T.C.

YEDİTEPE UNIVERSITY

INSTITUTE OF HEALTH SCIENCES

DEPARTMENT OF PHYSIOTHERAPY AND REHABILITATION

INVESTIGATION OF THE EFFECTS OF MANUAL THERAPY TECHNIQUES ON PAIN AND FUNCTIONALITY IN INDIVIDUALS WITH SHOULDER SUBACROMIAL IMPINGEMENT SYNDROME

MASTER OF THESIS

EMRE OKAN AYTAÇ

İSTANBUL -2019

T.C.

YEDİTEPE UNIVERSITY

INSTITUTE OF HEALTH SCIENCES

DEPARTMENT OF PHYSIOTHERAPY AND REHABILITATION

INVESTIGATION OF THE EFFECTS OF MANUAL THERAPY TECHNIQUES ON PAIN AND FUNCTIONALITY IN INDIVIDUALS WITH SHOULDER SUBACROMIAL IMPINGEMENT SYNDROME

MASTER OF THESIS

EMRE OKAN AYTAÇ

SUPERVISOR

Asst. Prof. Dr. Feyza Şule BADILLI DEMİRBAŞ

İSTANBUL -2019

TEZ ONAYI FORMU

Kurum : Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü

Program : Fizyoterapi ve Rehabilitasyon

Tez Başlığı : Omuz Subakromial Sıkışma Sendromu Olan Bireylerde Manuel Terapi Tekniklerinin Ağrı ve Fonksiyonellik Üzerine Etkisinin Araştırılması

Tez Sahibi : Emre Okan AYTAÇ

Sınav Tarihi : 26.06.2019

Bu çalışma jurimiz tarafından kapsam ve kalite yönünden Yüksek Lisans Tezi olarak kabul edilmiştir.

	Unvanı, Adı-Soyadı (Kurumu)	İmza
Jüri Başkanı:	Prof.Dr. Feryal SUBAŞI (Yeditepe Üni.)	
Tez danışmanı:	Dr.Öğr.Üy.F.Şule BADILLI DEMİRBAŞ (Yeditepe Üni.)	
Üye:	Doç.Dr. Tuğba KURU (Marmara Üni.)	
Üye:		
Üye:		

ONAY

Bu tez Yeditepe Üniversitesi Lisansüstü Eğitim-Öğretim ve Sınav Yönetmeliğinin ilgili maddeleri uyarınca yukarıdaki jüri tarafından uygun görülmüş ve Enstitü Yönetim Kurulu'nun 28/06/2019 tarih ve 2019/11-55 sayılı kararı ile onaylanmıştır.

Prof. Dr. Bayram YILMAZ
Sağlık Bilimleri Enstitüsü Müdürü

DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

Emre Okan AYTAÇ

ACKNOWLEDGEMENTS

I would like to thank and say my gratitude to Asst. Prof. Dr. Feyza Şule Badıllı Demirbaş, who helped me to develop so many new skills, for her supervisory support. It is a great honor to be her master student.

I would like to thank Assoc. Prof. Dr. Pınar Öztop Çiftkaya for her contributions to the ethical approval application process.

I am thankful to Assoc. Prof. Dr. Nur Coşar because of she performed the statistical analysis of my thesis.

I would like to thank Prof. Dr. Armağan Altun for his contributions to the ethical approval application process.

I would like to thank my colleagues Physiotherapist Belde Çulhaoğlu and Physiotherapist Berna Yalçın for their valuable contributions.

I would particularly like to express my special thankyou to Assoc. Prof. Dr. Pınar Doruk Analan for her unique support and much valued advices.

I also send my endless love to my family who are all wonderful and shown me such tremendous support.

This study was supported by Başkent University Research Fund (Project no: KA17/275).

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

ADL	Activities of Daily Living
ASES	The American Shoulder and Elbow Surgeons Standardized Shoulder Assessment
CM	Centimeters
CS	Constant (Murley) Score
CT	Conservative Treatment
DASH	Disabilities of The Arm, Shoulder and Hand Questionnaire
GH	Glenohumeral
KTT	Kinesio Taping Techniques
NSAIDs	Nonsteroidal Anti-Inflammatory Drug
MM	Mulligan Mobilization
MMT	Mulligan Mobilization Technique
MWM	Mobilization with Movement
RC	Rotator Cuff
ROM	Range of Motion
SIS	Subacromial Impingement Syndrome
SPADI	Shoulder Pain and Disability Index
SST	Simple Shoulder Test
TENS	Transcutaneous Electrical Nerve Stimulation
UCLA	University of California at Los Angeles Shoulder Rating Scale
UEFI	The Upper Extremity Functional Index
US	Ultrasound
VAS	Visual Analog Scale

ABSTRACT

Aytaç, E. O. (2019). Investigation of the Effects of Manual Therapy Techniques on Pain and Functionality in Individuals with Shoulder Subacromial Impingement Syndrome. Yeditepe University, Institute of Health Sciences, Physiotherapy and Rehabilitation Program, Master thesis, İstanbul.

