
3	6 Weeks

Figure 4.11: Profile plot of mean SPADI disability score by treatment group and time

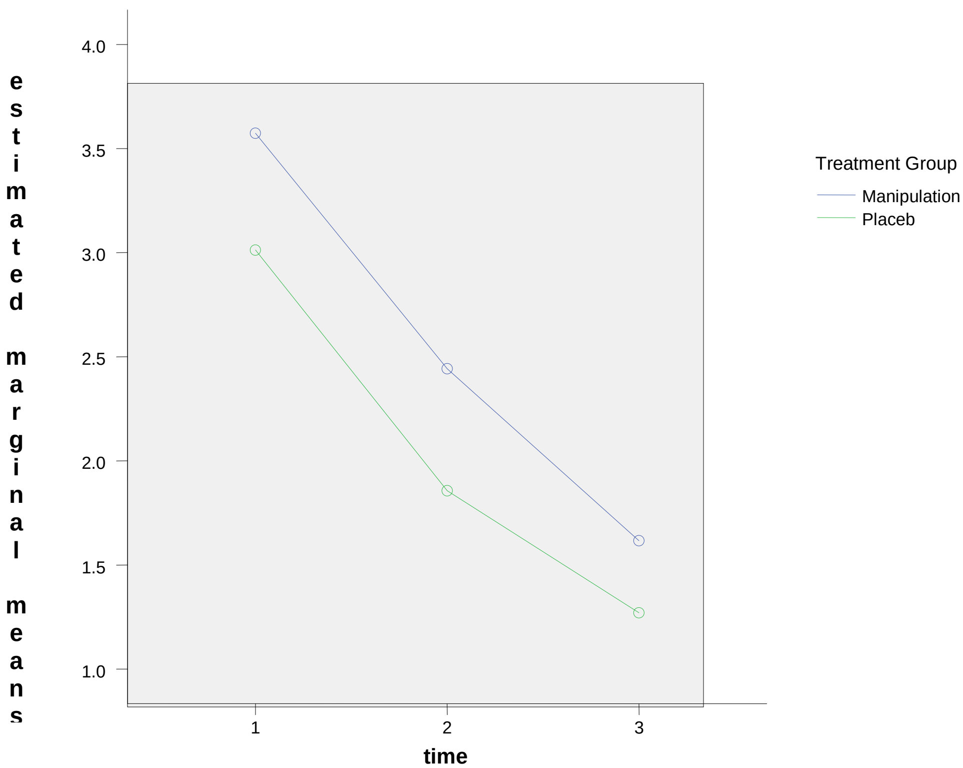
The discussion under section 4.4.4.1 holds true for the SPADI disability score outcomes.

4.4.4.3 Total SPADI score

Overall there was a highly significant decrease in total SPADI score over the seven-week time period in both groups (p<0.001). There was no evidence of a differential treatment effect (p=0.836) and the profiles appear relatively parallel in Figure 4.12. Similarly to the SPADI disability score the placebo treatment was as effective as manipulation.

<u>Table 4.16: Within and between – subjects effects for total SPADI score</u>

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.240	<0.001
Time*group	Wilk's lambda=0.979	0.836
Group	f = 1.215	0.280



Key:	
Time	***Value***
1	Initial
2	2 Weeks
3	6 Weeks

<u>Figure 4.12: Profile plot of mean total SPADI score by treatment group and time</u>

The discussion under section 4.4.4.1 holds true for the SPADI disability score outcomes.

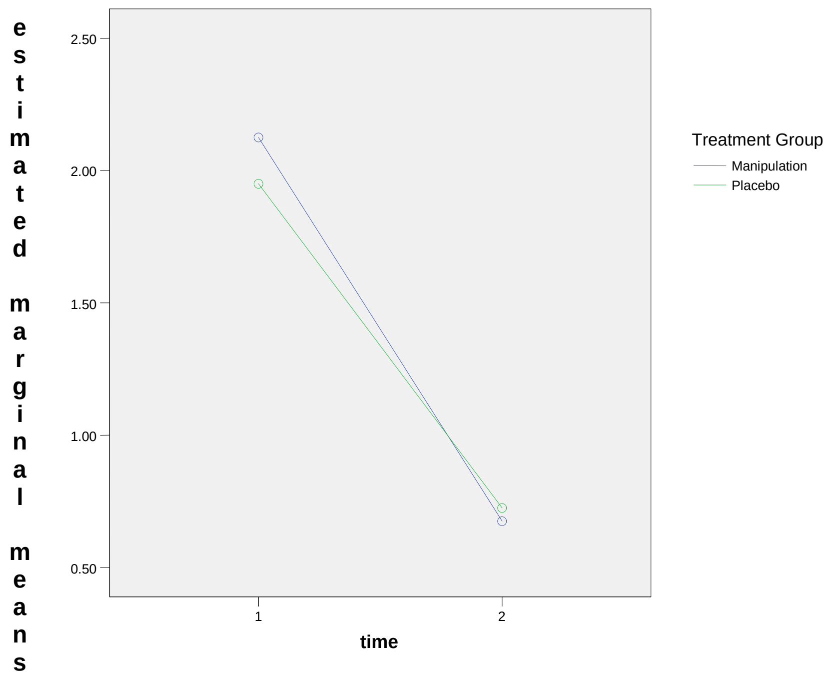
4.4.5 Shoulder Rating Questionnaire (SRQ)

4.4.5.1 SRQ pain score

The pain decreased significantly in both groups over the seven-week time period ($p<0.001$), but the rate of decrease was the same in both treatment groups as there was a non significant time*group interaction effect ($p=0.458$). Figure 4.13 confirms that the slopes were almost parallel and there is no evidence to suggest that there was a beneficial effect of the manipulation over the placebo for this outcome.

Table 4.17: Within and between – subjects effects for SRQ pain score

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.181	<0.001
Time*group	Wilk's lambda=0.969	0.458
Group	f = 0.102	0.753



Key:	
Time	***Value***
1	Initial
2	6 Weeks

Figure 4.13: Profile plot of mean SRQ pain score by treatment group and time

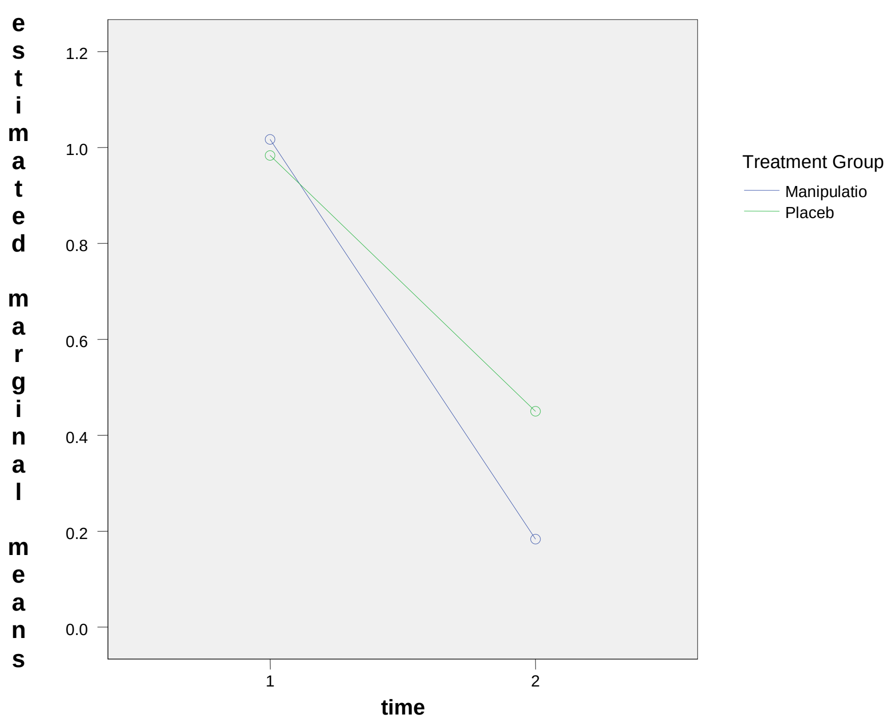
The discussion under section 4.4.4.1 holds true for the SPADI disability score outcomes.

4.4.5.2 SRQ daily activities score

The daily activities score decreased significantly in both groups over the seven-week time period (p<0.001), but the rate of decrease was the same in both treatment groups as there was a non significant time*group interaction effect (p=0.204). Figure 4.14 suggests that the slope was steeper in the manipulation group than the placebo group, so there may be a slightly beneficial manipulation effect for this outcome but at this stage there is not enough evidence to confirm a beneficial effect of the manipulation over the placebo.

