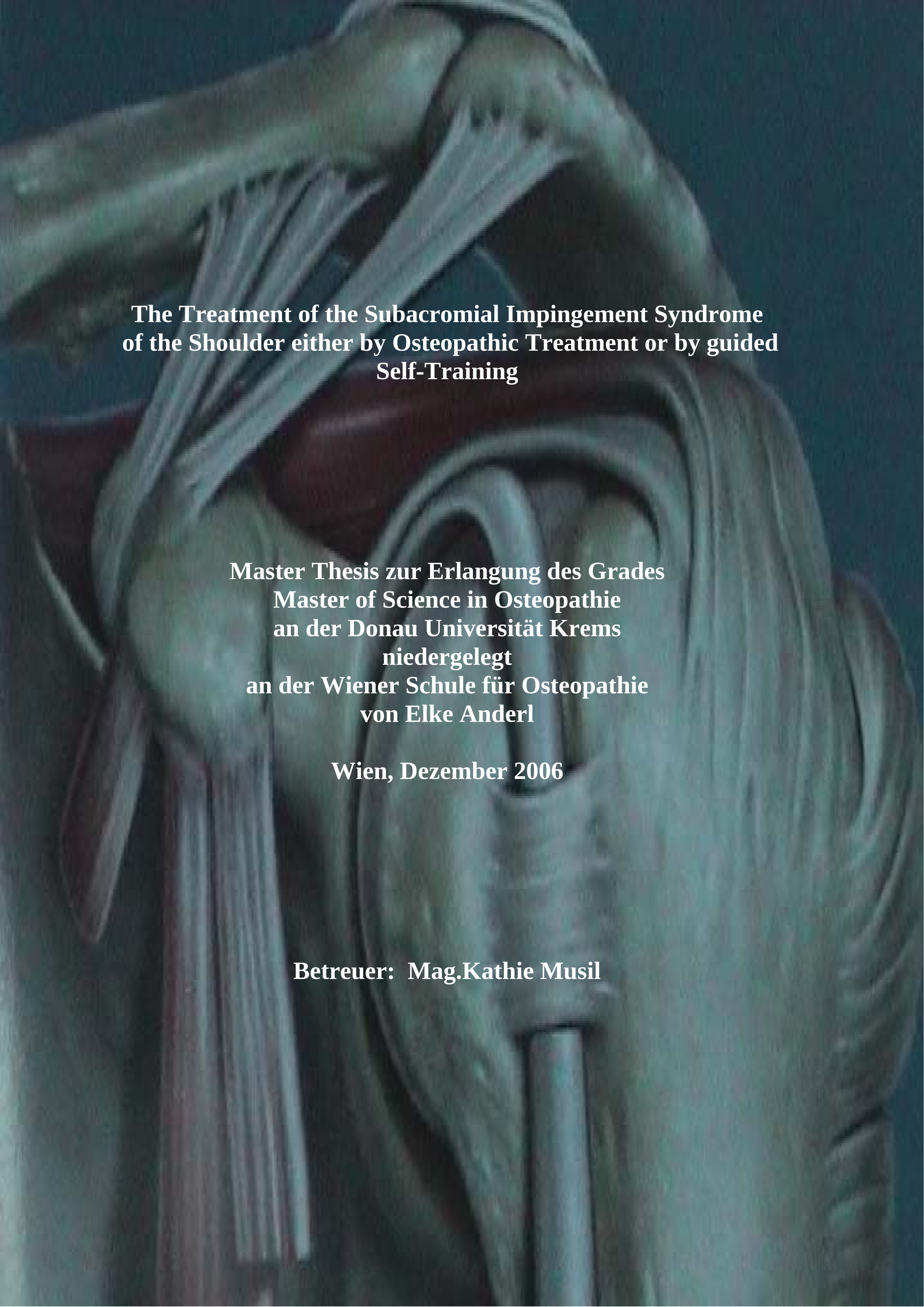


The Treatment of the Subacromial Impingement Syndrome of the Shoulder either by Osteopathic Treatment or by guided Self-Training

Master Thesis zur Erlangung des Grades
Master of Science in Osteopathie
an der Donau Universität Krems
niedergelegt
an der Wiener Schule für Osteopathie
von Elke Anderl

Wien, Dezember 2006

Betreuer: Mag.Kathie Musil

Danksagung

Ich möchte gerne einigen Personen meinen Dank aussprechen, die eine besondere Rolle bei meinem beruflichen Werdegang gespielt haben.

Meinen Eltern, die mich in jeder Hinsicht unterstützen und immer Zeit für mich und meine Familie haben.

An der Entstehung dieser Arbeit war maßgeblich mein Mann beteiligt. Für seine fachliche aber auch emotionale Unterstützung möchte ich mich ganz herzlich bedanken.

Ganz besonders danke ich meinen beiden Kindern Lisa und Alex für ihre Geduld und dafür, dass sie mir jeden Tag die Prioritäten im Leben aufzeigen.

Auch allen Freunden, die mir wertvolle Ratschläge erteilten und mich mit aufmunternden Worten zum Durchhalten motivierten, sei an dieser Stelle herzlich gedankt.

Ich möchte mich aber auch bei meinen Patienten bedanken, ohne die diese Arbeit nicht entstanden wäre.

Contents

1 Introduction

The number of patients who come to my practice because of shoulder problems has grown considerably over the past few years. On the one hand this is due to an improved cooperation with referring doctors and on the other hand to the considerable progress in the conservative and surgical management of shoulder problems. Also increased expectations of the patients with regard to the preservation of their shoulder function seem to play a major role in this context. Due to trend sports like golf or tennis especially the shoulders have to take enormous strain right into old age (Kim et al., 2004).

During the past few years my treatment approach for patients with subacromial impingement syndromes has changed following the continuing education courses that I attended. While in the beginning I mainly applied traditional physical therapy treatment approaches, I started to integrate more and more osteopathic techniques from the moment I started the osteopathic training. Today I am completely committed to the osteopathic philosophy and its principle to understand the human being as an entity, an attitude which has fundamentally altered the work with my patients.

The shoulder is a very complex articulation. For the best possible use of the upper extremity a good interaction of several mechanisms is necessary.
To be able to recognize the specific problem which leads to a shoulder strain detailed knowledge of anatomy and physiology as well as experience are indispensable. But the individuality of every single patient with his/her particular functional relations needs to be respected and taken into account. Thus it does not seem to make much sense to establish a single and fixed treatment concept. Therefore I think osteopathy can provide a valuable contribution because it does not confine itself to looking only at certain structures, to treating only certain regions or to using only certain treatment techniques. Osteopathy considers the patient as a whole.

With this study I thus wanted to find out whether the effectiveness of osteopathic treatment for patients suffering from a subacromial impingement syndrome can be proven. Further I was interested in comparing the effectiveness of an osteopathic treatment with that of a conventional physical therapy treatment.

2 The Subacromial Impingement Syndrome (SIAS)

This chapter describes the specific anatomy of the subacromial space, the classification, pathology and aetiology, clinical examination and diagnosis of the subacromial impingement syndrome.

2.1 Anatomy of the subacromial space:

The subacromial space is formed by the superior aspect of the humeral head below, and the under surface of the acromion, the acromioclavicular joint, the coracoid process and the coracoacromial ligament above (Fig.1.).

Anatomically the *cranial boundary* of the subacromial space is the fornix humeri including the acromion, the coracoacromial ligament, the coracoid process and the acromioclavicular joint.

The width of the subacromial space can be influenced by the shape of the acromion (Type I-III, described by Bigliani, 1997), the coracoid process, and the variable thickness of the coracoacromial ligament. The *inferior boundary* of the subacromial space is formed by the tendon of the supraspinatus muscle, the anterior section of the tendon of the infraspinatus muscle and the coracohumeral ligament. The subacromial and subdeltoid bursa form the articular cavity of the subacromial secondary joint. The subacromial bursa is movable, connected with the musculature of the supraspinatus muscle about loose connective tissue. This plays an important role for gliding motions of the shoulder.

The width of the subacromial space varies among individuals. In general the subacromial space is wider posteriorly than anteriorly.

In an anatomical study of Peterson et al. (1984) the subacromial distance was found to be between 9 and 10 mm in 175 asymptomatic shoulders. A distance of less than 6 mm was considered pathology of rotator cuff disease.

The distance between humeral head and fornix humeri changes with the position of the arm; in internal rotation the subacromial space is smaller than in external rotation**.**

Fig 1.: The Subacromial Space
(Neer, C.S., 1990. p.44)

2.2 Definition of the Subacromial Impingement Syndrome:

Impingement syndrome was originally described by Neer (1972) as mechanical impingement of the supraspinatus and the long head of the biceps tendon underneath the acromial arch (Fig. 2). The primary pathology involves a bursal surface lesion. The condition is often classified as primary impingement, in contrast to secondary impingement, which involves primary instability.

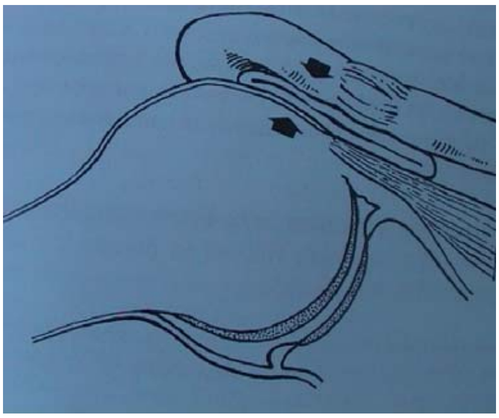


Fig.2: Primary Impingement
(Habermeyer, P., 2002. p.35)

2.3 Classification of SIAS:

Neer (1983) originally divided impingement lesions into three clinical stages (Tab1.).

In **stage I** lesions, overuse of the arm above the horizontal causes edema and hemorrhage. This lesion was felt to be more commonly seen in individuals less than 25 years of age and was reversible with rest and avoidance of the offending mechanism. A single traumatic event, wherein the humerus is impacted into the undersurface of the acromion, also can present in a similar fashion. Neer termed this type of lesion “acute traumatic subacromial bursitis”. Again, this condition tends to respond to rest and conservative care.