This study was carried out with 34 patients with subacromial impingement syndrome (SIS) to investigate the effect of manual therapy techniques on pain and functionality in individuals with shoulder subacromial impingement syndrome. Patients were divided into two groups as conservative treatment (CT) group and mulligan mobilization (MM) group. Hot pack, TENS, Codman exercises, range of motion and strengthening exercises were applied to 17 patients to be included in the conservative treatment group. Mulligan mobilization (mobilization with movement / MWM) was applied to 17 patients to be included in the mulligan mobilization (MM) group in addition to the treatment applied in the conservative treatment group. Patients were included in physical therapy and rehabilitation program for a total of 14 sessions 3 times a week. Patients were evaluated for pain (Visual Analog Scale), range of motion (goniometer), muscle strength (manual muscle test) and functionality (DASH) immediately before and after treatment. The data were analyzed by using statistical version 22.0 SPSS. As a result of the evaluations, it was determined that both treatment methods were effective in decreasing the symptoms of patients. There was a significant difference in favor of MM group who applied MWM in postoperative night pain, shoulder flexion, abduction, internal rotation, external rotation muscle strength assessments ($p<0.05$). There were no statistically significant differences between the two groups in terms of other pain, range of motion, and DASH score assessments ($p>0.05$). When the difference between the values before and after treatment is examined night pain, activity pain, passive flexion and active internal rotation parameters have been found significant difference in favor of MM group applied MWM ($p<0.05$). In conclusion, in patients with SIS, we think that the combined use of MWM technique with conservative treatment may provide more effective results in decreasing pain, increasing range of motion, muscle strength and functional activity.

KEY WORDS: Mobilization with Movement, Subacromial İmpingement Syndrome, Functionality, Pain

This study was supported by Başkent University Research Fund (Project no: KA17/275).

ÖZET

Aytaç, E. O. (2019). Omuz Subakromial Sıkışma Sendromu Olan Bireylerde Manuel Terapi Tekniklerinin Ağrı ve Fonksiyonellik Üzerine Etkisinin Araştırılması. Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü, Fizyoterapi ve Rehabilitasyon Programı, Master Tezi. İstanbul.

Bu çalışma omuz subakromial sıkışma sendromu (SSS) olan bireylerde manuel terapi tekniklerinin ağrı ve fonksiyonellik üzerine etkisinin araştırılması amacıyla SSS tanısı konmuş 34 hasta ile yapılmıştır. Hastalar randomize olarak konservatif tedavi grubu (KT) ve mulligan mobilizasyon (MM) grubu olarak iki gruba ayrılmıştır. KT grubuna alınan 17 vakaya sıcak paket (hotpack-HP), TENS, Codman egzersizleri, eklem hareket açıklığı (EHA) ve güçlendirme egzersizleri uygulandı. Mulligan mobilizasyon grubuna alınan 17 vakaya ise konservatif tedavi grubunda uygulanan tedaviye ek olarak mulligan mobilizasyon (hareket ile mobilizasyon/MWM) uygulaması yapılmıştır. Hastalar haftada 3 gün toplamda 14 seans olmak üzere fizyoterapi ve rehabilitasyon programına alındı. Hastalar tedavi öncesi ve tedavi bittikten hemen sonra ağrı (Vizüel Analog Skala), eklem hareket açıklığı (gonyometre), kas kuvveti (manuel kas testi) ve fonksiyonellik (DASH) açısından değerlendirildi. Elde edilen veriler, istatistik sürüm 22.0 SPSS kullanılarak analiz edilmiştir. Yapılan değerlendirmeler sonucunda her iki tedavi yönteminin de hastaların semptomlarının azalmasında etkili olduğu belirlenmiştir. Tedavi sonrası gece ağrısı, omuz fleksiyon, abdüksiyon, internal rotasyon, eksternal rotasyon kas kuvvetleri değerlendirmelerinde MWM uygulanan MM grup lehine anlamlı fark bulunmuştur ($p<0.05$). Bunların dışında kalan ağrı, eklem hareket açıklığı, DASH skoru değerlendirmelerinde iki grup arasında istatistiksel anlamlı fark bulunamamıştır ($p>0.05$). Tedavi öncesi-sonrası değerlerin farkı incelendiğinde gece ağrısı, aktivite ağrısı, pasif fleksiyon ve aktif internal rotasyon parametrelerinde MWM uygulanan MM grup lehine anlamlı fark bulunmuştur ($p<0.05$). Sonuç olarak SSS bulunan hastalarda MWM tekniğinin konservatif tedavi ile kombine olarak uygulanmasının ağrının azalmasında, eklem hareket açıklığı, kas kuvveti ve fonksiyonel aktivite düzeylerinin artmasında daha etkili sonuçlar verebileceğini düşünmekteyiz.

Anahtar Kelimeler: Hareket ile Mobilizasyon, Subakromial Sıkışma Sendromu, Fonksiyonellik, Ağrı

Bu çalışma Başkent Üniversitesi Araştırma Fonunca desteklenmiştir (Proje no: KA17/275).

1. INTRODUCTION

The shoulder joint is the most mobile joint in the human body (1). At the present time, shoulder pain can be seen at any age. It is more common in middle age group and athletes and is an important health problem that negatively affects the quality of life. Shoulder pain takes places in the third place among the musculoskeletal problems according to the prevalence (2).

Subacromial impingement syndrome (SIS) is the most common syndrome among shoulder pathologies. SIS is characterized by pain which increases with overhead activities or elevation of the arm. SIS was first described by Neer in 1972 as a pathology that started with inflammation, then turned into fibrosis, and was finally characterized by rotator cuff rupture. SIS is a disease known as painful arc syndrome which is observed as the result of repeated traumas, continuous use of the arm or using over the level causing pain in the patient. In other words, the rotator cuff muscles, subacromial bursa and biceps tendon squeeze in the subacromial space between humerus proximal and carocoacromial arc formed by acromion, coracoid process, coracoacromial ligament during the shoulder elevation (3, 4, 5).