Table 4.18: Within and between – subjects effects for SRQ daily activities score

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.333	<0.001
Time*group	Wilk's lambda=0.912	0.204
Group	f = 0.635	0.436



Key:	
Time	***Value***
1	Initial
2	6 Weeks

Figure 4.14: Profile plot of mean SRQ daily activities score by treatment group and time

With respect to the outcomes of the SRQ daily activities score, it can be seen that movement required by daily activity improves to a larger extent in the manipulation group. This seems to affirm the earlier findings (refer to sections on the Inclinometer readings and Algometer readings section 4.4.3 and 4.4.1) that indicate that the AC joint dysfunction seems to have a restrictive effect on the shoulder girdle complex when dysfunctional and with the improved movement as a result of manipulation (Gatterman and Goe, 1990; Bergman et al, 1993; Haldeman, 2005), there is a concomitant improvement in the movement about the shoulder girdle.

It therefore seems that pathologies that are present as a result of the restricted AC joint movement (e.g. impingement syndromes, subacromial bursitis, tendonitis (Boyles et al., 2008, Mulyadi et al., 2008), may improve simultaneously as the stressor of the dysfunctional AC joint is removed, thus leading to the concomitant decrease in reported pain – at least in the group receiving manipulation.

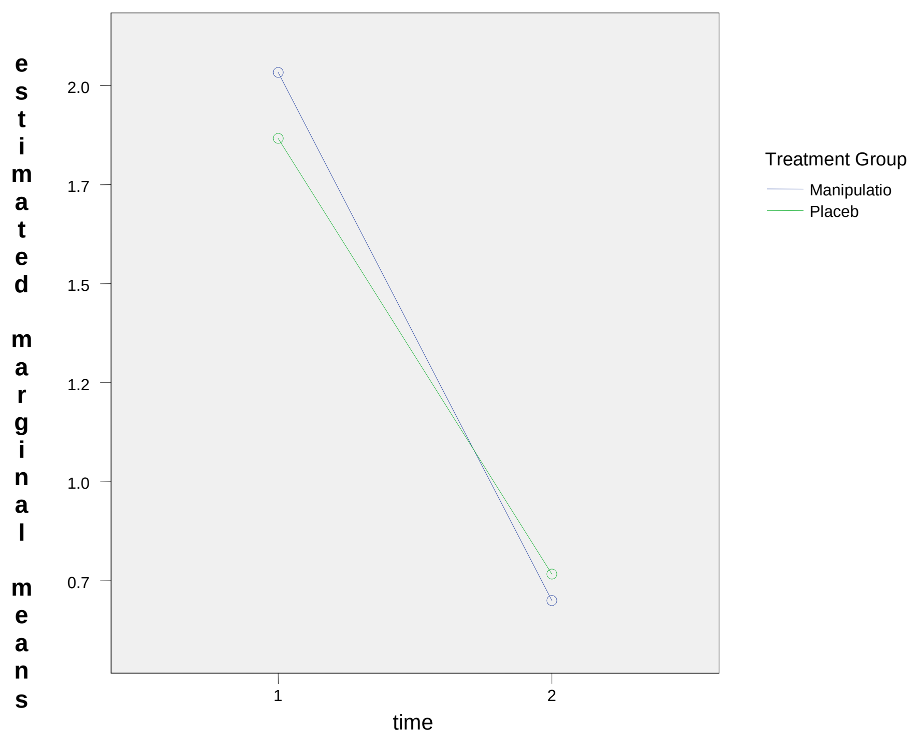
The outcome that still requires further research and that cannot be categorically dealt with in this research is the trend that the placebo group also improves in terms of pain even without the intervention. One factor that should be considered in future research, to quantify this phenomenon, is that of activity levels during the course of the research. As it has not been recorded in this research, it is not possible to determine whether the placebo group maintained activity during the course of the study (i.e. a lack of activity during the study may have been the cause of the decreased pain in the placebo group – especially if current recommendations for conservative care are followed, where rest/ immobilisation are highly recommended (Mouhsine et al., 2003)). Furthermore, it is also not known whether the manipulation group increased activity during the course of the study. The improved reported levels of daily activity and the increase in range of motion (Inclinometer) (refer to sections on the improved activity and Inclinometer readings section 4.4.4.2 and 4.4.3) would seem to suggest that this may have been possible, even though it was not recorded. Therefore, this study can recommend this area as a possible research point for a future study.

4.4.5.3 SRQ athletic activities score

The score decreased significantly in both groups over the seven-week time period (p<0.001), but the rate of decrease was the same in both treatment groups as there was a non significant time*group interaction effect (p=0.462). Figure 4.15 confirms that the slopes were almost parallel and there is no evidence to suggest that there was a beneficial effect of the manipulation over the placebo for this outcome.

Table 4.19: Within and between – subjects effects for SRQ athletic activities score

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.227	<0.001
Time*group	Wilk's lambda=0.970	0.462
Group	f = 0.036	0.851



Key:	
Time	***Value***
1	Initial
2	6 Weeks

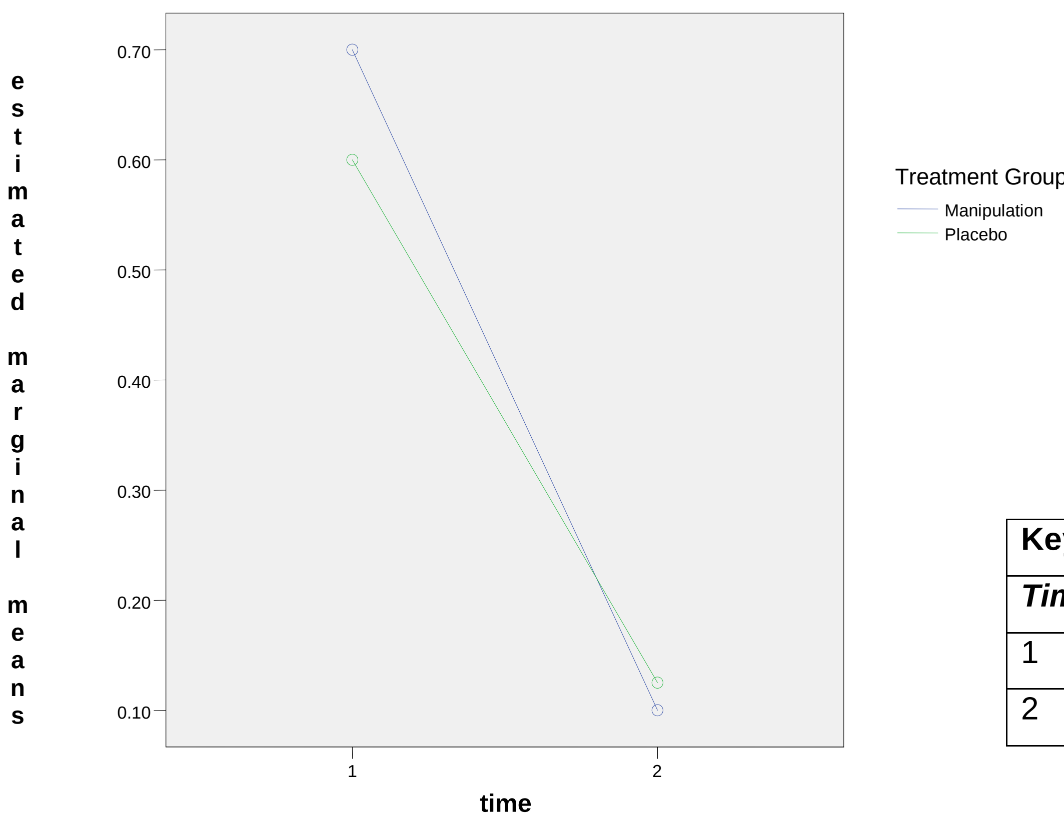
Figure 4.15: Profile plot of mean SRQ athletic activities score by treatment group and time

4.4.5.4 SRQ work score

The work score decreased significantly in both groups over the seven-week time period (p=0.004), but the rate of decrease was the same in both treatment groups as there was a non significant time*group interaction effect (p=0.708). Figure 4.16 confirms that the slopes were almost parallel and there is no evidence to suggest that there was a beneficial effect of the manipulation over the placebo for this outcome.