During **stage II**, repetition of the insulting events results in thickening and fibrosis of the subacromial bursa and the associated tendinitis. Typically, patients in this group are between 25 and 40 years of age. Neer again felt that the majority of these patients tended to improve with rest and conservative measures. However, persistent pain and disability after several months and failure of conservative care were felt to warrant surgical treatment with anterior acromioplasty and division of the coracoacromial ligament.

Stage III lesions represent partial or complete tearing of the rotator cuff tear, with possible biceps tendon rupture and associated bony changes. This was felt to occur in individuals more than 40 years of age. Neer felt that these patients could be improved after acromioplasty, bursectomy, and rotator cuff repair were performed as indicated.

Three Stages of Outlet Impingement

Stage I:

- **EDEMA and HEMORRHAGE**
  typical age < 25
  diff.diagnosis subluxation, A/C arthritis
  clinical course reversible
  treatment conservative

Stage II:

- **FIBROSIS and TENDINITIS**
  typical age 25-40
  diff.diagnosis frozen shoulder,calcium
  clinical course recurrent pain with activity
  treatment consider bursectomy; C/A ligament division

Stage III:

- **BONE SPURS and TENDON RUPTURE**
  typical age >40
  diff.diagnosis cervical radiculitis; neoplasm
  clinical course progressive disability
  treatment anterior acromioplasty; rotator cuff repair

Tab.1: Neer stages of outlet impingement

(Neer, C.S., 1990. p.54)

2.4 Incidence:

Van der Windt et al.(1995) and Vecchio et al.(1995) have postulated that subacromial impingement syndrome (SAIS) of the shoulder is the most common disorder of the shoulder, accounting for 44-65% of all complaints of shoulder pain during a physician´s office visit.
The authors believe that subacromial impingement is the primary underlying problem or a mitigating factor in many rotator cuff disorders.

2.5 Aetiology and Pathogenesis:

Multiple etiologic factors associated with the development of SAIS have been reported and are still under discussion.

- ***Glenohumeral joint kinematics:***

The glenohumeral joint possesses six degrees of freedom, three rotations and three translations. With simulated cadaver or active in vivo glenohumeral abduction in the scapular plane (approximately 30-40° anterior to the frontal plane), the humerus concomitantly externally rotates (Browne et al., 1990; An et al., 1991; Pearl et al., 1992). External rotation is important for clearance the greater tuberosity and its associated tissues as it passes under the coracoacromial arch, as well as for relaxation of the glenohumeral ligaments to allow maximum glenohumeral elevation (Brown et al., 1990; An et al., 1991). Limited glenohumeral external rotation during elevation has been hypothesized to lead to SIAS (Browne et al., 1990), however no evidence is available to support this postulate in patients with SAIS.
Excessive superior or anterior humeral head translation has been also hypothesized to lead to SAIS and rotator cuff degeneration (Ludewig and Cook, 2002; Deutsch et al., 1996; Paletta et al., 1997).

A decrease in the width of the acromio-humeral interval occurs during glenohumeral abduction (Flatow et al., 1994; Graichen et al., 1999a, 2001) and an increase in the con tact between the inferior acromion and underlying subacromial tissues occurs during glenohumeral abduction and flexion (Flatow et al., 1994; Brossmann et al., 1996; Solem-Bertoft et al., 1993). Contact pressure and force in the subacromial space has also been demonstrated to increase during glenohumeral abduction, with the highest subacromial force and contact pressure observed in the mid-range of motion (Nordt et al., 1999; Payne et al., 1997; Wülker et al., 1994a).

The long head of the biceps via its attachment on the anterior superior glenoid serves to stabilize the head of the humerus anteriorly and superiorly. Contraction of the biceps muscle has been demonstrated to result in a decrease in superior humeral head translation (Pradhan et al., 2000) and anterior translation (Kumar et al., 1989), as well as a decrease the pressure in the subacromial space (Payne et al., 1997)

Glenohumeral elevation range of motion is decreased in patients with SAIS (Ludewig and Cook, 2000; Lukasiewicz et al., 1999; Greenfield et al., 1995). This may be due, in part to the pain experienced during elevation as a painful arc during glenohumeral elevation is a common finding in this patients (Neer, 1972, 1983). This complaint of pain in the mid-range of glenohumeral abduction corresponds to the highest values of subacromial pressure (Nordt et al., 1999).

- ***Scapulothoracic articulation kinematics:***

The joint is described with five degrees of freedom, three rotations and two translations. Van der Helm and Pronk (1995) describe scapular upward rotation occurring about an anterior-posterior axis, with the inferior angle of the scapula moving laterally; External rotation occurring about a superior-inferior axis, with the lateral border of the scapula moving posteriorly; and posterior tilt occurring about a medial-lateral axis, with the inferior angle moving anteriorly. The predominant motion of the scapula during glenohumeral elevation is upward rotation, and to a lesser degree scapular external rotation and posterior tilt.

Scapular kinematics can be altered by various surrounding soft tissues and bone. Weak or dysfunctional scapular musculature (Ludewig and Cook, 2000; Mc Quade et al., 1998; Pascoal et al., 2000), fatigue of the infraspinatus and teres minor (Tsai, 1998), and changes in thoracic and cervical spine posture (Kebaetse et al., 1999; Ludewig and Cook, 1996; Wang et al., 1999). Other potential causes of altered scapular kinematics are weak or dysfunctional rotator cuff musculature, soft tissue tightness about the scapula, bony morphology or soft tissue changes at the coracoacromial arch, and shoulder pain.

- ***Tendon and bursa pathology:***

SAIS involves a degree of inflammation of the tendons or bursa of the subacromial space (Fu et al., 1991; Bigliani and Levine, 1997; Ogata and Uthloff, 1990). This inflammation will cause a decrease in the volume of the subacromial space, potentially leading to increased compression of the tissues against the borders of the subacromial space.

- ***Acromial morphology and shape:***

Dimensional changes in the subacromial space can be caused by variations in the architecture of the coracoacromial arch. One factor implicated is the acromion, specifically the morphology or the presence of osteophytes on the inferior aspect of the acromion or acromioclavicular joint (Fig.3).

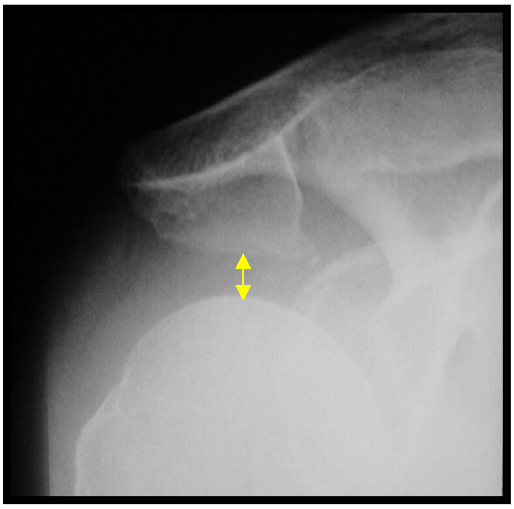


Fig.3.: Acromion type III

(Archiv, St.Vinzenz Shoulder and Sports Clinic, Vienna)

Another possible cause of encroachment into the subacromial space is the coracoacromial ligament. A thickened coracoacromial ligament (shown in Fig.4) can directly decrease the subacromial space, causing decreased space for tendon excursion (Yanai, 2006).

Other potential factors of the coracoacromial arch that may lead to subacromial impingement are the coracoid process and a unfused distal acromial epiphysis, or os acromiale. A deformity of the coracoid process that results in a encroachment into the subacromial space can cause impingement.

These findings suggest that the morphology or changes in the coracoacromial arch may result in compression of the structures of the subacromial space, thus contributing to SIAS. The question of whether degenerative changes in these tissues produce impingement or impingement produces degenerative changes remains to be answered.

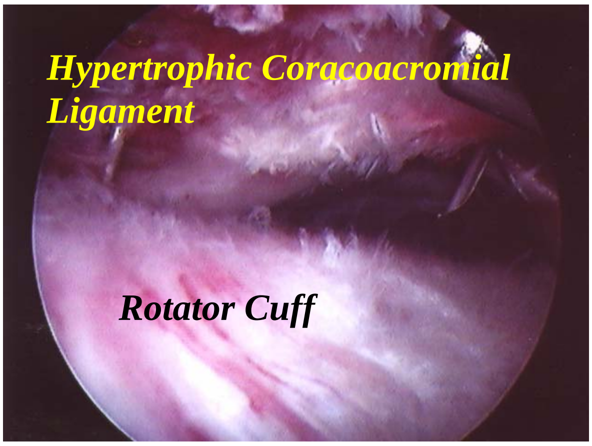


Fig.4: Hypertrophic coracoacromial ligament
(Anderl, W., 1992)

- ***Posture:***

Position and mobility of the thoracic and cervical spine, especially increased flexion of the upper thoracic spine, can directly influence scapulothoracic and glenohumeral kinematics and thereby lead to impingement (Lewis et al., 2005).

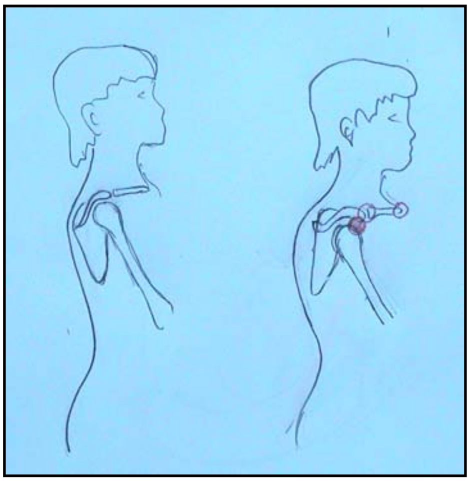


Fig.5: Influence of posture on scapular position
(Anderl, W. 2000)

- ***Posterior capsule:***

Posterior capsular tightnes may cause changes in glenohumeral kinematics leading to SAIS. Excessive superior and anterior humeral head translations can decrease the size of the subacromial space, leading to in creased mechanical compression of the subacromial structures (Flatow et al., 1994; Brossmann et al., 1996).