Many factors such as weakness of rotator cuff muscles, acromial morphology, muscle imbalance, capsular laxity or tension, dysfunction in glenohumeral (GH) and scapulotorocic kinematics, degeneration in tendon or bursa or inflammation can cause SIS (6, 7).

Although many treatments have been used in the SIS, only the efficacy of some treatment has been proven by randomized controlled studies (8, 9, 10). Injections, non-steroid anti-inflammatory drugs (NSAID), physical treatment modalities, stretching and strengthening exercises can be considered among the non-surgical approaches in SIS treatment (11, 12, 13).

Another method used in SIS treatment is manual therapy techniques. It includes deep friction massage, soft tissue and joint mobilizations (14). The purpose of manual therapy in SIS is to reduce subacromial inflammation, to enable healing and strengthening of dysfunctional rotator cuff muscles and to provide painless shoulder functions to the person (15, 16, 17).

In the shoulder problems which do not give sufficient respond with conventional therapy, it is suggested to add manipulation / mobilization techniques applied to joints

to the treatment. Unfortunately, there is little evidence of the efficacy of such interventions in patients with SIS who do not respond to conventional treatment (6).

Mobilization with movement (MWM), a mulligan mobilization technique, is one of the manual therapy methods that can be practiced safely and it has gained popularity over the recent years (18). Clinically, MMT administration showed successful results in decreasing pain, increasing painless EHA and rehabilitating functionality in various joints in the body (19, 20, 21, 22, 23).

2. GENERAL INFORMATION

2.1. Shoulder Joint Anatomy

Shoulder is the joint of the body with maximum range of motion. The shoulder complex, which connects the upper extremity to the torso and brings the hand to appropriate positions to perform functions such as capture, reach and access, consists of articulation between the humerus, clavicle and scapula bones (24, 25, 26).

2.2. Bones

2.2.1. Clavicle

Clavicle is a long, flat and cylindrical bone with the form of "S" letter. It is located just above the first costa and close to the horizontal. It joints with manubrium sternum in the medial and joints with acromion in lateral (Fig. 2.1.). The convexity in the medial half of the clavicle which its outer end is depressed from the top to the bottom, faces forward, and the convexity in the lateral half faces rear (25, 26).

2.2.2. Scapula

It is a flat, triangular bone with two sides, three corners and three edges on the 2nd and 7th costa located in the posterolateral of the thorax. It makes a 30 ° front angle in frontal plane. The scapula is divided into six parts: the body, the spina scapula, the acromion, the scapula neck, the glenoid fossa and the coracoid process. Glenoid fossa and coracoid process is located in the lateral corner of the scapula (Fig. 2.1.). The glenoid fossa has a retroversion angle of 20-70 °. Coracoid process is the zone on which pectoralis minor, short head of biceps, coracobrachialis and coracoclavicular, coracoacromial and coracohumeral ligaments hold. The scapula is divided into two parts by the spina scapula in posterior and the supraspinatus muscle is located in the supraspinatus fossa and the infraspinatus and teres minor muscles are located in the infraspinatus fossa in the inferior.

The spina scapula ends with an acromion that appears depressed from front to rear and extending to lateral. The acromion covers the shoulder joint from top and joints with the clavicle. Three types of acromion have been described: anatomically flat (Type 1: 18%), curved (Type 2: 41%) and hook (Type 3: 41%). It is reported that rotator cuff pathologies are more frequent in patients with type 3 acromion (25, 26).

2.2.3. Humerus

It is the longest and thickest bone of the upper extremity located between the shoulder and forearm. There is a half-sphere-like structure called as humerus head (caput humeri) at the proximal and makes joints with the glenoid fossa of the scapula (Fig. 2.1.). The caput humeri narrows downward and takes the name of the collum anatomicum. Joint capsule holds collum anatomicum. There are two process called the tuberculum majus and minus at the exterior of caput humeri. Supraspinatus, infraspinatus, teres minor muscles hold tuberculum majus and the subscapularis muscle holds tuberculum minus. The groove between tuberculum majus and minus is called sulcus intertubercularis (bicipital groove). The long head of the biceps tendon and a branch of anterior circumflex artery pass through this groove. The neck part located under the tubercles is called collum chirurgicum. The opening between the caput humeri and the corpus humeri has an angle of 130 ° facing downwards. On the outer edge of the corpus humeri, there is a rough area called tuberositas deltoidea where deltoid muscle holds. The radial groove is located beneath the tuberositas deltoidea. The radial nerve and the arteria profunda brachii pass through this groove. The distal end of the humerus is in the form of reel. There are two process which is called medial epicondyle on the inner side and lateral epicondyle at the exterior side. Behind the medial epicondyle there is the groove called sulcus nervi ulnaris which the ulnar nerve passes through. There are two conjugate joint surfaces called as trochlea humeri in the medial and as capitulum humeri in the lateral which are under the distal end. Trochlea humeri makes joint with the upper edge of ulna and capitulum humeri makes joint with radius head (25, 26).