Table 4.20: Within and between – subjects effects for SRQ work score

Effect	***Statistic***	***p-value***
Time	Wilk’s lambda=0.627	0.004
Time*group	Wilk’s lambda=0.992	0.708
Group	f = 0.028	0.868



Key:	
Time	***Value***
1	Initial
2	6 Weeks

Figure 4.16: Profile plot of mean SRQ work score by treatment group and time

Sections 4.4.5.3 and 4.4.5.4 do not seem to support the discussion as presented in section 4.4.5.2, which again confounds the proposed reasoning with respect to the improvement reported and recorded between the two groups under study.

However, having stated the above, the specificity and the sensitivity of the two outcomes measures utilised in this study needs to be considered. If it is assumed that the SPADI and the SRQ are both shoulder dysfunction and disability questionnaires (Yeomans, 2000) which have been shown to be responsive to change and accurate discriminants of clinical change (Yeomans, 2000), the question needs to be raised in terms of the specificity and sensitivity that these two questionnaires have in terms of AC joint dysfunction within the context of the shoulder girdle complex.

The principle reason for this question is that in terms of at least the objective findings, the participants have shown improvement as pertinent to the AC joint and the current literature (as discussed in the relevant sections 4.4.1 and 4.4.3) seems to support these outcomes; it is only when the subjective outcomes in this study is considered, that the disjuncture in the congruency of the literature becomes apparent.

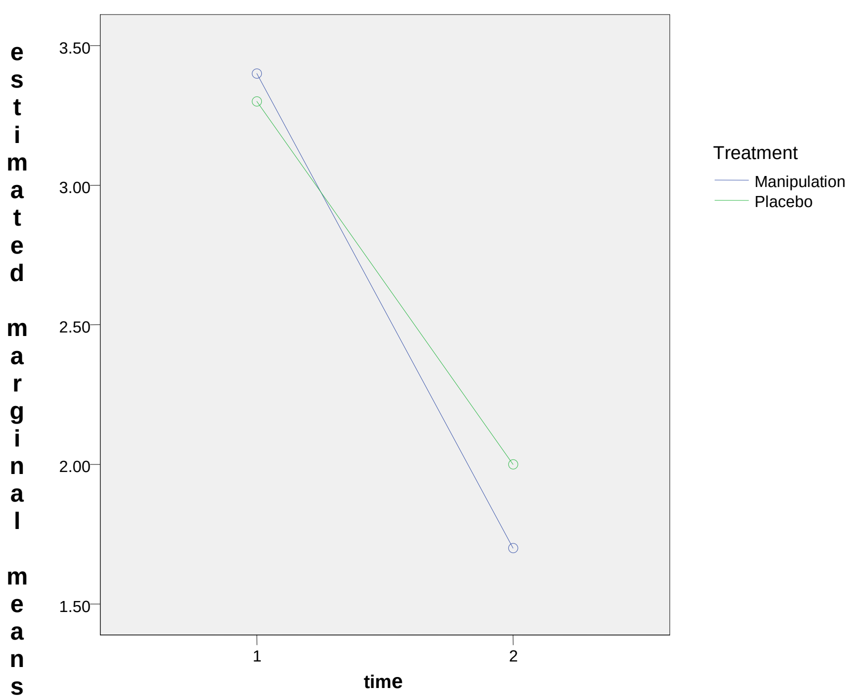
It is therefore suggested that the questionnaire is researched more fully to establish whether participants respond differently according to their pathologies within the shoulder girdle over a period of natural history and/ or intervention (whether in a clinical trial and / or clinical intervention in a practice setting). Correlation with these findings and those of participant activity measures (as discussed in the relevant sections 4.4.4.2, 4.4.5.3 and 4.4.5.4) would provide useful information in this regard.

4.4.5.5 SRQ satisfaction score

The satisfaction score decreased (indicating highly significant levels of satisfaction) in both groups over the seven-week time period ($p<0.001$), but the rate of decrease was the same in both treatment groups as there was a non-significant time*group interaction effect ($p=0.431$). Figure 4.17 confirms that the slopes were almost parallel, but there was a slightly steeper slope in the manipulation group than in the placebo group, although there is no evidence to conclude that there was a beneficial effect of the manipulation over the placebo for this outcome.

Table 4.21: Within and between – subjects effects for SRQ satisfaction score

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.330	<0.001
Time*group	Wilk's lambda=0.965	0.431
Group	f = 0.240	0.630



Key:	
Time	***Value***
1	Initial
2	6 Weeks

Figure 4.17: Profile plot of mean SRQ satisfaction score by treatment group and time

The results obtained with respect to the participant satisfaction are difficult to analyse for a number of reasons, the most important relating to the fact that there is no further tool that has been utilised to evaluate satisfaction and therefore triangulation of the data is not possible. Therefore, future research should incorporate additional questionnaires, which cover aspects of environment, participant and service (Hayes, 1994; Robbins, 1996; Bergh et al., 1999) so that more accurate data can be gleaned in terms of these three aspects of care. This would also assist in determining whether the satisfaction improvement or lack thereof is actually related to the clinical encounter, the environment, the treatment (clinical intervention) as well as whether the overall satisfaction (Hayes, 1994; Eysenck and Keane, 1996; Robbins, 1996; Bergh et al., 1999) is related to the congruence of these parameters.

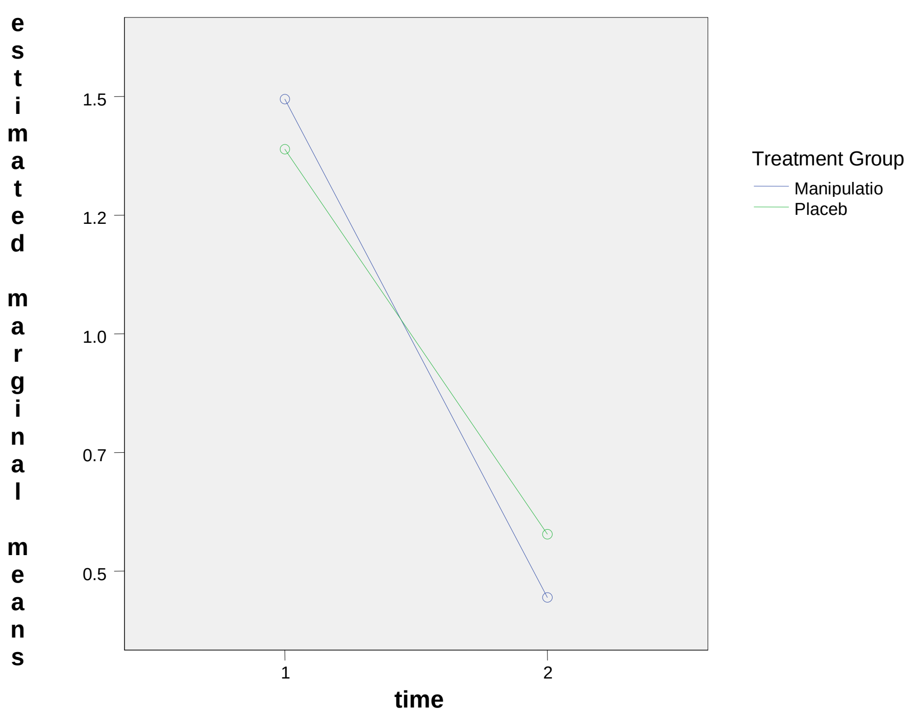
Currently the only form of information that can be gleaned from this portion of the SRQ is that the satisfaction levels seem to be more closely related to the decreases in perceived pain as reported by the participant (as both groups reported the decrease, so the levels of satisfaction increased (shown as a decrease in Figure 4.17)).

4.4.5.6 Total SRQ score

The total SRQ score decreased significantly in both groups over the seven-week time period (p<0.001), but the rate of decrease was the same in both treatment groups as there was a non significant time*group interaction effect (p=0.265). Figure 4.18 suggests that there was a slightly steeper slope in the manipulation group than in the placebo group, indicating a trend of a beneficial effect in the manipulation group compared with the placebo group. However, there is not sufficient evidence to conclude that there was a beneficial effect from the manipulation over the placebo treatment for this outcome.