- ***Rotator cuff muscle:***

The rotator cuff muscles (supraspinatus, infraspinatus, subscapularis and teres minor) serve to maintain the congruent contact between the humeral head and the glenoid fossa by producing a compressive force during glenohumeral movements. The rotator cuff creates a downward force on the humeral head, resisting the upward shear force of the deltoid generated during active elevation of the arm. The loss of the rotator cuff force couple, resulting from pathological conditions (rotator cuff weakness, rotator cuff tendon defects) destabilize the balance of forces and lead to a superior translation of the humeral head, and thus increased mechanical compression of the subacromial contents (Payne et al., 1997).

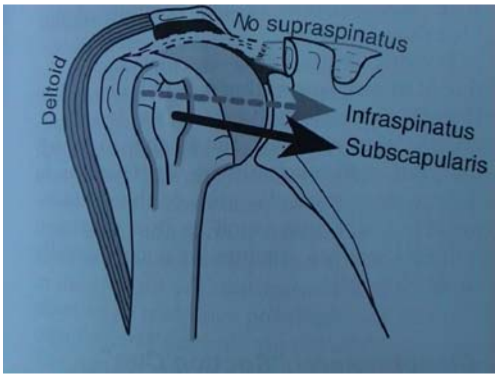


Fig.6: Glenohumeral force couple. The loss of the rotator cuff force couple results in superior translation of the humeral head.
(Matsen, F.A. et al. 1994. p.71)

- ***Scapular musculature:***

An important role of the scapular musculature is to stabilize the scapula to support the base of the glenohumeral joint. With a decrease in the stabilization of the scapula by the surrounding musculature, a change in scapular position or motion may result (Ludewig and Cook, 2000; McQuade et al., 1998; Pascoal et al., 2000). The altered scapular position can change the length-tension relationship of the muscles attached to the scapula, specifically the rotator cuff.

During glenohumeral elevation, the serratus anterior is required to work on concert with the trapezius to upwardly rotate the scapula to allow free movement of the subacromial structures under the coracoacromial arch (McQuade et al., 1998). Fatigue of the serratus anterior has resulted in an altered pattern of scapulohumeral rhythm in the range of 60-150° of glenohumeral motion (McQuade et al., 1998). Proper scapulohumeral rhythm is critical in this mid-range of glenohumeral motion, because that is the range in which impingement of the structures of the subacromial space will occur (Flatow et al., 1994; Brossmann et al., 1996). Changes in the timing and function of the upper and lower trapezius as well as the serratus anterior lead to changes in scapular kinematics, and thus most likely alter glenohumeral kinematics as well.

2.6 Clinical presentation:

Patients with impingement syndrome usually complain of functional losses due to pain, stiffness, weakness, and catching when their arm is used in the flexed and internally rotated position. Symptoms may also include difficulties in sleeping on the affected side and in carrying out routine activities of daily living, such as difficulty with dressing or inability to lift objects off shelves (Koester et al., 2005).

Pain is the primary complaint. This is usually described as sharp pain at the lateral aspect of the upper arm near the deltoid insertion, over the anterior proximal humerus, or in the periacromial area. In more advanced cases, pain may radiate proximally into the trapezius muscle and towards the cervical spine.

Pain is usually related to activity, in particular to elevation of the arm. Patients may still be able to reach full elevation, but complain of pain when the arm is near the horizontal, equivalent to the painful arc sign (Fig.7).

Fig.7: Painful arc
(Habermeyer, P., 2002, p.49)

Stiffness of the shoulder is mostly secondary to shoulder pain.
Weakness of the shoulder , if not due to pain, is generally evidence of advanced rotator cuff involvement.
Inspection of the shoulder may reveal deltoid or cuff atrophy, particularly if the condition had been chronic.
Palpation usually reveals little if any tenderness.
Range of motion is often limited, particularly in internal rotation and in cross-body adduction, indicating some degree of posterior capsular tightness (Lin et al., 2006).

2.7 Diagnosis:

This chapter describes the clinical and radiographic evaluation of patients with subacromial impingement syndrome using standard clinical tests and standard diagnostic imaging techniques.

2.7.1 Clinical examination:

2.7..1.1 History: Three major components of the patient´s interview are important: location, nature and behavior of symptoms.

2.7.1.2 Observation: The observation includes the assessment of symmetrie of the shoulders, position of scapula, posture and muscle contours. Also signs of inflammation, such as swelling or redness are noted.

2.7.1.3 Palpation includes noting warmth, tenderness, deformity, and crepitus.

2.7.1.4 Active range of motion:

- *Elevation:* Active elevation in the plane of the scapula (also known as “scaption”) offers an assessment of scapulohumeral rhythm and scapular stability. The movement should be observed for symmetry and quality of movement (Fig.8).
- *External rotation* should be tested simultanly for both sides at 0° and 90° of glenohumeral abduction.
- *Internal rotation* (hands behind back) is measured by having the patient take the thumb as far up the spine as possible and recording the level at which the thumb reaches the most superior aspect of the spine.
- *Passive range of motion* of the glenohumeral joint is usually normal, except in very advanced disease. This is assesse with one hand of the examiner stabilizing the scapula and the other hand moving the patient´s arm into flexion, abduction, and internal/external rotation.

Usually active arm motion is more painful than passive arm motion.

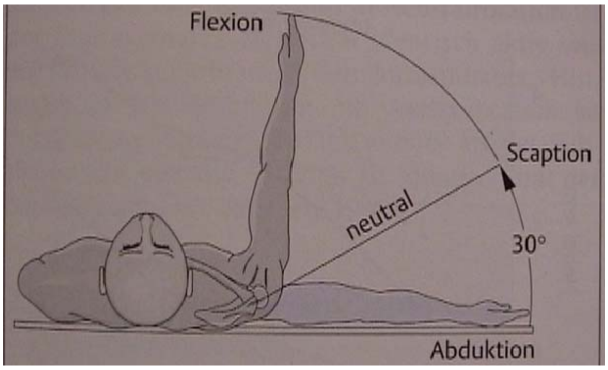


Fig. 8: Scaption: functional arc of arm elevation
(Hauser-Bischof, 2003. p.19)

2.7.1.5 Musculotendinous strength:

Resistive tests may be defined as isometric muscle tests for strength and provocation of pain. Usually glenohumeral abduction, internal and external rotation are tested.

2.7.1.6 Impingement Tests:

Impingement tests are designed to approximate the greater tubercle of the humerus and the acromion, thereby compressing the subacromial structures.

Neer Impingement Test :

The patient is seated while the examiner stands. Scapular external rotation is blocked with one hand while the other hand raises the arm in forced flexion, causing approximation of the greater tuberosity and the acromion. Pain implicates impingement of the supraspinatus and long head of biceps tendon (Fig.9).

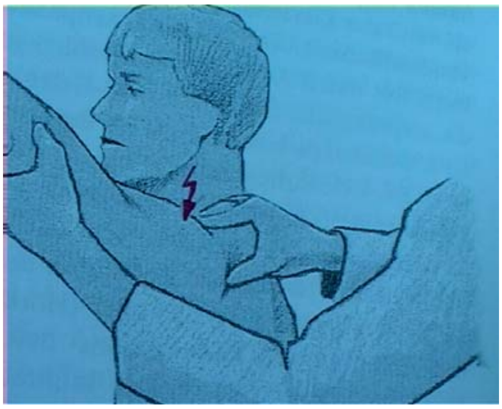


Fig. 9: Neer Impingement Test
(Habermeyer, P., 2002. p.55)

Hawkins and Kennedy Impingement Test:

The humerus is placed in 90° of flexion and then internally rotated (Hawkins 1980). The maneuver is accomplished by exerting force through the forearm to bring the distal glenohumeral joint into internal rotation. Pain implicates supraspinatus tendon impingement (Fig. 10).

Fig. 10: Hawkins and Impingement Test
(Hauser-Bischof, C., 2003. p.43)

2.7.2 Imaging techniques:

2.7.2.1 Radiographs:

Supraspinatus outlet view:

The supraspinatus outlet view is the most useful radiograph for assessement of the subacromial space and its pathology (Neer and Poppen 1987).

The acromion slope, i.e. the angle between the axis of the acromion and the axis of the body of the scapula, can be measured on the supraspinatus outlet view. More importantly, the curvature of the acromion undersurface can be assessed (Fig. 11).

Fig. 11: Supraspinatus Outlet view

(Archiv, St.Vinzenz Shoulder and Sports Clinic, Vienna)

2. 7.2.2 Ultrasonography:

Ultrasonography is particularly useful in assessing the rotator cuff, the subacromial bursa and the long biceps tendon (Wülker and Kohn 1991, Wülker and Rudert 1995).
Ultrasonographic examination must be comprehensively cover all shoulder structures that may participate in subacromial disease. In the initial phase of subacromial impingement, swelling compared to the contralateral side may be noted.

2.7.2.3 Magnetic resonance imaging (MRI):

MRI may be used to evaluate the quality of the rotator cuff muscles (Nakagaki et al 1994). Even though MRI is particularly useful for soft-tissue lesions, bone changes at the anteolateral border of the acromion (where osteophytes often occur) and at the under surface of the acromioclavicular joint are well represented with this technique.

2.7.2.4 Diagnostic subacromial injection:

If the subacromial space is the source of the patient´s symptoms, a decrease in pain and an improvement of motion and strength will occur within few minutes and last as long as the local anaesthetic is active.

2.8 Principles of Treatment:

(Algorithm for the management of subacromial impingement syndrome, St. Vinzenz Shoulder and Sports Clinic, KH BH Schwestern, Vienna).