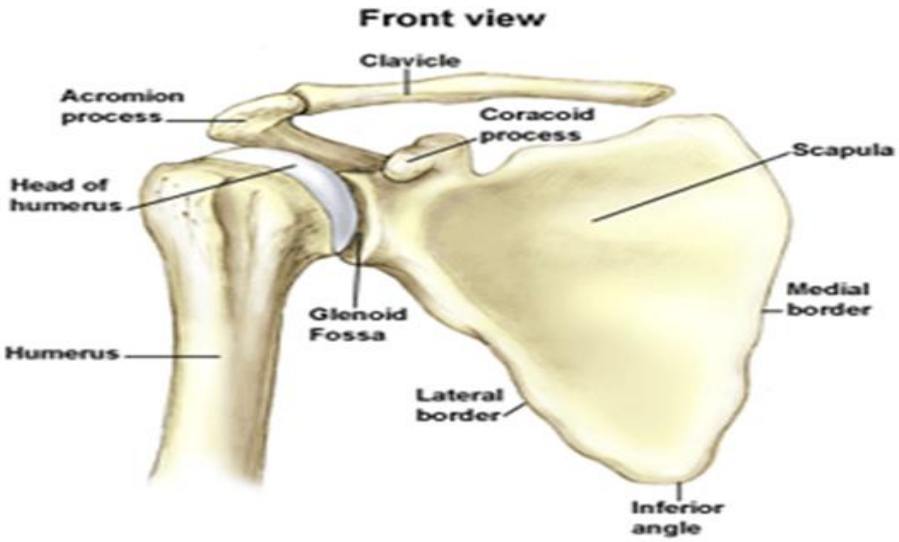


Figure 2.1. Shoulder Complex Bones

2.3. Joints

2.3.1. Glenohumeral (GH) Joint

It is a joint with covered with hyaline cartilage between the caput humeri and the glenoid fossa and is movable in multi-axis and in the type of ball and socket. However, only 1/3 of the caput humeri makes contact with the glenoid. Therefore, its stability is provided primarily by strong ligament and muscle structures (27).

Passive stabilizers of the joint are joint capsule, glenoid labrum, coracohumeral ligament, coracoacromial ligament and the joint surface of glenoid cavity (Fig. 2.2.). The upward slope of the glenoid fossa increases inferior stability. Glenoid labrum made of fibrous cartilage increases the contact surface with humerus head by deepening the glenoid fossa, and makes more contribution to the joint stabilization. The joint capsule is composed of three parts as to be upper, middle and lower and called as capsular ligament. Tuberculum supraglenoidale which the long head of biceps muscle holds takes place in the upper part of the capsule. GH ligament is located on the anterior surface of the capsule and consists of three parts: superior, medial and inferior. The inferior GH ligament plays an important role in the anterioinferior stabilization of the shoulder joint in abduction and external rotation. The contribution of the superior and medial parts in the stabilization is low. The broadband-shaped coracohumeral ligament

strengthens the upper part of the joint capsule. It starts from the lateral of coracoid process and proceeds to exterior and hold to the anterior edge of the tuberculum majus (Fig. 2.2.). It prevents inferior translation when humerus is in adduction. Transverse humeral ligament extends from the humerus tuberculum majus to the tuberculum minus. This ligament turns the intertubercular sulcus into the canal. This ligament acts as a retinaculum for the long head of the biceps and reinforces the tendon in the sulcus. The coracoacromial ligament is a triangular ligament that lies between the coracoid process and the acromion. Acromion, coracoid process and coracoacromial ligament form the coracoacromial arch. This arch protects the humerus head and rotator cuff tendons and prevents dislocation of the humerus to the superior during arm elevation. These structures are separated by a bursa from the supraspinatus tendon. The zone between the coracoacromial arch and the GH joint is expressed as a subacromial space. The supraspinatus tendon, the upper fibers of the subscapularis tendon and the infraspinatus tendon pass through this space (25, 26, 27).

The active (dynamic) stabilizers of the joint are rotator cuff muscles and the trapezius, serratus anterior, rhomboids and levator scapula muscles which are scapular rotators. Among the rotator cuff muscles subscapularis is located in anterior, supraspinatus is located in superior, infraspinatus and teres minor are located in posterior. The activity of these muscles provides the humeral head to be centralized in the glenoid cavity (28, 29).

2.3.2. Acromioclavicular Joint

It is a planar joint located between the lateral end of the clavicle and the medial of the acromion and its both joint surface is covered with fibrous cartilage and its long axis is in anteroposterior direction (Fig. 2.3.). There is a disc between the joint faces. The upper surface of the joint is covered by the acromioclavicular ligament. The coracoclavicular ligament is located between the clavicle and the coracoid process (Fig. 2.4.). The coracoclavicular ligament is divided into two parts; trapezoid on the external side and the conoid in the rear inner side (30).

2.3.3. Sternoclavicular Joint

It is between the sternal end of the clavicle and the manubrium sternum and is a sellar type joint that connects the shoulder complex to the thorax (Fig: 2.3.). Intraarticular disc and fibrous joint capsule between the joint surfaces, anterior and posterior sternoclavicular ligaments contribute to the stability of the joint. The sternal ends of the two clavicles joints with interclavicular ligament. Costoclavicular ligament takes place between the first costa and clavicle. Anterior sternoclavicular ligament limits anterior movement, posterior sternoclavicular ligament limits posterior movement, interclavicular ligament limits downward movement, costoclavicular ligament limits elevation, protraction and retraction (31, 30).

2.3.4. Scapulothoracic Joint

It is defined as a physiological joint. It contributes to the formation of movements without structures such as synovial membranes and fibrous capsules (Fig 2.3.). The anterior surface of the scapula is separated from the chest wall by subscapularis and serratus anterior muscles. An important part of the scapulothoracic movements is between the fascia of these muscles and the thoracic fascia (32).