Table 4.22: Within and between – subjects effects for total SRQ score

Effect	***Statistic***	***p-value***
Time	Wilk's lambda=0.183	<0.001
Time*group	Wilk's lambda=0.932	0.265
Group	f = 0.008	0.929



Key:	
Time	***Value***
1	Initial
2	6 Weeks

Figure 4.18: Profile plot of mean total SRQ score by treatment group and time

These results concur with the discussions under the various sections (4.4.5.1; 4.4.5.2; 4.4.5.3; 4.4.5.4; 4.4.5.5) that cover the various aspects of the SRQ.

4.5 Intra-group corrections between changes in outcomes

KEY

∆alg	–	Change in Algometer
∆NRS	–	Change in Numerical Pain Rating Scale
∆incl flex	–	Change in Inclinometer Flexion
∆incl ext	–	Change in Inclinometer Extension
∆incl abd	–	Change in Inclinometer Abduction
∆incl add	–	Change in Inclinometer Adduction
∆incl int rot	–	Change in Inclinometer Internal Rotation
∆incl ext rot	–	Change in Inclinometer External Rotation
∆SPADI (p)	–	Change in Shoulder Pain And Disability Index Pain Score
∆SPADI (d)	–	Change in Shoulder Pain And Disability Index Disability Score
∆SPADI (tot)	–	Change in Shoulder Pain And Disability Index Total Score
∆SRQ (tot)	–	Change in Shoulder Rating Questionnaire Total Score

Table 4.23: Pearson’s correlation between changes in outcomes in the manipulation group (N = 10)

		∆alg	∆NRS	∆incl flex	∆incl ext	∆incl abd	∆incl add	∆incl int rot	∆incl ext rot	∆SPADI (p)	∆SPADI (d)	∆SPADI (tot)	∆SRQ (tot)
∆alg	Pearson Correlation	1	-0.460	-0.152	-0.396	-0.325	-0.472	0.438	0.482	-0.463	-0.004	-0.306	0.079
	Sig. (2-tailed)		0.181	0.675	0.258	0.359	0.168	0.206	0.158	0.178	0.992	0.389	0.828
	N	10	10	10	10	10	10	10	10	10	10	10	10
∆NRS	Pearson Correlation	-0.460	1	0.307	0.652(*)	-0.172	-0.085	-0.317	-0.101	0.710(*)	0.648(*)	0.760(*)	0.411
	Sig. (2-tailed)	.181		0.388	0.041	0.635	0.816	0.372	0.782	0.021	0.043	0.011	0.238
	N	10	10	10	10	10	10	10	10	10	10	10	10
∆incl flex	Pearson Correlation	-0.152	0.307	1	0.608	0.570	-0.345	-0.046	-0.056	0.251	0.374	0.335	0.364
	Sig. (2-tailed)	0.675	0.388		0.062	0.086	0.329	0.899	0.878	0.484	0.287	0.345	0.301
	N	10	10	10	10	10	10	10	10	10	10	10	10
∆incl ext	Pearson Correlation	-0.396	0.652(*)	0.608	1	0.206	-0.121	-0.241	-0.181	0.584	0.441	0.583	0.358
	Sig. (2-tailed)	0.258	0.041	0.062		0.568	0.740	0.503	0.617	0.076	0.203	0.077	0.309
	N	10	10	10	10	10	10	10	10	10	10	10	10
∆incl abd	Pearson Correlation	-0.325	-0.172	0.570	0.206	1	0.321	-0.381	-0.524	0.213	-0.098	0.096	0.056
	Sig. (2-tailed)	0.359	0.635	0.086	0.568		0.366	0.277	0.120	0.555	0.788	0.793	0.878
	N	10	10	10	10	10	10	10	10	10	10	10	10
∆incl add	Pearson Correlation	-0.472	-0.085	-0.345	-0.121	0.321	1	-0.258	-0.724(*)	-0.045	-0.447	-0.232	-0.302
	Sig. (2-tailed)	0.168	0.816	0.329	0.740	0.366		0.471	0.018	0.903	0.195	0.519	0.396
	N	10	10	10	10	10	10	10	10	10	10	10	10
∆incl int rot	Pearson Correlation	0.438	-0.317	-0.046	-0.241	-0.381	-0.258	1	0.336	-0.592	0.106	-0.341	0.307
	Sig. (2-tailed)	0.206	0.372	0.899	0.503	0.277	0.471		0.342	0.071	0.771	0.334	0.388
	N	10	10	10	10	10	10	10	10	10	10	10	10
∆incl ext rot	Pearson Correlation	0.482	-0.101	-0.056	-0.181	-0.524	-0.724(*)	0.336	1	-0.109	0.252	0.042	0.154
	Sig. (2-tailed)	0.158	0.782	0.878	0.617	0.120	0.018	0.342		0.765	0.483	0.907	0.671
	N	10	10	10	10	10	10	10	10	10	10	10	10
∆SPADI (p)	Pearson Correlation	-0.463	0.710(*)	0.251	0.584	0.213	-0.045	-0.592	-0.109	1	0.609	0.933(**)	0.477
	Sig. (2-tailed)	0.178	0.021	0.484	0.076	0.555	0.903	0.071	0.765		0.061	0.000	0.163
	N	10	10	10	10	10	10	10	10	10	10	10	10

Table 4.23 Continued: Pearson's correlation between changes in outcomes in the manipulation group (N = 10)

ΔSPADI (d)	Pearson Correlation	-0.004	0.648(*)	0.374	0.441	-0.098	-0.447	0.106	0.252	0.609	1	0.853(**)	0.921(**)
	Sig. (2-tailed)	0.992	0.043	0.287	0.203	0.788	0.195	0.771	0.483	0.061		0.002	0.000
	N	10	10	10	10	10	10	10	10	10	10	10	10
ΔSPADI (tot)	Pearson Correlation	-0.306	0.760(*)	0.335	0.583	0.096	-0.232	-0.341	0.042	0.933(**)	0.853(**)	1	0.730(*)
	Sig. (2-tailed)	0.389	0.011	0.345	0.077	0.793	0.519	0.334	0.907	0.000	0.002		0.016
	N	10	10	10	10	10	10	10	10	10	10	10	10
ΔSRQ (tot)	Pearson Correlation	0.079	0.411	0.364	0.358	0.056	-0.302	0.307	0.154	0.477	0.921(**)	0.730(*)	1
	Sig. (2-tailed)	0.828	0.238	0.301	0.309	0.878	0.396	0.388	0.671	0.163	0.000	0.016	
	N	10	10	10	10	10	10	10	10	10	10	10	10

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

Table 4.24: Pearson's correlation between changes in outcomes in the placebo group (N = 10)

		Δalg	ΔNRS	Δincl flex	Δincl ext	Δincl abd	Δincl add	Δincl int rot	Δincl ext rot	ΔSPADI (p)	ΔSPADI (d)	ΔSPADI (tot)	ΔSRQ (tot)
Δalg	Pearson Correlation	1	-0.529	0.445	-0.071	-0.047	0.130	-0.243	0.589	-0.475	-0.010	-0.406	-0.769(**)
	Sig. (2-tailed)		0.116	0.197	0.845	0.897	0.719	0.499	0.073	0.166	0.978	0.244	0.009
	N	10	10	10	10	10	10	10	10	10	10	10	10
ΔNRS	Pearson Correlation	-0.529	1	-0.263	-0.139	0.362	0.399	0.236	-0.496	0.737(*)	0.096	0.679(*)	0.499
	Sig. (2-tailed)	0.116		0.463	0.702	0.304	0.253	0.511	0.145	0.015	0.792	0.031	0.142
	N	10	10	10	10	10	10	10	10	10	10	10	10
Δincl flex	Pearson Correlation	0.445	-0.263	1	-0.349	0.657(*)	-0.139	0.252	0.590	-0.571	0.258	-0.326	-0.667(*)
	Sig. (2-tailed)	0.197	0.463		0.322	0.039	0.702	0.482	0.073	0.085	0.472	0.358	0.035
	N	10	10	10	10	10	10	10	10	10	10	10	10
Δincl ext	Pearson Correlation	-0.071	-0.139	-0.349	1	-0.034	0.041	0.340	0.213	-0.008	0.547	0.323	0.339
	Sig. (2-tailed)	0.845	0.702	0.322		0.927	0.910	0.336	0.555	0.983	0.102	0.363	0.338
	N	10	10	10	10	10	10	10	10	10	10	10	10
Δincl abd	Pearson Correlation	-0.047	0.362	0.657(*)	-0.034	1	-0.053	0.413	0.175	-0.050	0.555	0.292	-0.087
	Sig. (2-tailed)	0.897	0.304	0.039	0.927		0.885	0.235	0.629	0.891	0.096	0.413	0.811
	N	10	10	10	10	10	10	10	10	10	10	10	10