All patients with subacromial impingement are initially treated non-operatively. Principles of treatment for Stage I are to reduce and eliminate inflammation, muscle control, and prevent muscle atrophy or weakness. The patient should be instructed to rest from activity but not function, and to perform all activities in front of the shoulder and below shoulder level. The patient would do well to take anti-inflammatory medicine, in conjunction with anti-inflammatory modalities including cryotherapy, iontophoresis or ultrasound.
Stage II impingement is characterized by fibrosis of the glenohumeral capsule and subacromial bursa and tendinitis of the involved tendons. The principles of treatment are similar to those of Stage I with the exception that the major goal is to restore full active and passive ROM (range of motion) to avoid further impingement and tissue damage. Manual therapy with traction and concave translation of the humeral head on the glenoid may be helpful.

Indications for operative treatment:

Operative Treatment is indicated in patients with subacromial impingement syndrome who have undergone a sufficient trial of non-operative treatment. The duration of non-operative treatment varies according to the severity of symptoms, the occupational and athletic demands and the patient´s general health. Non-operative treatment prior to surgery should last at least 3 months and will generally be closer to 6 months to 1 year.

3 Material and Methods

3.1 Purpose of the study

- Evaluating the efficacy of osteopathic treatment on patients with impingement syndrome using the Constant Murley Score (Constant et al., 1987).
- Comparison of two treatment groups: the treatment of subacromial impingement syndrome either by osteopathic treatment or by guided self-training.

3.2 Design of the study

A repeated measure design was used, with all measurements being taken before and after a 12-week intervention period. Shoulder function was assessed by use of the Constant-Murley score (1986), which includes pain, activities of daily living, pain-free range of motion, and muscle power.

Subjects were randomly assigned to either the osteopathic treatment group or the guided self-training group using the permuted block randomisation method. Following random assignment, examination before and after 12 weeks of treatment was performed by the same orthopaedic physician. . Both the subject and examiner were blinded to group assignment. The principal investigator (osteopath) performed all treatments in group I, subjects of group II were instructed by an experienced physical therapist who was trained by the principal investigator. We designed the program to be simple and require a low number of visits. The program was essentially a home program with 3 times coaching in 12 weeks. The patients of the osteopathic group received 6 treatments over the 12-week period.

Constant Murley Score

The Constant score is a widely used shoulder-specific scoring system (Tab.2). First published by Constant and Murley in 1987, it proposes a scoring system directed exclusively toward a numeric description of the quality of function of the shoulder. It uses subjective and objective measures to determine whether a certain functional movement is possible. The Constant score includes an analysis of pain, shoulder motion, strength, and function. Each is given points as shown in Table 2. From a perfect score of 100, it reserves 35 points for patient-reported subjective assessment, including the presence of pain and the ability to perform basic activities of daily living, and 65 points for objective measurement. For the latter, 40 points are allocated to range of motion and 25 points are allocated to strength.

Strength was assessed by use of the Isobex Dynamometer (Cursor AG, Bern, Switzerland). This is a microprocessor-driven device whose measurement is triggered by a minimum force of 1 kg. It disregards the first second of force application, where a rapid linear increase in force is noted typically, and averages 10 readings per second for the following 3 seconds of force application to produce a strength reading. All measurements were made in the scapular plane of abduction. A maximum of 25 points is avoided for the ability to hold 12,5 kg or more at 90° in the plane of the scapula.

Pain (average between a verbal assessment and a reverse linear analog scale between 0 and 15)	
	Points
No pain	15
Mild pain	10
Moderate pain	5
Severe pain	0
Activities of daily living (part I)	
Full work	4
Full recreation/sport	4
Unaffected sleep	2
Total	10
Activities of daily living (part II)	
Positioning	
Up to waist level	2
Up to the xiphoid process	4
Up to neck level	6
Up to the top of the head	8
Above the head level	10
Painless active range of motion	
Forward elevation and abduction (in degrees assessed with the goniometer)	
0-30°	0
31-60°	2
61-90°	4
91-120°	6
121-150°	8
151-180°	10
Functional external rotation	
Hand behind head with elbow held forward	2
Hand behind head with elbow held back	2
Hand on top of the head with elbow held forward	2
Hand on top of the head with elbow held back	2
Full elevation from top of the head	2
Total	10
Functional internal rotation	
Dorsum of the hand to lateral thigh	0
Dorsum of the hand to buttock	2
Dorsum of the hand to lumbosacral junction	4
Dorsum of the hand to L3	6
Dorsum of the hand to TH12	8
Dorsum of the hand to interscapular level	10
Strength (average 3 times for 5-second period) in pounds	25 maximum

Tab. 2: The Constant score
(Constant, C.R., Murley, A.H.G., 1987)

3.3 Subjects

A total of 26 subjects were initially recruited and were judged to meet the criteria for the study. Subjects were recruited from Krankenhaus der Barmherzigen Schwerstern, Vienna. Six subjects did not complete the study, leaving a total of 20 subjects. The reasons for dropping out of the study were different: one subject decided to have injections rather than participate in an exercise program, two subjects started also with accupuncture and ultrasound, and three subjects simply did not return and did not give an explanation.
Eleven female and 9 male patients diagnosed with primary subacromial impingement syndrome were enrolled. Five female and five male of group I (osteopathic group), and six female and 4 male of group II (self-training group) completed the study.

Inclusion criteria:

The diagnosis of subacromial impingement syndrome was made by an orthopaedic surgeon using clinical examination, x-ray in three planes, MRI and ultrasound examination. The Neer test (subacromial injection of 10ml Xyloneural) was positive in all patients.

Exclusion criteria:

Exclusion criteria were full-thickness tear of the rotator cuff, frozen shoulder, disorders of the acromioclavicular joint, symptomatic osteoarthritic disorders of the glenohumeral joint, concomitant cervical radiculopathy and involvement in workers compensation claims. Subjects who were judged to have glenohumeral instability or previous shoulder surgery were also excluded.

After informed consent was obtained, 26 consecutive patients with impingement syndrome of the shoulder were randomized into two different treatment groups:

3.4 Groups

Group 1: Osteopathic Treatment

The patients of group 1 received a maximum of 6 osteopathic treatments over a period of 12 weeks.
The patients belonging to this group were examined according to osteopathic principles.

In this osteopathic treatment I proceeded as follows:

1. Case history
2. Observation
3. General and local listening
4. Thermodiagnostics
5. Palpation
6. Tests of function: identification of mechanical dysfunctions in active and passive movements of the whole locomotor system
7. Craniosacral screening
8. Test of visceral functions
9. If indicated additional tests: neurological tests, provocation tests

The most important difference between an osteopathic examination and an examination according to physical therapy or orthopaedic principles in patients with a subacromial impingement syndrome resides in the fact that in an osteopathic evaluation not only the shoulder region and at best the cervical and thoracic spine are examined but the whole individual is taken into consideration. Influences from the lower extremities and the pelvic region will be considered as well as – for instance – visceral and cranial influences.

The osteopathic treatment was guided by the findings of the examination. In every new session the patient was re-evaluated and the treatment adapted to the new findings. The annex includes a case study of one patient.

Group 2: Self-training

The patients of the self-training group were instructed in a standardized self-training program to strengthen the rotator cuff and scapular stabilizers, enhance flexibility of thoracic and cervical spine and glenohumeral posterior capsule. Subjects also were given education related to shoulder anatomy, pathogenesis and strategies for reducing load on the shoulder during DLA.

The self-training program was taught to patients under the guidance of a physiotherapist for a maximum of three sessions. The patients were instructed to do the training at least 5 times a week for 10 to 15 minutes. A diary was used to document the frequency and the progression of self-training.

The exercises were chosen according to the initial clinical findings. Instructions for the exercise program were printed with Physio Tools software (Physio Tools Sverige, Malmö, Sweden) and given to patients. The exercise program was divided into two stages. Each stage has goals that are established and criteria that must be met before moving into the next stage. For most of the exercises, an elastic Thera-Band (The Hygenic Corporation, 1245 Home Ave, Akron, OH 44310) was used.

Stage I: The patient was instructed to maintain his arm below shoulder level and in front of the shoulder to avoid impingement. The patient was also advised of the following: sleeping on the contralateral side with a pillow under the affected arm, avoiding undue repetition and prolonged static work postures as well as avoiding reaching and lifting activities.

1. *Shoulder external rotation*: starting in approximately 45 degrees of internal rotation, with the arm by the side and the elbow flexed to 90 degrees.
2. *Shoulder internal rotation*: starting in approximately 45 degrees of external rotation, with the arm by the side and the elbow flexed to 90 degrees.
3. *Shoulder extension*: starting with the arm forward flexed approximately 45 degrees.

Fig. 12: Exercises of Stage I

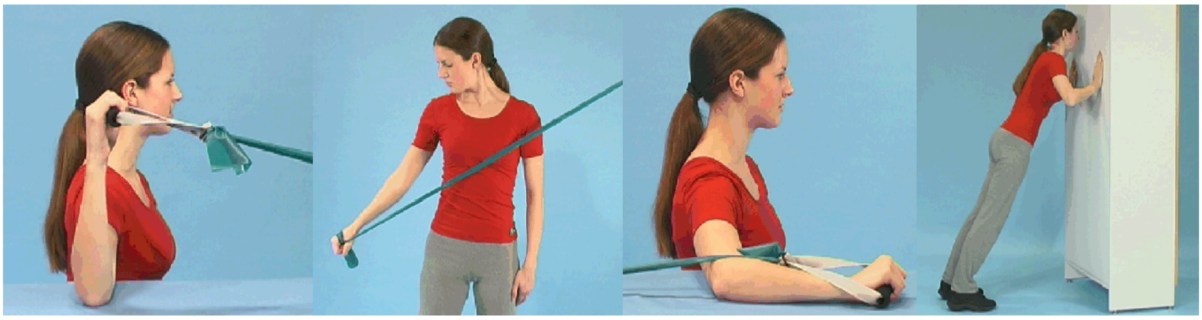
The subjects were instructed to start with the yellow band under very mild tension in pain-free range. Three sets of 5-20 repetitions were recommended.