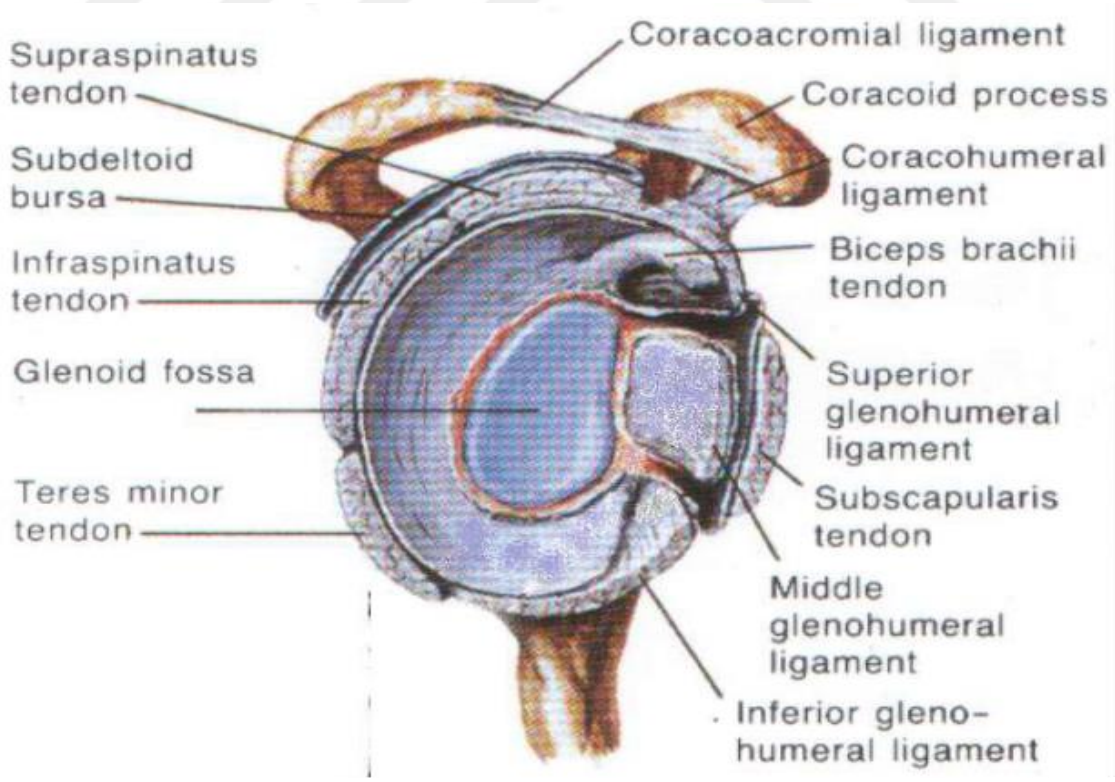


Figure 2.2. Shoulder Complex Ligaments, Tendons

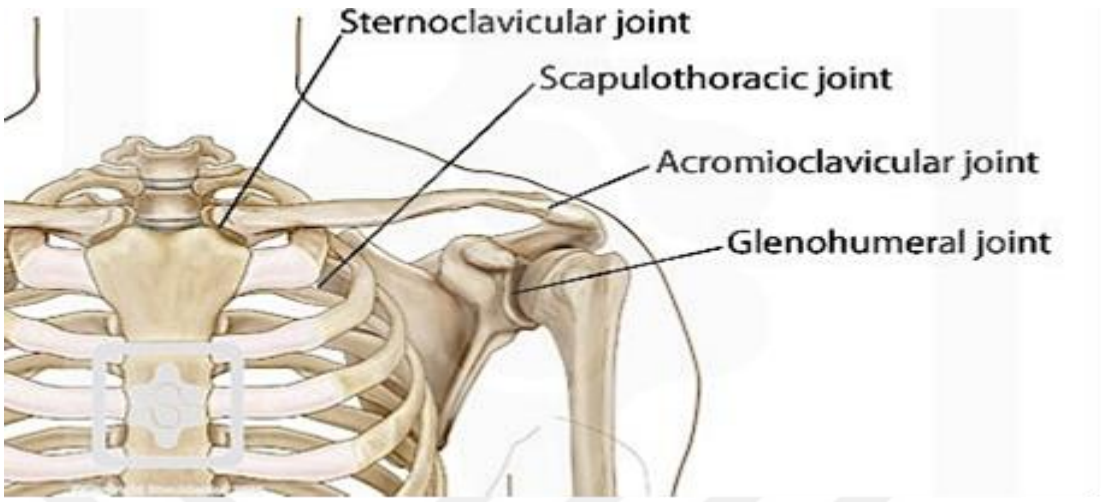


Figure 2.3. Shoulder Complex Joints

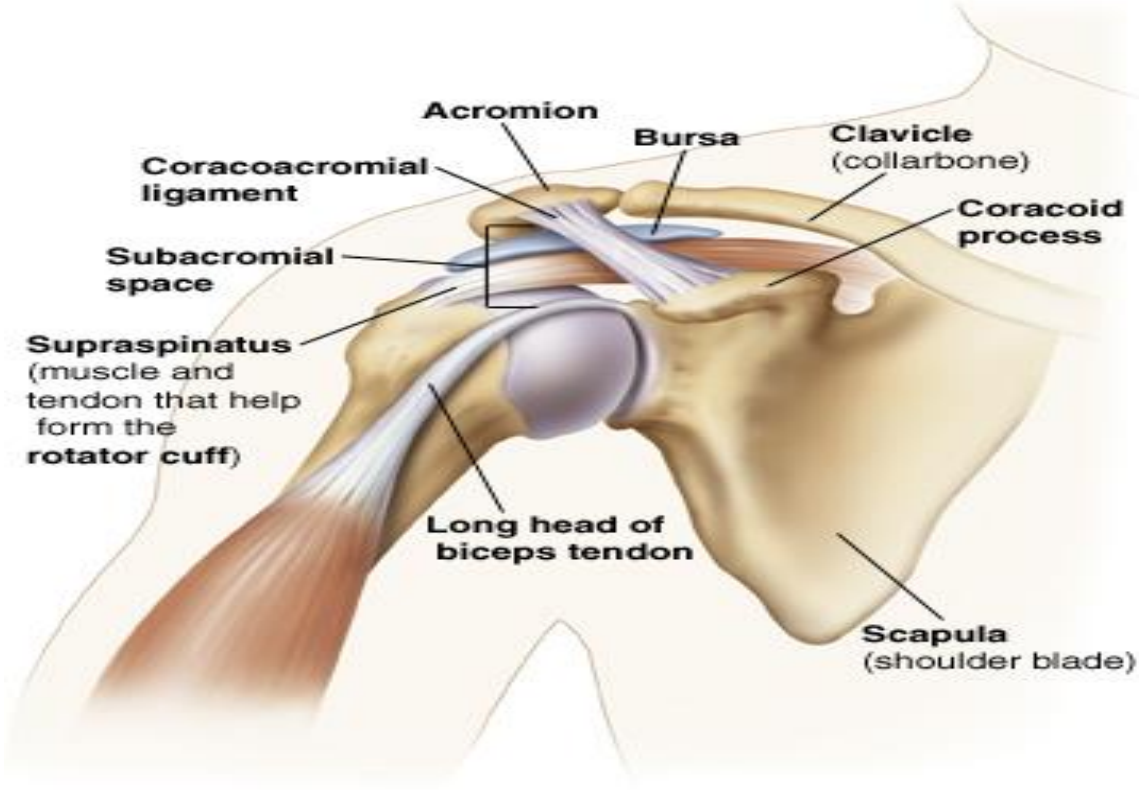


Figure 2.4. Subacromial Space

Bursae

Subacromial-Subdeltoid Bursa

It is located between the joint capsule and the acromion (Fig. 2.4.). It is usually located under the coracoacromial ligament and is associated with subdeltoid bursa. Therefore, it is called subacromial bursa instead of two bursas. There is no connection with GH joint. Reactive inflammation may be seen in bursa at SIS (32).

Subscapular Bursa

It is located between the subscapular tendon and the joint capsule. It is connected with GH joint. Apart from these, bursas can be found between the long head of the triceps and the teres major muscle behind the coracobrachialis muscle (33).

Shoulder Dynamic Stabilizers

1. Rotator Cuff (RC) muscles (Fig. 2.5.) and biceps long head tendon

2. Scapulatorasic muscles (contain M. Trapezius [upper, middle and lower parts] M. Levator Scapula, M. Serratus Anterior, M. Pectoralis Minor and M. Romboideus. Postural support is provided by upper part of M. Levator Scapula and M. Trapezius.)

3. Proprioceptive feedback

4. Dynamic neuromuscular control (34, 35).