Table 4.24 Continued: Pearson's correlation between changes in outcomes in the placebo group (N = 10)

Δincl add	Pearson Correlation	0.130	0.399	-0.139	0.041	-0.053	1	0.342	0.340	-0.034	-0.099	-0.088	-0.106
	Sig. (2-tailed)	0.719	0.253	0.702	0.910	0.885		0.333	0.337	0.926	0.785	0.808	0.771
	N	10	10	10	10	10	10	10	10	10	10	10	10
	Pearson Correlation	-0.243	0.236	0.252	0.340	0.413	0.342	1	0.499	-0.118	0.372	0.124	0.004
Δincl int rot	Sig. (2-tailed)	0.499	0.511	0.482	0.336	0.235	0.333		0.142	0.745	0.290	0.732	0.991
	N	10	10	10	10	10	10	10	10	10	10	10	10
	Pearson Correlation	0.589	-0.496	0.590	0.213	0.175	0.340	0.499	1	-0.762(*)	0.191	-0.528	-0.622
Δincl ext rot	Sig. (2-tailed)	0.073	0.145	0.073	0.555	0.629	0.337	0.142		0.010	0.598	0.117	0.055
	N	10	10	10	10	10	10	10	10	10	10	10	10
	Pearson Correlation	-0.475	0.737(*)	-0.571	-0.008	-0.050	-0.034	-0.118	-0.762(*)	1	-0.072	0.800(**)	0.718(*)
ΔSPADI (p)	Sig. (2-tailed)	0.166	0.015	0.085	0.983	0.891	0.926	0.745	0.010		0.843	0.005	0.019
	N	10	10	10	10	10	10	10	10	10	10	10	10
	Pearson Correlation	-0.010	0.096	0.258	0.547	0.555	-0.099	0.372	0.191	-0.072	1	0.541	-0.031
ΔSPADI (d)	Sig. (2-tailed)	0.978	0.792	0.472	0.102	0.096	0.785	0.290	0.598	0.843		0.106	0.933
	N	10	10	10	10	10	10	10	10	10	10	10	10
	Pearson Correlation	-0.406	0.679(*)	-0.326	0.323	0.292	-0.088	0.124	-0.528	0.800(**)	0.541	1	0.587
ΔSPADI (tot)	Sig. (2-tailed)	0.244	0.031	0.358	0.363	0.413	0.808	0.732	0.117	0.005	0.106		0.075
	N	10	10	10	10	10	10	10	10	10	10	10	10
	Pearson Correlation	-0.769(**)	0.499	-0.667(*)	0.339	-0.087	-0.106	0.004	-0.622	0.718(*)	-0.031	0.587	1
ΔSRQ (tot)	Sig. (2-tailed)	0.009	0.142	0.035	0.338	0.811	0.771	0.991	0.055	0.019	0.933	0.075	
	N	10	10	10	10	10	10	10	10	10	10	10	10

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

Table 4.23 shows the correlations between changes in outcomes in the manipulation group. The Algometer measurement showed no correlation. A change in NRS was positively correlated with a change in extension, as well as a change in the SPADI pain score, disability score and the total SPADI score. Change in flexion was not correlated with any other measurement, nor was change in abduction, or internal rotation. Change in adduction was negatively correlated with a change in external rotation. The SPADI pain score and the total SPADI score were highly correlated, as was SPADI disability score and total SPADI score. SPADI disability score and SRQ score were also highly correlated, as was SRQ and total SPADI score.

Table 4.24 shows the correlations between changes in the outcomes in the placebo group. The objective pain measurement using the Algometer showed only one correlation with the SRQ total score. A change in the NRS was correlated positively with a change in the SPADI pain score and the total SPADI score. A change in flexion was correlated with a change in abduction and negatively correlated with the SRQ score. A change in external rotation was negatively correlated to a change in the SPADI pain score. The SPADI pain score was highly correlated with the total SPADI score and with the SRQ total score. The SPADI pain score and the total SPADI score were highly correlated.
The changes in the adduction, internal rotation and SPADI disability scores showed no correlation.

Table 4.25: Pearson's correlation between changes in outcomes in the manipulation group (N = 10) – significant findings only

		ΔNRS	Δincl add	ΔSPADI (p)	ΔSPADI (d)	ΔSPADI (tot)
Δincl ext	Pearson Correlation	.652(*)	-.121	.584	.441	.583
	Sig. (2-tailed)	.041	.740	.076	.203	.077
	N	10	10	10	10	10
The significant relationship that is identified here has been discussed under the section on the range of motion measure (Inclinometer), which is section 4.4.3.2.						
Δincl ext rot	Pearson Correlation	-.101	-.724(*)	-.109	.252	.042
	Sig. (2-tailed)	.782	.018	.765	.483	.907
	N	10	10	10	10	10
The significant relationship that is identified here has been discussed under the section on the range of motion measure (Inclinometer), which is section 4.4.3.6.						
ΔSPADI (p)	Pearson Correlation	.710(*)	-.045	1	.609	.933(**)
	Sig. (2-tailed)	.021	.903		.061	.000
	N	10	10	10	10	10
The significant relationship that is identified here has been discussed under the section on the SPADI – with particular reference to pain, which is section 4.4.4.1.						
ΔSPADI (d)	Pearson Correlation	.648(*)	-.447	.609	1	.853(**)
	Sig. (2-tailed)	.043	.195	.061		.002
	N	10	10	10	10	10
The significant relationship that is identified here has been discussed under the section on the SPADI – with particular reference to disability, which is section 4.4.4.2.						
ΔSPADI (tot)	Pearson Correlation	.760(*)	-.232	.933(**)	.853(**)	1
	Sig. (2-tailed)	.011	.519	.000	.002	
	N	10	10	10	10	10
The significant relationship that is identified here has been discussed under the section on the SPADI – with particular reference to total / overall results, which is section 4.4.4.3. This result indicates that there is good internal validity to the SPADI (Yeomans, 2000)						

Table 4.25 continued: Pearson's correlation between changes in outcomes in the manipulation group (N = 10) – significant findings only

<table>
<tr><th></th><th></th><th>ΔNRS</th><th>Δincl add</th><th>ΔSPADI (p)</th><th>ΔSPAD I (d)</th><th>ΔSPADI (tot)</th></tr>
<tr><td rowspan="3">ΔSRQ (tot)</td><td>Pearson Correlation</td><td>.411</td><td>-.302</td><td>.477</td><td>.921(**)</td><td>.730(*)</td></tr>
<tr><td>Sig. (2-tailed)</td><td>.238</td><td>.396</td><td>.163</td><td>.000</td><td>.016</td></tr>
<tr><td>N</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td colspan="7">The significant relationship that is identified here has been discussed under the section on the SRQ – with particular reference to total / overall findings, which is section 4.4.5.6.
This result also bears testament to the fact that both questionnaires measure the same construct (i.e. shoulder girdle pathology) (Yeomans, 2000) and that there may be a specificity and sensitivity issue around these questionnaires when it comes to the identification of specific shoulder pathologies as in this study – the AC joint dysfunction.</td></tr>
</table>

Table 4.26: Pearson's correlation between changes in outcomes in the placebo group (N = 10) – significant findings only

<table>
<tr><th></th><th></th><th>Δalg</th><th>ΔNRS</th><th>Δincl flex</th><th>Δincl ext rot</th><th>ΔSPADI (p)</th></tr>
<tr><td rowspan="3">Δincl abd</td><td>Pearson Correlation</td><td>-.047</td><td>.362</td><td>.657(*)</td><td>.175</td><td>-.050</td></tr>
<tr><td>Sig. (2-tailed)</td><td>.897</td><td>.304</td><td>.039</td><td>.629</td><td>.891</td></tr>
<tr><td>N</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td colspan="7">The significant relationship that is identified here has been discussed under the section on the range of motion measure (Inclinometer), which is section 4.4.3.3.
It is of interest to note that this significant result seems to bear testament to the possible presence of bicipital tendonitis (bicipital tendonitis is aggravated by forward flexion as opposed to the AC joint which is aggravated more by abduction (around the z-axis) or horizontal adduction (around the y-axis)) in this participant cohort more so than the manipulation cohort and this may be the reason for the inherent differences experienced between the two groups.</td></tr>
<tr><td rowspan="3">ΔSPADI (p)</td><td>Pearson Correlation</td><td>-.475</td><td>.737(*)</td><td>-.571</td><td>-.762(*)</td><td>1</td></tr>
<tr><td>Sig. (2-tailed)</td><td>.166</td><td>.015</td><td>.085</td><td>.010</td><td></td></tr>
<tr><td>N</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td colspan="7">The significant relationship that is identified here has been discussed under the section on the SPADI – with particular reference to pain, which is section 4.4.4.1.</td></tr>
</table>