The criteria for progress into Stage II of the exercise program were decreased inflammatory signs (no discomfort at rest, good tolerance of above program) and ability of passing 3 sets of 20 repetitions without feeling pain or fatigue.

Stage II: The next strongest elastic band was used. New exercises were added when patients had progressed using the green elastic band.

1. *Shoulder external rotation* at 45° abduction in the scapular plane with elbow flexed 90°: starting from internal rotation to pain-free external rotation
2. *Shoulder abduction* (scapular plane) through a 0- to 60 degree arc, pulling the band down and away from the body.
3. Shoulder flexion in a sitting position with the arm lifted to the side and supported on a table, extending the elbow and flexing the shoulder.
4. *Scapular stabilizers strengthening* in a standing position with push-up into wall.

Fig. 13: Exercises of Stage II (1-4)



The subjects were instructed to start with light resistance, beginning with three sets of 10 repetitions with progression to 20 repetitions.

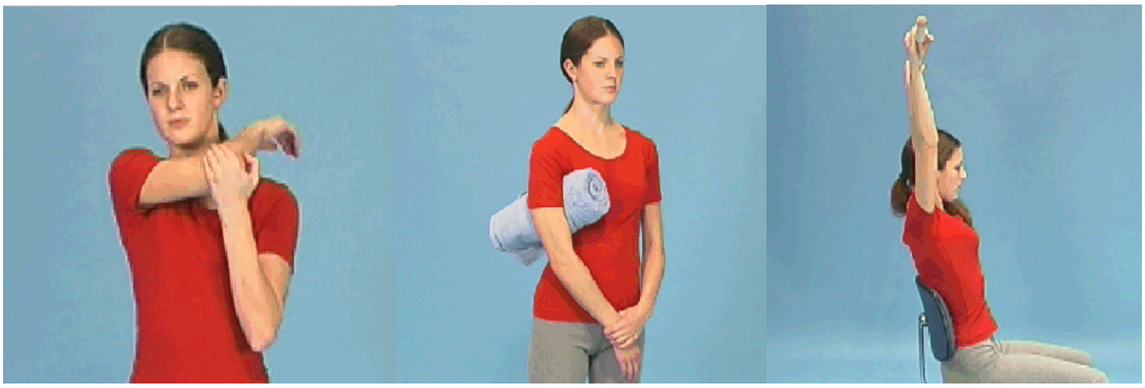
Flexibility exercises for the shoulder were done throughout the 12-week period and consisted of the following (Fig. 14):

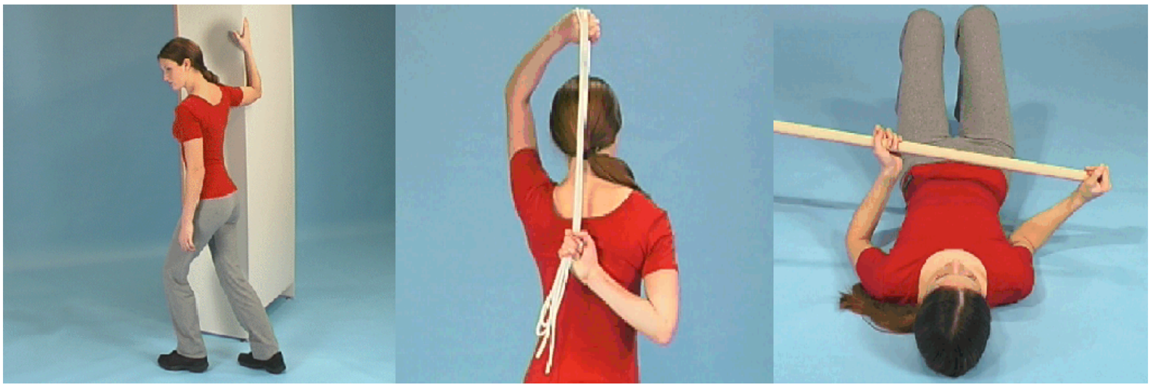
1. *Posterior capsule self-stretch*: The subjects were instructed to pull involved arm across chest to stretch the back of the involved shoulder by holding at end point.
2. *Distraction of glenohumeral joint*: The patient was instructed to put a towel under the armpit, taking the wrist with the opposite hand and moving the arm across the body, pulling it softly toward the ground.
3. *Shoulder flexion stretch*: Subjects were instructed to hold a stick with both hands while lying supine and use the unaffected arm to raise both arms overhead until they felt a comfortable stretch.

4. *Doorway pectoral muscle stretch*: Subjects were instructed to stand to the side of a doorframe and grasp the doorframe at shoulder height and then rotate the upper body away from the door.
5. *Internal rotation stretch*: The patient was instructed to hold a stick or towel with the affected side behind the back and to use the other arm to pull the affected arm up the back.
6. *Shoulder external stretch*: Subjects were instructed to lie on back with involved arm against body and elbow bent at 90°, holding a stick with both hands and to use the unaffected arm to move affected shoulder into external rotation.

All subjects were also given exercises to enhance cervical and thoracic flexibility.

Fig.14: Exercises for shoulder flexibility





4 Results

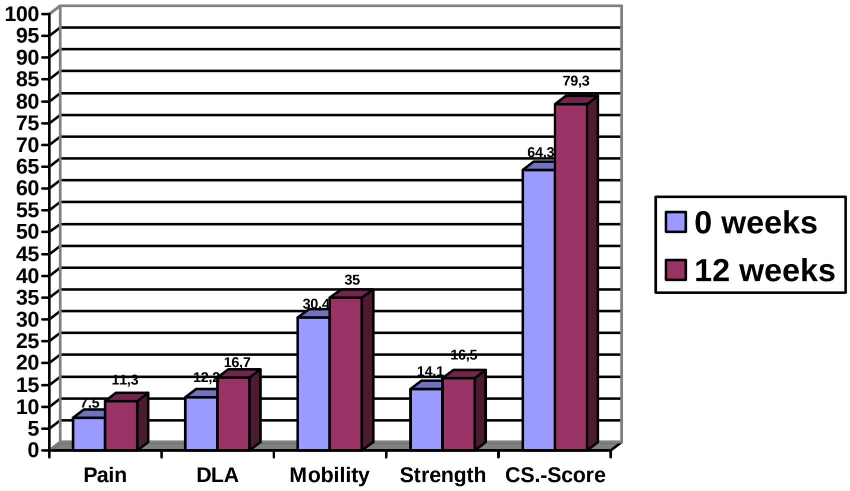
The statistical analysis did not show any significant differences in age, duration of desease, pain level and initial outcome of the Constant–Murley score . Details of the two therapy groups are illustrated in Table 3.

Tab. 3: Details of the two therapy groups

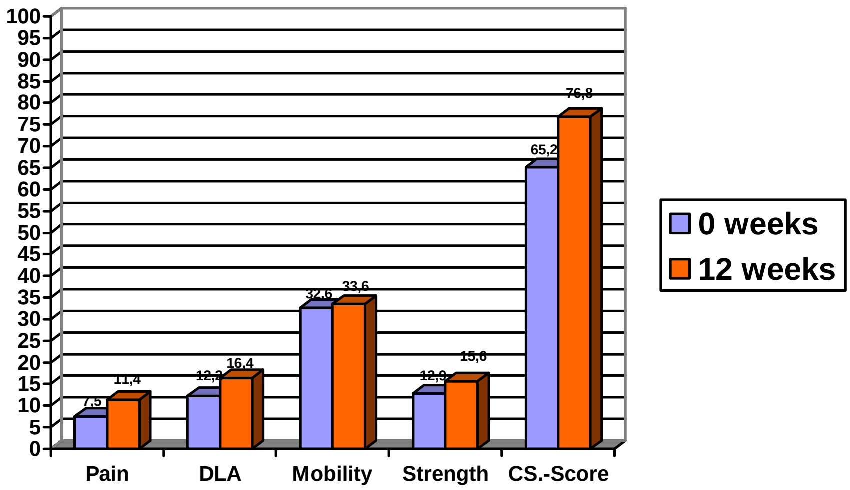
Group	Age(y)		Sex		Affected Side		Duration of Symtoms (mo)	
	Mean	Range	Female	male	non dominant	dominant	Mean	Range
I Osteopathy	57.1	38-73	5	5	6	4	10.8	3-24
II Self-training	55.2	33-70	6	4	6	4	9.8	3-18

Both groups showed an improvement in the overall Constant-Murley score within 3 months, however, the improvement showed no difference among the two groups (Tab. 4, Tab.5).