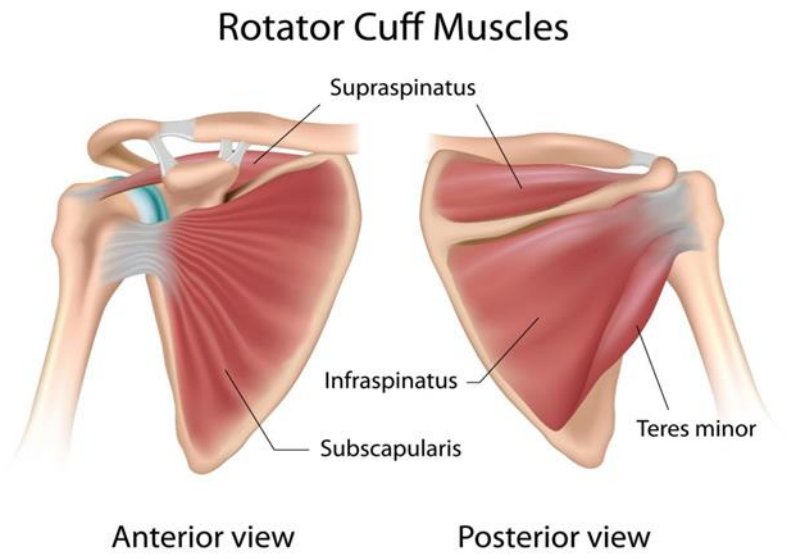


Figure 2.5. Rotator Cuff Muscles

Shoulder Static Stabilizers

1. Bone geometry of humeral head and glenoid fossa

2. Glenoid labrum

3. Negative intraarticular pressure and joint fluid

4. Capsule (Joint surface is covered with a cartilage of hyaline. It extends joint surfaces and increases the stability by increasing the glenoid-humerus head relations by 75% vertical and 56% in transverse direction. Thus, stability is provided in the movement limits of shoulder joint without any limitation (35, 36).

5. **Ligaments**

-Superior GH ligament

- Middle GH ligament

-Inferior GH ligament

-Coracohumeral ligament

- Coracoacromial ligament (Fig. 2.2.) (37, 36).

Subacromial Space

Clinically, the most important structure in the acromioclavicular joint region is the subacromial space. This space consists of the coracoid process, the acromion and the coracoacromial ligament, which provide interconnection (Fig. 2.4.). Deltoid muscle is located above the subacromial space, and subacromial bursa, supraspinatus muscle and biceps long head is located under it. This structure protects the humeral head and rotator cuff tendons from direct trauma and also prevents upward dislocation of the humeral head (5).