Table 4.26 continued: Pearson's correlation between changes in outcomes in the placebo group (N = 10) – significant findings only

<table>
<tr><th></th><th></th><th>∆alg</th><th>∆NRS</th><th>∆incl flex</th><th>∆incl ext rot</th><th>∆SPADI (p)</th></tr>
<tr><td rowspan="3">∆SPADI (tot)</td><td>Pearson Correlation</td><td>-.406</td><td>.679(*)</td><td>-.326</td><td>-.528</td><td>.800(**)</td></tr>
<tr><td>Sig. (2-tailed)</td><td>.244</td><td>.031</td><td>.358</td><td>.117</td><td>.005</td></tr>
<tr><td>N</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td colspan="7">The significant relationship that is identified here has been discussed under the section on the SPADI – with particular reference to total / overall results, which is section 4.4.4.3.
This result indicates that there is a lesser degree of internal validity to the SPADI (Yeomans, 2000), when participants present with a dissimilar set of conditions on entry into the study.</td></tr>
<tr><td rowspan="3">∆SRQ (tot)</td><td>Pearson Correlation</td><td>-.769(**)</td><td>.499</td><td>-.667(*)</td><td>-.622</td><td>.718(*)</td></tr>
<tr><td>Sig. (2-tailed)</td><td>.009</td><td>.142</td><td>.035</td><td>.055</td><td>.019</td></tr>
<tr><td>N</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td colspan="7">The significant relationship that is identified here has been discussed under the section on the SRQ – with particular reference to total / overall findings, which is section 4.4.5.6.
This result also bears testament to the fact that both questionnaires measure the same construct (i.e. shoulder girdle pathology) (Yeomans, 2000) and that there may be a specificity and sensitivity issue around these questionnaires when it comes to the identification of specific shoulder pathologies as in this study – the AC joint dysfunction.
The SRQ seems to be more reliable in measuring bicipital tendonitis in these participants as it is more closely related to the forward flexion movements.</td></tr>
</table>

4.6 Summary and conclusion

For most of the outcomes measured there was a non-significant trend, which suggested a beneficial effect of the manipulation relative to the placebo. For some outcomes the placebo effect was large and there appeared to be no beneficial effect of the manipulation. A larger study is necessary to confirm these trends statistically.

In the context of the aim of this study, which was to assess the efficacy of a chiropractic manipulation in the treatment of AC joint dysfunction in weight trainers, the following objectives were considered at the outset:

1. To determine the efficacy of manipulation in terms of subjective clinical findings.

    The First Hypothesis:

    That the participant would not notice an improvement in normal day-to-day activities (including usual training) as evident in the subjective findings.

    Based on the outcomes of this study, this hypothesis is ***accepted***, although caution needs to be utilised in accepting this outcome due to limitations in sample size, subjective measure sensitivity and specificity as well as the stringency of the inclusion and exclusion criteria.

2. To determine the efficacy of manipulation in terms of objective clinical findings.

The Second Hypothesis:

That clinical improvement would not be noted through clinical measurements taken before, during and after the treatment protocol.

Based on the outcomes of this study, this hypothesis is ***rejected*** based on the evidence trends and significant findings that indicated that the manipulation group improved by a significantly greater proportion than the placebo group (which also showed improvement). Similarly to the limitations as stated in hypothesis one, a small sample size as well as the stringency of the inclusion and exclusion criteria, still need to be taken into consideration.

3. To determine any correlations between the objective and subjective clinical findings.

The Third Hypothesis:

To show that improvements noticed by the participant would not be correlated to the improvement seen through clinical measurements.

Based on the outcomes of this study, this hypothesis is ***accepted*** (based on the significant findings only). However, the same limitations that applied in hypothesis one (i.e. a small sample size as well as the stringency of the inclusion and exclusion criteria) still need to be considered.

Chapter Five

Conclusions and Recommendations

5.1 Introduction

This chapter will discuss the outcomes of this research and make recommendations with regards to further research.

5.2 Conclusions

The aim of this study was to assess the short-term efficacy of Chiropractic manipulation on AC joint dysfunction in those participating in weight training.

With respect to the conclusions it was found that:

- Manipulation showed a significant improvement over placebo in terms of the objective measures:

Table 5.1: Improvements within Objective outcomes

Algometer	Non-significant trend
Inclinometer Flexion	Non-significant trend towards differential treatment effect
Inclinometer Extension	Borderline non-significant time effect and a borderline non-significant intervention effect
Inclinometer Adduction	Borderline non-significant trend
Inclinometer Internal Rotation	Non-significant intervention effect
Inclinometer External Rotation	Non-significant trend

- Manipulation showed inconclusive results in terms of the subjective findings, for a number of suggested reasons, which are expanded on below in the recommendations.

5.3 Recommendations

Further recommendations include:

- Further studies should be conducted to promote understanding of the relationship between preferred handedness and the side of AC dysfunction with larger sample sizes to prevent bias.
- Further studies are necessary with larger sample sizes to confirm the trend observed in table 5.1.
- With future research, follow up algometer readings should be taken at 3 weeks, 4 weeks and potentially a month follow up in order to establish whether this trend maintains its upward gain or plateaus.
- In clinical trials and/ or general clinical assessments of patients researchers/ practitioners should be wary of utilizing pain scores (NRS, SPADI or any other such tool) when assessing AC joint dysfunction in patients, as the reported pain does not necessarily reflect the AC joint pathology.
- Future research should consider diagnosing and documenting concomitant pathologies that may be present in the shoulder girdle complex. This may be a complex undertaking as the inclusion/ exclusion criteria for the future studies would need to be considered carefully so as not to exclude these concomitant pathologies. However, to be able to generate reliable results if there are multiple concomitant pathologies, the studies would require large sample sizes to generate reliable statistical data.
- The quandary that still requires further research and that cannot be categorically dealt with in this research is the trend that the placebo group also improves in terms of pain even without the intervention. One factor that should be considered in future research, to quantify this phenomenon, is that of activity levels during the course of the research. As it has not been recorded in this research, it is not possible to determine whether the placebo group maintained activity during the course of the study (i.e. a lack of activity during the study may have been the cause of the decreased pain in the placebo group – especially

if current recommendations for conservative care are followed, where rest/ immobilisation are highly recommended (Mouhsine et al, 2003)). Furthermore, it is also not known whether the manipulation group increased activity during the course of the study. The improved reported levels of daily activity and the increase in range of motion (inclinometer) would seem to suggest that this may have been possible, even though it was not recorded – therefore this study can recommend this area as a possible research point for a future study.

- It is suggested that the Shoulder Rating Questionnaire is researched more fully to establish whether patients respond differently according to their pathologies within the shoulder girdle over a period of natural history and/ or intervention (whether in a clinical trial and/ or clinical intervention in a practice setting). Correlation with these findings and those of patient activity measures would provide useful information in this regard.
- Future research should incorporate additional questionnaires, which cover aspects of environment, patient and service (Bergh et al., 1999; Robbins, 1996; Hayes, 1994) so that more accurate data can be gleaned in terms of these three aspects of care. This would also assist in determining whether the satisfaction improvement or lack thereof is actually related to the clinical encounter, the environment or the treatment (clinical intervention) as well as whether the overall satisfaction (Bergh et al., 1999; Eysenck and Keane, 1996; Robbins, 1996; Hayes, 1994) is related to the congruence of these parameters.
- Having a peer intern or clinician to take objective and subjective measures may result in more reliable readings and limit researcher bias.

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Appendix A
Letter of Information

Dear Participant,

I am a student currently pursuing my M.Tech: Chiropractic qualification at the Durban University of Technology.

Study Title

A quantitative placebo controlled study of the efficacy of manipulation of acromioclavicular joint dysfunction in weight trainers.

Background to study:

As the acromioclavicular (AC) joint is the only bony connection of the shoulder to the rest of the body, it must therefore stabilize the shoulder in just about any weightlifting manoeuvre of the arm making it prone to injury in weightlifters.