Tab. 4: Constant-Score of Group 1 (Osteopathy treatment group):

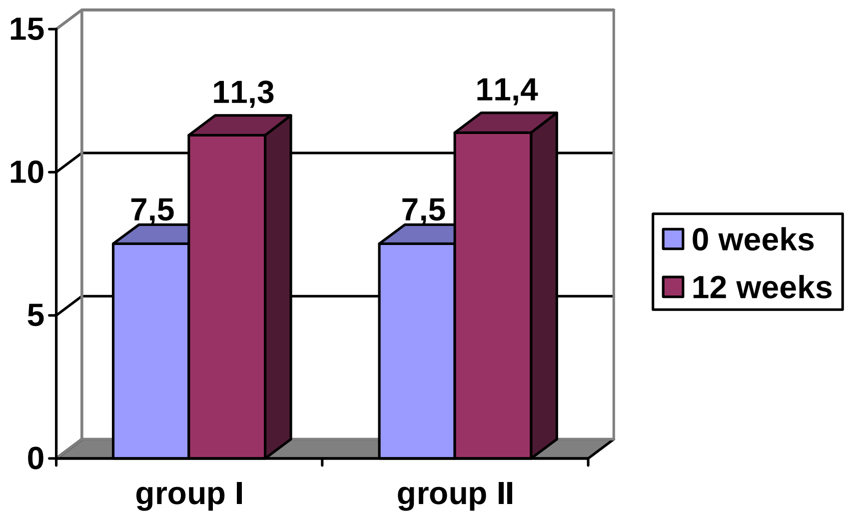


Tab. 5: Constant-Score of Group 2 (standardized self –training group)

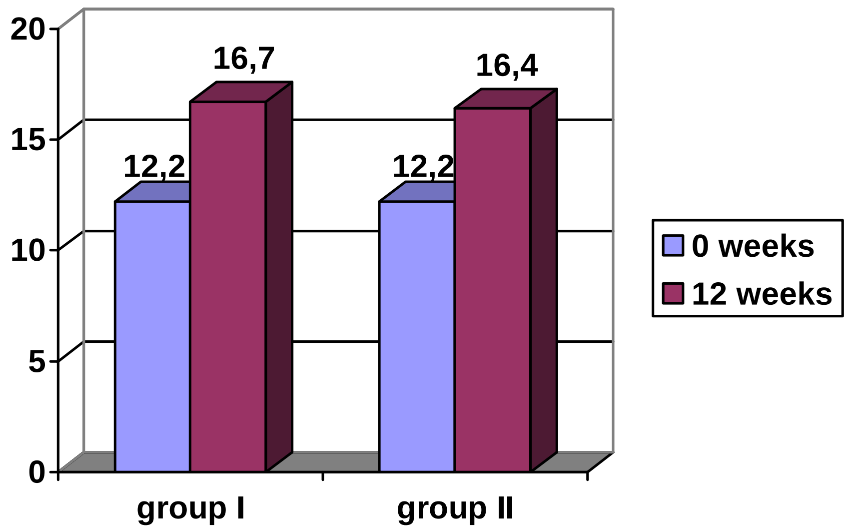


The analysis of isolated subitems within the Constant-Murley score concerning pain, muscle strength, and DLA (daily life activities), showed a significant improvement in both groups (Tab.6, Tab.7, Tab.8). The comparison of these items between group 1 and group 2 showed no significant difference (Tab.10).

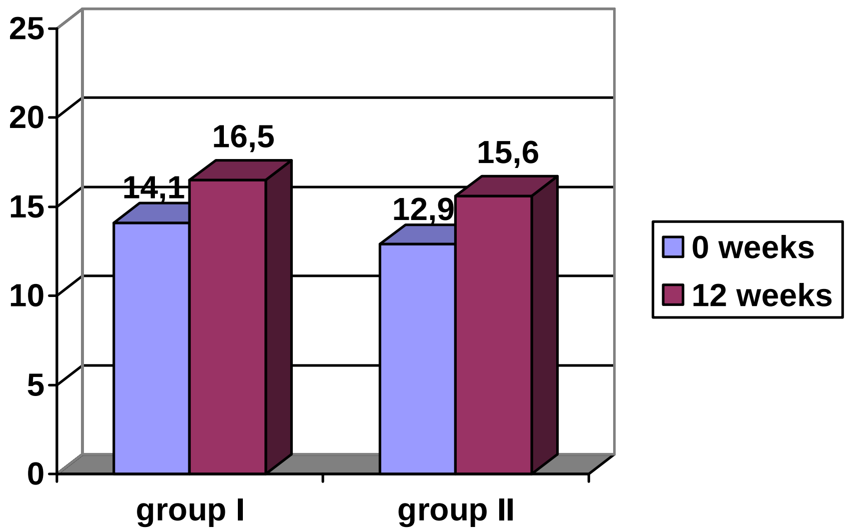
Tab. 6: Pain scores of group I/II before treatment and after 12 weeks of therapy



Tab. 7: DLA scores of group I/II before treatment and after 12 weeks of therapy

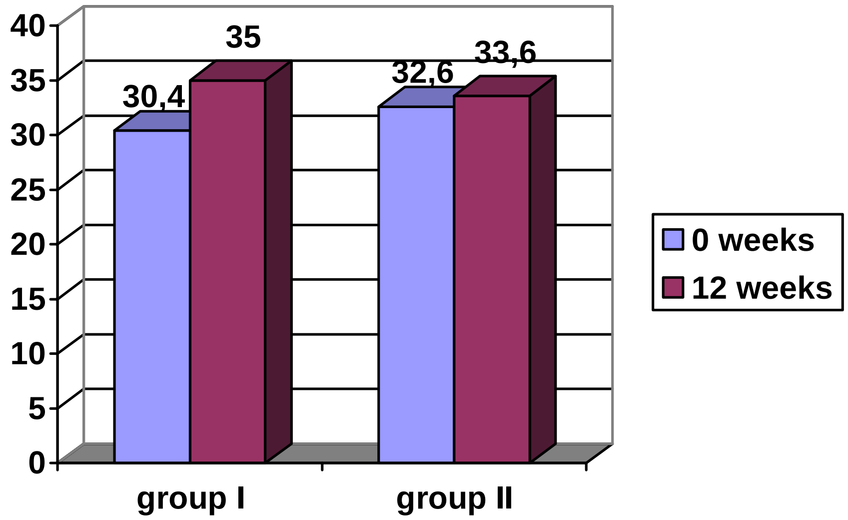


Tab. 8: Strength scores of group I/II before treatment and after 12 weeks of therapy



The evaluation of mobility within the Constant-Murley score revealed a significant difference between group 1 and group 2 using the Mann/Whitney-U-test .During the first examination, the measurement of mobility in group 1 showed a mean value of 30,4 points, group 2 had a mean value of 32,6. After 12 weeks, group 1 achieved a mean value of 35 points, group 2 had a mean value of 33,6 points. (Tab.9 / Tab.10)

Tab. 9: Active Mobility scores of group I/II before treatment and after 12 weeks of therapy



Tab. 10: Mann-Whitney-U tests for dependent variables following treatment

Variable	GroupI(n=)	GroupII(n=)	U (I/II)	*p*	Significance
Pain	10	10	47/53	0,81036941	NS
ADL	10	10	50/50	1	NS
Mob	**10**	**10**	**80/20**	**0,0971222**	**Significant**
Strength	10	10	55/45	0,68746822	NS

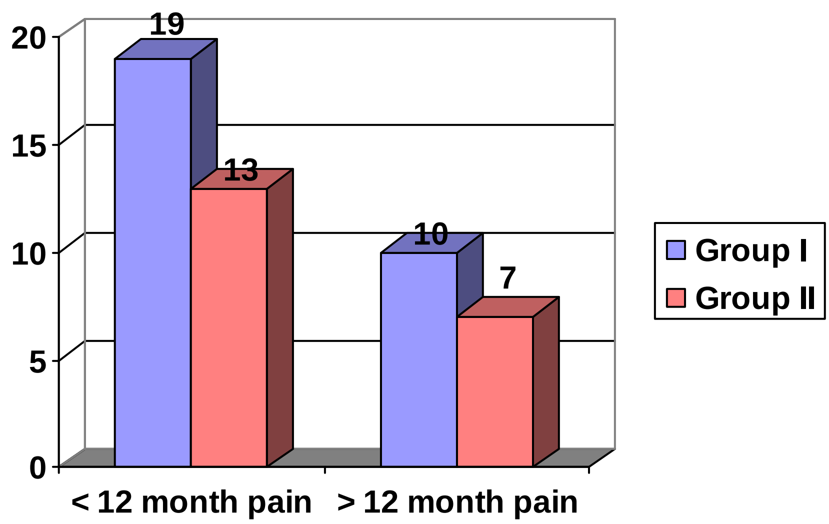
A correlation between results in the Constant-Murley score and the acromion type in the outlet view projection could not be found within both groups.

The investigation about the influence of the duration of subacromial pain period before treatment on the average improvement points in the overall Constant Score (Tab.11/Tab12) revealed that a pain period less than 12 months leads to a significant higher improvement in the overall Constant Score in both groups than a pain period longer than 12 months.

Additionaly, the ostheopathic group (group I) guaranties a significant higher average improvement in the overall Constant Score (19 points) than the guided self-training group (13 points) if the pain period is less than 12 months.

The difference between both groups was not significant if pain existed more than 12 months.

Tab. 11: Amount of average improvement in the Constant score dependent from duration of subacromial pain period before treatment



Tab. 12 : Frequences and Mann-Whitney-U test for influence of subacromial pain period on the amount of improvement in the constant score in both therapy groups

Variable	GroupI	GroupII	U (I/II)	Z	*p*	Significance
> 12month	5	3	11,5/3,5	-1,2070255	0,22742232	non significant
< 12month	5	7	31,5/3,5	-2,3186203	0,02041563	**significant**

To examine whether age, sex and hand dominance affected results, independent sample *t*-tests, Mann-Whitney U tests and Fishers Exact tests were used.
Age, sex and side of dominance had no effect on the outcomes.

5 Discussion

The primary purpose of this study was to evaluate the effectiveness of the osteopathic treatment on patients with subacromial impingement syndrome. The second purpose of this study was to find out if the osteopathic treatment offers advantages comparing to a conventional physiotherapeutic self-training program concerning pain, mobility, function and muscle strength.

Subacromial Impingement Syndrome is one of the most common shoulder disorders in adults. The natural cause of SIAS is poorly described, but evidence suggests that the condition is not self-limiting (Chard, 1988).

Defects in proprioception, and motor coordination of the rotator cuff and the deltoid muscle were recently discussed as playing a major role in the development of SIAS. This is one of the main reason why physiotherapy is considered to be the first choice in conservative treatment. A benefit of guided self-training could be demonstrated by Anderson et al. (1999) who consider guided self-training as a major part of the rehabilitation of subacromial disorders.