2.4. Shoulder Complex Muscles

Rotator Cuff Muscles: It is a complex consists of four muscles and these muscles start from the scapula and proceed along the joint capsule, mix with capsule fibers in tuberculum majus and minus adherence zone and hold this zone (38). It forms from supraspinatus, infraspinatus, teres minor and subscapularis muscles and plays an important role in the movement and stabilization of the shoulder joint (Table 2.1.) (38, 39).

M. supraspinatus: It is located on the upper part of the scapula. It is the most important muscle of the rotator cuff and is the most exposed muscle to injury (39). It starts from fossa supraspinatus and passes under the coracoacromial arch and adheres to the tuberculum majus (Fig. 2.5.). It makes abduction to the shoulder and makes the maximum contraction at the first 30 ° elevation (40). It is surrounded by subacromial bursa and acromion above and it is surrounded by the humerus head at the bottom. Therefore, the tendon is exposed to compression and injury. Especially, the possibility of supraspinatus rupture increases in people aged 40 years and over (Table 2.1.) (3).

M. infraspinatus: 60-90% of external rotation is performed by this muscle (41). It adheres to the posterior of tuberculum majus (Fig. 2.5.). It is the depressor of humerus head. It covers the humerus head during internal rotation and stabilizes the shoulder against posterior subluxation. When the shoulder is in abduction and external rotation, it

pulls the shoulder towards the posterior and prevents anterior subluxation (Table 2.1.) (32).

M. Teres Minor: It starts from the middle zone of the lateral edge of the scapula and it adheres to lower back of the tuberculum majus (Fig. 2.5.). Deltoid is located in the upper zone and posterior capsule is located in the lower zone (Table 2.1.) (42).

M. subscapularis: It starts from subscapular fossa in anterior surface of the scapula and it passes from the anterior of joint and adheres to the tuberculum minus (Fig. 2.5.). It provides internal rotation to the shoulder and its lower fibers function as humerus depressor (42, 43). Subscapularis muscle prevents anterior dislocation when the arm is near the body and prevents anterior dislocation together with middle and lower GH ligaments when shoulder joint is in 45 ° abduction (Table 2.1.) (44).

M. Deltoid: It starts from the 1/3 lateral of the clavicle, the acromion and the spina scapula and adheres to the deltoid tubercle in the proximal humerus. Functionally there are three parts. The middle part providing shoulder abduction is also the strongest part. Anterior deltoid is involved in flexion and also has a role in horizontal adduction and internal rotation. The posterior deltoid provides extension and horizontal abduction. It also involves in external rotation (Table 2.1.) (45).

M. Teres Major: It starts from the low angle from the outer edge of the scapula and moves around the arm from the anterior and adheres under tuberculum minus. It provides adduction and extension to the arm (Table 2.1.) (32).

M. Trapezius: It starts from spinous process of C7-T12 vertebras (40). The place for adhesion is 1/3 exterior part of clavicle for upper fibers, acromion and spina scapula for lower cervical and upper thoracic fibers and medial of the spina scapula for the lower fibers (46). This muscle works as a scapular retractor. The upper fibers

provide elevation to the scapula and the lower fibers provide depression and retraction (Table 2.2.) (40, 46).

M. Levator Scapula: It starts from protrusion of C1-C3 and sometimes C4 vertebra and adheres to the upper corner of the scapula. It participates to the scapula elevation with trapezius upper fibers (Table 2.2.) (40, 46).

Rhomboid Muscles: Rhomboid minor starts from spinous process of the C7-T1 vertebra, and adheres the medial edge of scapula as close to the base of the spina scapula and rhomboid major starts from the spinous process of T2-T5 vertebra and adheres to scapula medial under the place where the rhomboid minor adheres. In addition to involvement to scapula elevation, its main task is to provide retraction to scapula (Table 2.2.) (40).

M. Serratus Anterior: It starts from the anterior of the first eight costas and ends at the costal side of the scapula. Its task is the protraction of the scapula and upward rotation (Table 2.2.) (3, 46).

M. Pectoralis Minor: It starts from 2-5 costas in the anterior of the chest wall and adheres to coracoid process of the scapula. Its task is the depression and protraction of the scapula (Table 2.2.) (40).

M. Biceps: It has two origins. While its long head starts from the bicipital tubercle of the glenoid and the upper corner of the labrum, the short head is originating from the coracoid process. Its main function is in the elbow joint but since the tendon of the long head passes through the capsule of the shoulder joint, it involves in diseases associated with the shoulder joint. It helps the humerus head's depression, especially during external rotation on the shoulder (Table 2.1.) (39, 40).

M. Latissimus Dorsi: It starts from spinous process of T7-T12 vertebra, thoracolumbar fascia, iliac crest, 9-12. costas and the lower edge of scapula and ends in the medial of the bicipital groove. It has a role in internal rotation, extension and

adduction of the arm. It also provides a downward rotation to the scapula (Table 2.2.) (47).

M. Pectoralis Major: It starts from the medial of the clavicle, sternum and the first 6 costal cartilage and adheres to the tubercle majus in the humerus. It consists of three parts. While the clavicular part is involved in the flexion with the anterior deltoid, the lower fibers support extension. This muscle is a strong adductor of the GH joint and indirectly serves as the depressor of the lateral corner of the scapula. Internal rotation and scapular depression are also affected when the sternocostal part is affected (Table 2.1.) (40).

Shoulder complex muscles according to their functions are given in Table 2.1. and Table 2.2.