Although the amount of movement at the AC joint is small it is integral in the mechanics of the shoulder girdle. Movements required for the commonly performed manoeuvres such as bench press and side lateral raisers cause repetitive loading of the AC joint predisposing it to injury.

Pain is expected during weight training and so is often ignored being attributed to a hard workout and as a result professional care is not sought.

Current treatment is conservative in nature with a large variety of options being used, but it is not known what is the primary therapy required for the restoration of the AC joint.

Objective of Study:

1. To test two treatment options of the same condition to determine their efficacy.
2. To assist in the management of shoulder injuries aggravated by weight training.

Risks and Benefits of the study

The benefits of participating in this study are that you may receive relief of your condition as well as furthering the knowledge of the Chiropractic profession. You may experience some post adjustment soreness that does abate after approximately two days.

Two free conventional treatments will be available for your condition at the end of the study as a sign of appreciation for your participation in the study.

What is expected of the participants?

If you are eligible for this study, you will be required to receive treatment twice a week for a two-week period, a one-week follow up as well as a one-month follow up. Please note that you will have a 50% chance of being allocated into either of the two treatment groups.

What could lead to the exclusion of the participants?

You as a participant are free to leave this study at any time without any repercussions. You may be excluded if you have an acute flare up of pain.

Costs of the study to the participants

You will not incur any cost; the treatment is free of charge if you are eligible for the study.

Confidentiality:

Be assured that this study has been approved by the appropriate Ethics and Bio-safety Committee, in order to protect your interests. In this respect it is important for you to note that all data will be coded for recording, analysis and reporting of the data and thus your identity and participation will be kept confidential.

However should you have any concerns regards this study you are free to direct any questions at myself or my supervisor on the numbers given above, or alternatively you are able to contact the secretary of the Ethics and Bio-safety Committee – Mr Vikesh Singh – on 031 2042701.

Your time, opinion, and assistance with this project are invaluable and greatly appreciated.

Yours sincerely,

______________	______________
Warren Jordan	Dr. Micah Atkinson
Research Student	Supervisor
(083 357 9574)	(084 800 0232)

If you have any queries please don't hesitate to contact my supervisor or myself on the above given numbers.

Appendix B
Informed Consent Form

Date: ....

Title of Research Project:

A quantitative placebo controlled study of the efficacy of manipulation of acromioclavicular joint dysfunction in weight trainers.

Name of Supervisor:	Name of Research Student:
Dr M. Atkinson (084 800 0232)	Warren Jordan (083 357 9574 & 031 204 2205 – DUT)

<u>**Please Cross Appropriate Box**</u>	**YES**	**NO**
1. Have you read the research information sheet?		
2. Have you had an opportunity to ask questions regarding this study?		
3. Have you received satisfactory answers to your questions?		
4. Have you had an opportunity to discuss this study?		
5. Have you received enough information about this study?		
6. Do you understand the implications of your involvement in this study?		
7. Do you understand that you are free to:		
a) Withdraw from this study at any time?		
b) Withdraw from the study at any time, without reasons given?		
c) Withdraw from the study at any time without affecting your future health care or relationship with the Chiropractic day clinic at the Durban University of Technology?		
8. Do you agree to voluntarily participate in this study?		

9. Who have you spoken to regarding this study?.......................................

If you have answered <u>NO</u> to any of the above, please obtain the necessary information from the researcher and / or supervisor before signing. Thank You.

Patient Name: .... Signature: ....

Witness Name: .... Signature: ....

<u>Please print in block letters</u>

Appendix C

FREE TREATMENT

SHOULD YOU QUALIFY FOR RESEARCH PARTICIPATION

Do you suffer with PAIN at the
TOP OF YOUR SHOULDER?

Are you MALE between the ages of 18 & 35 and
ACTIVELY INVOLVED IN WEIGHT TRAINING?

Research is currently being held at the
Durban University of Technology Chiropractic Clinic
on
Acromioclavicular Dysfunction.

If you qualify for the program, you will receive
FREE TREATMENT!

If you are interested, please call
Warren on 083 357 9574
or 031 204 2205 (DUT).

Appendix D
Shoulder Pain and Disability Index

Name: ______________________ Date: ______________________

Date – 1st reading: ______________________
Date – 2nd reading: ______________________
Date – 3rd reading: ______________________

Pain Scale: 0 – 10 numeric, where 0 = “no pain at all,” and 10 = “worst pain imaginable”
How severe is your pain:

	1st	**2nd**	**3rd**
1. At it’s worst?			
2. When lying on the involved side?			
3. Reaching for something on a high shelf?			
4. Touching the back of your neck?			
5. Pushing with the involved arm?			

Disability scale: 0 – 10 numeric, where 0 = “no difficulty,” and 10 = “so difficult it requires help”
How much difficulty do you have:

	1st	**2nd**	**3rd**
1. Washing your hair?			
2. Washing your back?			
3. Putting on an undershirt or pullover sweater?			
4. Putting on a shirt that buttons down the front?			
5. Putting on your pants?			
6. Placing an object on a high shelf?			
7. Carrying a heavy object of 10 pounds?			
8. Removing something from your back pocket?			

Appendix E
Shoulder Rating Questionnaire

Name: ______________________________ Date: ______________________

Date – 1st reading: ______________________________
Date – 2nd reading: ______________________________

Which is your dominant arm?

Left Right

For which shoulder(s) have you been evaluated or treated?

Left Right Both

Please answer the following questions regarding the shoulder for which you have been evaluated or treated. If a question does not apply to you, leave that question blank.

If you indicate that both shoulders have been evaluated or treated, please complete a separate questionnaire for each shoulder and mark the corresponding side (Left or Right) at the top of each form.

The following questions refer to pain.

1. During the past month, how would you describe the usual pain in your in your shoulder <u>at rest</u>?

A. Very Severe		
B. Severe		
C. Moderate		
D. Mild		
E. None		

2. During the past month, how would you describe the usual pain in your in your shoulder <u>during activities</u>?

A. Very Severe		
B. Severe		
C. Moderate		
D. Mild		
E. None		

3. During the past month, how often did the pain in your shoulder make it <u>difficult for you to sleep</u> at night?

A. Every Day		
B. Several days per week		
C. One day per week		
D. Less than one day per week		
E. Never		

4. During the past month, how often have you had <u>severe pain</u> in your shoulder?

A. Every Day		
B. Several days per week		
C. One day per week		

D. Less than one day per week		
E. Never		

The following questions refer to daily activities.

5. Consider all the ways you use your shoulder during daily personal and household activities (i.e. dressing, washing, driving, household chores, etc), how would you describe your ability to use your shoulder?

A. Very severe limitation; unable		
B. Severe limitation		
C. Moderate limitation		
D. Mild limitation		
E. No limitation		

Questions 6 – 10: During the past month, how much difficulty have you had in each of the following activities due to your shoulder?

6. Putting on or removing a pullover sweater or shirt.

A. Unable		
B. Severe difficulty		
C. Moderate difficulty		
D. Mild difficulty		
E. No difficulty		

7. Combing or brushing your hair.

A. Unable		
B. Severe difficulty		
C. Moderate difficulty		
D. Mild difficulty		
E. No difficulty		

8. Reaching shelves that are above your head.

A. Unable		
B. Severe difficulty		
C. Moderate difficulty		
D. Mild difficulty		
E. No difficulty		

9. Scratching or washing your lower back with your hand.

A. Unable		
B. Severe difficulty		
C. Moderate difficulty		
D. Mild difficulty		
E. No difficulty		

10. Lifting or carrying a full bag of groceries (5 to 10 pounds[3.6 to 4.5 kilograms])

A. Unable		
B. Severe difficulty		
C. Moderate difficulty		
D. Mild difficulty		
E. No difficulty		

The following questions refer to recreational or athletic activities.

11. Considering all the ways you use your shoulder during recreational or athletic activities (i.e. baseball, golf, aerobics, gardening, etc), how would you describe the function of your shoulder?

A. Very severe limitation; unable		
B. Severe limitation		
C. Moderate limitation		
D. Mild limitation		
E. No limitation		

12. During the past month, how much difficulty have you had throwing a ball overhand or serving tennis due to your shoulder?

A. Unable		
B. Severe limitation		
C. Moderate limitation		
D. Mild limitation		
E. No limitation		

13. List one activity (recreational or athletic) that you particularly enjoy and then select the degree of limitation you have, if any, due to your shoulder.