Walther et al. (2004) compared in a prospective, randomized study the results of treating SIAS by guided self-training program with the treatment by conventional physiotherapy or a functional brace. Sixty patients were randomly assigned to one of the three groups. The Constant-Murley score was assessed after 6 and 12 weeks. Shoulder pain was monitored with a visual analog scale. All three methods led to a significant improvement in the Constant-Murley score, and significant decrease in pain level over a period of 12 weeks. The differences among the three groups were small, and not statistically significant. This confirms the effect of muscular strengthening of the rotator cuff either by physiotherapy or by guided self-training. Interesting was that the control group treated with a functional brace achieved results similar to those of the exercising groups, although the concept of centering the humeral head is not accomplished with this treatment. Analysis of the subitems of Constant-Murley score showed that the functional brace led to a significant improvement in strength compared with the exercising groups. The authors suggest that the increase in muscle strength can be explained by pain reduction rather than limitation of excursions within the shoulder joint by the brace. A second possible reason could be an improvement of the neuromuscular control in the movement patterns of the shoulder girdle and the scapulohumeral rythm.

.

Bang and Deyle (2000) compared 52 subjects who were randomly assigned to 1 of 2 groups: a group that received supervised exercise with manual therapy and a group that received supervised exercise without manual therapy. The exercise group performed supervised flexibility and strengthening exercises, while the manual therapy group performed the same program and received manual physical therapy treatment. Manual therapy included individualized joint mobilisation to the glenohumeral, cervical or thoracic spine articulations, massage or muscle strengthening techniques. Both groups were treated 2 times per week for 3 weeks. The researchers measured pain, isometric force, and function. Although both groups showed improvement, the subjects who received manual therapy showed greater gains in pain reduction, and increase in function than the subjects who did not receive manual therapy. Strength in the manual therapy group improved significantly.

Based on the conflicting results of these studies it was my intention to examine the efficacy of osteopathic treatment in comparison to a self-training program.

At the beginning of our study there were no significant differences between groups on the dependent variables of pain, mobility, function, and muscle strength. The majority of the patients in both groups experienced SIAS on their non-dominant side. Following treatment both groups improved in pain reduction, function and strength without any significant differences. From interest was that the osteopathic treatment led to a significant improvement in pain-free active range of motion in contrast to the self-training group. There are several explanations why the osteopathic treatment performs better: The improvement in range of motion may be in part the product of many factors. Beneath neurophysiologic reduction in pain, and associated muscle guarding, mechanical reduction in edema, improved rotator cuff and shoulder girdle strength, or improved extensibilty of the shoulder musculotendinous and capsuloligamentous structures which can be also treated by the self-training group the osteopathic treatment includes further consideration of potential sources of shoulder pain. The osteopathic treatment offers not only local joint mobilization techniques but also relevant structures for the shoulder girdle (such as diaphragm, liver, gallbladder, lungs, heart, stomach, colon, etc.; influences from pelvis or lower extremity). In my point of view, osteopathic treatment guaranties a more precise treatment of abnormal thoracic and cervical spine problems, mostly associated with altered position of the scapula. Abnormal spine curves can result from chronic poor posture which may result in shoulder girdle muscle imbalance, altered muscle length, tension relationships, joint incongruity, ligamentous laxity, changes in arthrokinematics and cross shoulder motion (Greenfield 1995).

In my study age apperently had little influence on a subject´s response to both treatment groups for SIAS. One cause therefore could be that younger subjects may recover more rapidly due to fewer age-related degenerative changes, but on the other hand they may be disadvantaged secondary to increased activity risks. The effect of hand-dominance was also explored relative to the rate of occurrance and the degree of improvement in this patient population.

Duration of involvement was also explored, theorizing that subjects with more chronic involvement may not respond as well as their shorter duration counterparts. I could not find any differences between subjects with less than 12 months of symptoms and subjects with more than 12 months of symptoms on any of the dependent variables.

The weakness of my study is the small number of patients. Further studies are required to explore the efficacy of osteopathic treatment for SIAS using an adequate number of subjects to assure the power of the conclusions. Although the results of the self-training group were similar to the results reported from the literature (Walther 2004), I would recommend more physical therapy visits to have a better control on the frequency and on the quality of carrying out the exercises.

In my study I was focused on the assessement of the shoulder function. For further research it would be from great interest if any of both treatment options will lead to differences in quality of life scores.

6 Conclusion

This study confirms the hypothesis that osteopathic treatment leads to a significant improvement of pain reduction, function, muscle strength, and mobility in patients with subacromial impingement syndrome.

The comparison of the osteopathic treatment to an accepted self-training program showed that the osteopathic approach results in significant better mobility. All other subitems in the Constant score (pain reduction, daily life activities, and muscle strength) improved equal in both therapy groups.

7 References

An, K.N., Browne, A.o, Korinek, S., Tanaka, S., Morrey, B.F., 1991. Three-dimensional kinematics of glenohumeral elevation. J. Orthop. Res. 9, 143-149.

Anderson, N.H., Sojbjerg, H.V., Johannsen, H.V., Sneppen, O., 1999. Self-training versus physio-therapist-supervised rehabilitation of the shoulder in patients treated with arthroscopic subacromial decompression: a clinical randomized study. J Shoulder Elbow Surg 8, 99-101.

Bang, M.D., Deyle G.D., 2000. Comparison of supervised exercise program with and without manual physical therapy for patients with shoulder impingement syndrome. J Orthop Sports Phys Ther. 2000;30:126-137.

Bigliani, L.U., Levine, W.N., 1997. Subacromial impingement syndrome. J. Bone Joint Surg. Am. 79, 1854-1868.

Brossman, J., Preidler, K.W., Pedowitz, R.A., White, L.M., Trudell, D., Resnick, D, 1996. Shoulder impingement syndrome: influence of shoulder position on rotator cuff impingement – an anatomic study. AJR Am. J. Roentgenol. 167, 1511-1515.

Browne, A.O., Hoffmeyer, P., Tanaka, S., An, K.N., Morrey, B.F., 1990. Glenohumeral elevation studied in three dimensions. J. Bone Joint Surg. Br. 72, 843-845.

Chard, M.D., Satelle, L.M., Hazelman, B.L., 1988. The long-term outcome of rotator cuff tendonitis. A review study. Br. J Rheumatol. 27, 385-389.

Constant, C.R., Murley, A.H.G., 1987. A clinical method of functional assessment of the shoulder. Clin. Orthop. 214, 160-164.

Deutsch, A., Altchek, D.W., Schwartz, E., Otis, J.C., Warren, R.F., 1996. Radiologic measurement of superior displacement of the humeral head in the impingement syndrome. J. Shoulder Elbow Surg. 5, 186-193.

Flatow, E.L., Soslowsky, L.J., Ticker, J.B., Pawluk, R.J., Hepler, M., Ark, J., et al., 1994. Excursion of the rotator cuff under the acromion. Patterns of subacromial contact. Am. J. Sports Med. 22, 779-788.

Fu, F.H., Harner, C.D., Klein, A.H., 1991. Shoulder impingement syndrome. A critical review. Clin. Orthop., 162-173.

Graichen, H., Bonel, H., Stammberger, T., Englmeier, K.H., Reiser, M., Eckstein, F., 1999a. Subacromial space width changes during abduction and rotation – a 3-D MR imaging study. Surg. Radiol.Anat. 21, 59-64.

Graichen, H., Bonel, H., Stammberger, T., Englmeier, K.H., Reiser, M., Eckstein, F., 2001. Sex-specific differences of subacromial space width during abduction, with and without muscular activity, and correlation with anthropometric variables. J. Shoulder Elbow Surg. 10, 129-135.

Greenfield, B., Catlin, P.A., Coats, P.W., Green, E., McDonald, J.J., North, C., 1995. Posture in patients with shoulder overuse injuries and healthy individuals. J. Orthop. Sports Phys. Ther. 21, 287-295.

Hawkins, R.J., Kennedy, J.C., 1980. Impingement syndromes in athletes. Amer. J. Sports Med. 8, 151-158.

Kebaetse, M., McClure, P., Pratt, N.A., 1999. Thoracic position effect on shoulder range of motion, strenght, and three-dimensional scapular kinematics. Arch. Phys. Med. Rehabil. 80, 945-950.

Kim, D.H., Millett, P.J., Warner, J.J., Jobe, F.W., 2004. Shoulder injuries in golf. Am J Sports Med. 2004 Jul-Aug; 32(5):1234-30.

Kumar, V.P., Satku, K., Balasubramaniam, P., 1989. The role of the long head of the biceps brachii in the stabilization of the head of the humerus. Clin. Orthop. 172-175.

Lewis, J.S., Green, A., Wright, C., 2005. Subacromial impingement syndrome: the role of posture and muscle imbalance. Shoulder Elbow Surg. 14(4), 385-92.

Lin, J.J., Lim, H.K., Yang, J.L., 2006. Effect of shoulder tightness on glenohumeral translation, scapular kinematics, and scapulohumeral rythm in subjects with stiff shoulders. J Orthop Res., 1044-51.

Ludewig, P.M., Cook, T.M., 2000. Alterations of shoulder kinematics and associated muscle activity in people with symptoms of shoulder impingement. Phys. Ther. 80 (3), 276-291.

Ludewig, P.M., Cook, T.M., 2002. Translations of the humerus in persons with shoulder impingement symptoms.
J. Orthop. Sports Phys. Ther. 32, 248-259.

Lukasiewicz, A.C., McClure, P., Michener, L., Pratt, N., Sennett, B., 1999. Comparison of three-dimensional scapular position and orientation between subjects with and without shoulder impingement. J. Orthop. Sports Phys. Ther. 29, 574-583.

McQuade, K.J., Dawson, J., Smidt, G.L., 1998. Scapulothoracic muscle fatigue associated with alterations in scapulohumeral rythm kinematics during maximum resistive shoulder elevation. J. Orthop. Sports Phys. Ther. 28, 74-80.

Nakagaki, K., Ozaki, J., Tomita, Y., Tamai, S., 1994. Alterations in the supraspinatus muscle belly with rotator cuff tearing: evaluation with magnetic resonance imaging. J. Bone Elbow Surg. 3:88.

Neer, C.S., 1972. Anterior acromioplasty for the chronic impingement syndrome of the shoulder: a preliminary report. J Bone Joint Surg 54A:41-50.

Neer, C.S., 1983. Impingement lesions. Clin Orthop., 70-77.

Neer, C.S., Poppen, N.K.,1987. Supraspinatus outlet. Orthop. Trans. 11, 234.

Nordt III, W.E., Garretson III, R.B., Plotkin, E., 1999. The measurement of subacromial contact pressure in patients with impingement syndrome. Arthroscopy 15 (2), 121-125.

Ogata, S., Uthloff, H.K., 1990. Acromial enthesopathy and rotator cuff tear. A radiologic and histologic postmortem investigation of the subacromial arch. Clin. Orthop., 39-48

Paletta Jr., G.A., Warner, J.J., Warren, R.F., Deutsch, A., Altchek, D.W., 1997. Shoulder kinematics with two-plane X-ray evaluation in patients with anterior instability or rotator cuff tearing. J. Shoulder Elbow Surg. 6, 516-527.

Pascoal, A.G., van der Helm, F.F., Pezarat, C.P., Carita, I., 2000. Effect of different arm external loads on the scapulo-humeral rythm. Clin. Biomech. (Bristol, Avon) 15, S21-S24.

Payne, L.Z., Deng, X.H., Craig, E.V., Torzilli, P.A., Warren, R.F., 1997. The combined dynamic and static contributions to subacromial impingement. A biomechanical analysis. Am. J. Sports Med. 25, 801-808.

Peterson CJ, Redelund-Johnell I: The subacromial space in normal shoulder radiographs. Acta Orthop Scand 55:57, 1984.

Pradhan, R.L., Itoi, E., Kido, T., Hatakeyama, Y., Urayama, M., Sato, K., 2000. Effects of biceps loading and arm rotation on the superior labrum in the cadaveric shoulder. Tohoku J. Exp. Med. 190, 261-269.

Solem-Bertoft, E., Thuomas, K.A., Westerberg, C.E., 1993. The influence of scapular retraction and protraction on the width of the subacromial space. An MRI study. Clin. Orthop., 99-103.

Tsai, N., 1998. Change in scapular kinematics with induced fatigue of infraspinatus and teres minor. Master´s thesis, MCP Hahnemann University.

van der Helm, F.C., Pronk, G.M., 1995. Three-dimensional recording and description of motions of the shoulder mechanism. J. Biomech. Eng. 117, 27-40.

van der Windt D.A., Koes B.W., de Jong B.A., Bouter L.M.,1995. Shoulder disorders in general practice: incidence, patient characteristics, and management. Ann. Rheum. Dis. 54, 959-964.

Vecchio, P., Kavanagh, R., Hazleman, B.L., King, R.H., 1995. Shoulder pain in a community-based rheumatology clinic. Br. J. Rheumatol. 34, 440-442.

Walther, M.D., Werner, A., Stahlschmidt, T., Woelfel, R., Gohlke, F., 2004. The subacromial impingement syndrome of the shoulder treated by conventional physiotherapy, self-training, and a shoulder brace: Results of a prospective, randomized study. J Shoulder Elbow Surg 13, 417-423.

Wang, C.H., McClure, P., Pratt, N.E., Nobilini, R., 1999. Stretching and strengthening exercises: their effect on three-dimensional scapular kinematics. Arch. Phys. Med. Rehabil. 80, 923-929.

Wuelker, N., Kohn, D., 1991. Sonographische Routinediagnostik der Schulter. Ein vereinfachter Untersuchungsgang. Ultraschall Med. 12, 228-235.

Wuelker, N., Plitz, W., Roetman, B., 1994a. Biomechanical data concerning the shoulder impingement syndrome. Clin. Orthop., 242-249.

Wuelker, N., Rudert, M., 1995. Ultrasonographic imaging of the shoulder in normal and pathological conditions. J. Orthop. Sorg. Techn. 9, 11-18.

Yanai, T., Fuss, F.K., Fukunaga, T., 2006. In vivo measurements of subacomial impingement: substantial compression develops in abduction with large internal rotation. Clin. Biomech (Bristol, Avon), 692-700.

Figures

Tables

8 Annex

Case study

Case history

A 39-year-old sales representative of a commercial firm came for treatment with pain in the left shoulder which has been recurring for about two years. He reports that the pain occurred for the first time when he lifted skids and since then the pain has been recurring especially triggered by activities which put more strain on the shoulder (mowing the lawn, shovelling snow, etc.). An orthopaedist prescribed infiltrations which made the pain disappear for a few months. For two weeks the pain has become stronger again; due to the pain the patient can only sleep in supine position with his shoulder supported on a pillow. The pain is continuous and has a pulling quality with radiation into the region of the deltoid muscle and sometimes into the region of the biceps.

Medication: sometimes medication against heartburn

Other diseases/complaints: Heartburn and acid regurgitation almost daily; has to avoid certain kinds of beverages and food – but does not always do that

Surgery/injuries: Appendectomy, tonsillectomy, fracture of the right medial malleolus and a metatarsal bone on the right as well as a fracture of the left forearm – all when he was a child

Allergies: no known allergies

Lifestyle and dietary habits: stopped smoking about ¾ year ago; before that smoked 1 package a day for more than 23 years.
Has gained 6 kg since then and does not practice sports at the moment (lacking motivation); Height: 1.76 m, Weight: 87 kg; irregular and altering eating habits (main dish in the evening).

Findings on examination

Observation: flat arches of the foot on both sides; valgus position of both knee joints, flat lumbar lordosis; slight left rotation of the mid-thorax; high thoracic kyphosis and hyperlordosis of the cervical spine (“dowager’s hump”); protraction of both shoulders; muscle atrophy in the region of the M. supraspinatus.

Thermodiagnostics: increased temperature in the region of the cardia, slight temperature increase also over the left sternoclavicular articulation and over the cervicodorsal junction.
Local listening pointed toward the left epigastric region.
Palpation: hypertone extensor muscles of the cervical spine; occipital insertion of the neck muscles tender; painful spots in the region of the subclavian and lesser pectoral muscles; hypertone diaphragm; protective tension in the left epigastric region; tenderness on palpation in the cardia region; Chapman points positive for stomach.
Axial system: C3-C5 in ERS left; T1-5 in flexion; T6-9 in NSR left; both shoulders protracted; SC-joint left compressed; positive provocation test of the phrenic nerve left.
The patient has a painful arc in the active elevation of the left shoulder. The passive abduction and flexion is restricted and painful at the end of the ROM.
Visceral: fixation of the stomach, spasm of the cardia.
Neurologic: nothing abnormal detected

Osteopathic diagnosis:
The shoulder problems of the patient result from the interaction of several factors.
Due to the pronounced high thoracic kyphosis the thorax pushes both shoulders into a protracted position. This has the effect that the scapula rotates anteriorly and inferiorly and the acromium moves inferiorly, while the glenoid fossa changes its direction. If the patient now tries to elevate the arm, the tendon of the M. supraspinatus and /or the subdeltoid bursa can be pushed against the anterior part of the acromium. By and by this can result in the development of a subacromial impingement. Also the muscle balance changes. Due to the altered position of the scapula the following muscles will be shortened: M.serratus anterior, M.latissimus dorsi, M.teres major, M.subscapularis, M.pectoralis major and minor.

The irritation of the stomach is probably due to an unfavourable posture (hypertone diaphragm), bad eating habits as well as stress situations at work and in turn contributes to a deterioration of the thoracic kyphosis and the irritation of the capsule of the left shoulder joint because of fascial pulls.

Osteopathic treatment:

The osteopathic treatment comprises several areas. In order to achieve a relief in the painful shoulder region the primary goal is to re-establish the muscle balance in the shoulder region. This can be achieved with muscular techniques and gentle local joint mobilisations. Through improving the thoracic mobility an additional relief can be achieved.

The next step consists in treating the irritation of the stomach. The therapy involves a treatment of the thoracic diaphragm to re-establish the abdominal pressure balance as well as treatment through direct visceral techniques on the stomach.

9 Abstract

THE TREATMENT OF THE SUBACROMIAL IMPINGEMENT OF THE SHOULDER EITHER BY OSTEOPATHIC TREATMENT OR BY SELF-TRAINING

Author: Elke Anderl

BACKGROUND AND PURPOSE: Subacromial impingement syndrome of the shoulder is a common condition which, if treated ineffectively, can lead to more serious pathology. This study examines whether subjects receiving osteopathic treatment would have improved pain, mobility, muscle strength and function compared with patients receiving a guided self-training program.

SUBJECTS: Twenty-six patients with subacromial impingement syndrome were recruited, and twenty patients completed the 12-week rehabilitation program and follow-up testing.

METHODS: The osteopathic group received 6 treatments over a period of 12 weeks. Subjects of the exercise group were given a progressive exercise program, each subject attended 3 physical therapy sessions for a 12-week period.

Subjects were assessed before and after the 12-week period. Pain, mobility and function were measured using the Constant-Murley Score. Muscle Strength was assessed by using the Isobex Dynamometer. Pretest and Posttest scores were compared by using paired *t* tests and repeated measures analysis of variance.

RESULTS: Improvements were found for pain, mobility, muscle strength, and function in both groups. But there was significantly more improvement of mobility in the osteopathic group.

CONCLUSION: This study confirms the hypothesis that osteopathic treatment leads to a significant improvement of pain reduction, function, muscle strength, and mobility in patients with subacromial impingement syndrome.

Key Words: Shoulder, Impingement, Osteopathy, Self-Training

EIDESSTATTLICHE ERKLÄRUNG

Hiermit versichere ich, die vorgelegte Masterthese selbständig verfasst zu haben.

Alle Stellen, die wörtlich oder sinngemäß aus veröffentlichten oder nicht veröffentlichten Arbeiten anderer übernommen wurden, wurden als solche gekennzeichnet. Sämtliche Quellen und Hilfsmittel, die ich für die Arbeit genützt habe, sind angegeben. Die Arbeit hat mit gleichem Inhalt noch keiner anderen Prüfungsbehörde vorgelegen.

------------------------------ ----------------------------------

Datum Unterschrift