    Activity: ____________________

A. Unable		
B. Severe limitation		
C. Moderate limitation		
D. Mild limitation		
E. No limitation		

The following questions refer to work.

14. During the past month, what has been your main form of work?

A. Paid work (list type): ____________________		
B. Housework		
C. Schoolwork		
D. Unemployed		
E. Disabled due to your shoulder		
F. Disabled secondary to other causes		
G. Retired		

If you answered D, E, F, or G to the above question, please skip questions 15 – 18 and go onto question 19.

15. During the past month, how often were you unable to do any of your usual work because of your shoulder?

A. All days		
B. Several days per week		
C. One day per week		
D. Less than one day per week		
E. Never		

16. During the past month, on the days that you did work, how often were you unable to do your work as carefully or as efficiently as you would like because of your shoulder?

A. All days		
B. Several days per week		
C. One day per week		
D. Less than one day per week		
E. Never		

17. During the past month, on the days that you did work, how often did you work a shorter day because of your shoulder?

A. All days		
B. Several days per week		
C. One day per week		
D. Less than one day per week		
E. Never		

18. During the past month, on the days that you did work, how often did you have to change the way that your usual work is done because of your shoulder?

A. All days		
B. Several days per week		
C. One day per week		
D. Less than one day per week		
E. Never		

The following questions refer to satisfaction and areas for improvement.

19. During the past month, how would you rate your overall degree of satisfaction with your shoulder?

A. Poor		
B. Fair		
C. Good		
D. Very good		
E. Excellent		

20. Please rank the two areas in which you would most like to see improvement (place a 1 for the most important, a 2 for the second most important).

Pain		
Daily personal and household activities		
Recreational or athletic activities		
Work		

This is the end of the Shoulder Rating Questionnaire. Thank you for your cooperation.

Appendix F

DURBAN UNIVERSITY OF TECHNOLOGY
CHIROPRACTIC DAY CLINIC
CASE HISTORY

Patient: ______________________________ Date: __________

File # : __________ Age: __________

Sex : __________ Occupation: ______________________________

Intern : ______________________________ Signature ____________________

FOR CLINICIANS USE ONLY:
Initial visit
Clinician: Signature :

Case History:

Examination:
Previous: Current:

X-Ray Studies:
Previous: Current:

Clinical Path. lab:
Previous: Current:

CASE STATUS:

PTT:	Signature:	Date:

CONDITIONAL:
Reason for Conditional:

Signature: Date:

Conditions met in Visit No:	Signed into PTT:	Date:
Case Summary signed off:		Date:

Intern’s Case History:

1. Source of History:

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

3. Present Illness:

	Complaint 1	**Complaint 2**
< Location		
< Onset : Initial:		
Recent:		
< Cause:		
< Duration		
< Frequency		
< Pain (Character)		
< Progression		
< Aggravating Factors		
< Relieving Factors		
< Associated S & S		
< Previous Occurrences		
< Past Treatment		
< Outcome:		

4. Other Complaints:

5. Past Medical History:

< General Health Status

< Childhood Illnesses

< Adult Illnesses

< Psychiatric Illnesses

< Accidents/Injuries

< Surgery

< Hospitalizations

6. Current health status and life-style:

< Allergies

< Immunizations

< Screening Tests incl. x-rays

< Environmental Hazards (Home, School, Work)

< Exercise and Leisure

< Sleep Patterns

< Diet

< Current Medication
Analgesics/week:
< Tobacco

< Alcohol

< Social Drugs

7. Immediate Family Medical History:

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

8. Psychosocial history:

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

9. Review of Systems:

< General

< Skin

< Head

< Eyes

< Ears

< Nose/Sinuses

< Mouth/Throat

< Neck

< Breasts

< Respiratory

< Cardiac

< Gastro-intestinal

< Urinary

< Genital

< Vascular

< Musculoskeletal

< Neurologic

< Haematologic

< Endocrine

< Psychiatric

Appendix G

Durban University of Technology

PHYSICAL EXAMINATION: SENIOR

Patient Name : ______________________ **File no :**__________ **Date :**_________

Student : **Signature :**

VITALS:

Pulse rate:			Respiratory rate:		
Blood pressure:	R	L	Medication if hypertensive:		
Temperature:			Height:		
Weight:	Any recent change? Y / N		If Yes: How much gain/loss	Over what period	

GENERAL EXAMINATION:

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

SYSTEM SPECIFIC EXAMINATION:

CARDIOVASCULAR EXAMINATION

RESPIRATORY EXAMINATION

ABDOMINAL EXAMINATION

NEUROLOGICAL EXAMINATION

COMMENTS

Clinician: **Signature :**

DURBAN UNIVERSITY of TECHNOLOGY

Appendix H

SHOULDER REGIONAL EXAMINATION

Patient: ……………………………………………………. File No: ………………….. Date: …………….

Intern: ……………………………………………….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 cartridge:	
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		Medial rotation	
Extension		Lateral Rotation	
Adduction		Elbow flexion	
Abduction		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)(50°) ____________________
Anterior movement of humeral head (P-A glide) (25°) ____________________
Posterior shear of humeral head (A-P glide) **>50%** 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

1. Anterior Instability Tests

	R Pos	R Neg	R n/a	L Pos	L Neg	L n/a
Anterior drawer Test						
Rowe Test						
Fulcrum Test						
Apprehension (crank) Test						
Clunk Test (tear of labrum)						
Rockwood Test						

2. Posterior Instability Tests

	Pos	Neg	n/a	Pos	Neg	n/a
Posterior Apprehension Test						
Norwood Stress Test						
Push-pull Test						
Jerk Test						

3. Inferior and Multi-directional instability tests

	Pos	Neg	n/a	Pos	Neg	n/a
Inferior Shoulder Instability Test						
Feagin Test (antero-inferior instability)						

A-C Joint Stress Test: ____

S-C Joint Stress Test: ____

Tests for Muscle or Tendon Pathology

1.	Speed's Test (bicipital tendonitis)	
2.	Gilchrest Sign (bicipital tendonitis)	
3.	Supraspinatus Test (supraspinatus tendonitis)	
4.	Hawkins-Kennedy Impingement Test (supraspinatus tendonitis)	
5.	Drop –arm Test (rotator cuff tear)	
6.	Impingement Test	
7.	Pectoralis Major Contracture Test	
8.	Ludington's Test (rupture of long head of biceps)	

Tests for neurological function

Brachial Plexus Tension Test	Radial Nerve												
	Median Nerve												
Tinel's Sign (Scalene triangle)													
Dermatones	C4		C5		C6		C7		C8		T1		T2
Reflexes	Biceps(C5/6)						Triceps (C7/8)						

Thoracic Outlet Syndrome Tests

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

Appendix I

DURBAN UNIVERSITY OF TECHNOLOGY

Patient Name: ***File #:*** ***Page:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature:***

S: *Numerical Pain Rating Scale (Patient)* *Intern Rating* ***A:***
Least *0 1 2 3 4 5 6 7 8 9 10* *Worst*

0: ***P:***

E:

Special attention to: ***Next appointment:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature:***

S: *Numerical Pain Rating Scale (Patient)* *Intern Rating* ***A:***
Least *0 1 2 3 4 5 6 7 8 9 10* *Worst*

O: ***P:***

E:

Special attention to: ***Next appointment:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature***

S: *Numerical Pain Rating Scale (Patient)* *Intern Rating* ***A:***
Least *0 1 2 3 4 5 6 7 8 9 10* *Worst*

O: ***P:***

E:

Special attention to: ***Next appointment:***

DURBAN UNIVERSITY OF TECHNOLOGY

Patient Name: ***File #:*** ***Page:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature:***

S: ***Numerical Pain Rating Scale (Patient)*** ***Intern Rating***
Least 0 1 2 3 4 5 6 7 8 9 10 Worst

A:

0:

P:

E:

Special attention to: ***Next appointment:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature:***

S: ***Numerical Pain Rating Scale (Patient)*** ***Intern Rating***
Least 0 1 2 3 4 5 6 7 8 9 10 Worst

A:

O:

P:

E:

Special attention to: ***Next appointment:***

Date: ***Visit:*** ***Intern:***
Attending Clinician: ***Signature***

S: ***Numerical Pain Rating Scale (Patient)*** ***Intern Rating***
Least 0 1 2 3 4 5 6 7 8 9 10 Worst

A:

O:

P:

E:

Special attention to: ***Next appointment:***