Table 2.1. GH Joint Muscles and Functions

GH Joint Muscles	
Shoulder Flexion	Deltoid Biceps brachii Coracobrachialis
Shoulder Extension	Deltoid Latissimus dorsi Teres major Teres minor
Shoulder Abduction	Deltoid Supraspinatus

Shoulder Adduction	Pectoralis major Latissimus dorsi Teres major
Shoulder Internal Rotation	Subscapularis Pectoralis major Latissimus dorsi Teres major
Shoulder External Rotation	İnfraspinatus Teres minor

Table 2.2. Periscapular Muscles and Functions

Periscapular Muscles	
Scapular protraction	Serratus anterior Pectoralis minor
Scapular retraction	Trapezius Romboideus major Romboideus minor

Scapular elevation	Levator scapula Trapezius
Scapular rotation	Serratus anterior Trapezius Romboideus major Romboideus minor

Shoulder Joint Biomechanics

Movement in the frontal plane (Abduction-adduction)

The movement of the upper extremity in the process of frontal plane determines upward rotation of GH joint and scapula. It simultaneously involved in the movement at acromioclavicular and sternoclavicular joints. During the first 90 ° of movement, the clavicle makes approximately 40 ° elevation in the sternoclavicular joint.

It rotates 40-50 ° along its long axis in the remaining part of the movement.

It makes approximately 20 ° movement in the starting and closing stages of elevation simultaneously in the acromioclavicular joint (48).

2/3 of the 180 ° abduction is performed from the GH joint and 1/3 is performed from the scapulothoracic joint. GH / scapulothoracic rate of movement is 2: 1. This is expressed as scapulothoracic rhythm (36). The muscles which are responsible from GH elevation are the middle part of the deltoid and the rotator cuff muscles. The deltoid forms the upward vectorial part of the force couple. The rotator cuff stabilizes the humeral head and forms a downward vectorial force (48, 25).

Internal rotation is performed by the subscapularis, pectoralis major, and the anterior part of the deltoid, while the adduction is associated with coracobrachialis. During the adduction-internal rotation of the shoulder to the anterior body, the scapula makes abduction and this movement is controlled by the serratus anterior and pectoralis minor muscles. The posterior adduction movement of the shoulder is provided by the

latissimus dorsi, teres major, the long head of the triceps and the posterior part of the deltoid. Latissimus dorsi and teres major also determine the internal rotation. During this movement, the middle part of the trapezius, the rhomboids and the latissimus dorsi provides adduction to scapula in combined form. The scapula rotates downward as it moves down the maximum elevation. This movement is provided by the cooperation of the latissimus dorsi, the lower part of the pectoralis major and the levator scapula. The pectoralis minor serves as the downward-oriented of force couple levator scapula and rhomboid serves as upwardly-oriented vector component. In cases of heavy load-bearing activity on the shoulder, levator scapula, the upper part of the trapezius and the rhomboid muscles, which are the elevators of the scapula, are involved in the upward stabilization of the frontal plane (48, 25).

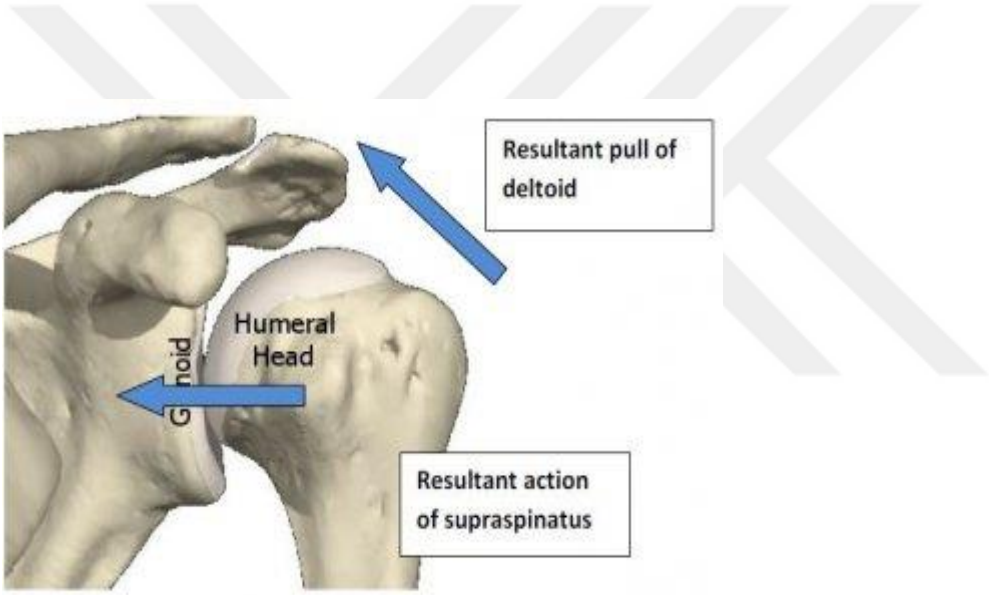


Figure 2.6. Vector Forces on Shoulder Complex

Movement in sagittal plane (flexion-extension)

The flexion in the sagittal plane, made by the anterior part of the deltoid, the biceps, the coracobrachialis, and the clavicular head of the pectoralis major. During this movement, the rotator cuff is also active for stabilization of the humeral head (Fig. 2.6.). Scapula is in the stable position on the thorax in the first 60 ° flexion and the first 30 ° abduction of the GH joint. Then the scapula begins to participate in movement and function, and the scapula and GH joint movements continue in a synchronous manner.

All extensors are active except pectoralis major in extension. The extension is 60 ° and the gravity and the down rotators of the scapula are added to the movement (48).

Movement in the horizontal plane

While the upper extremity is at 90 ° elevation in the frontal plane, the extreme end of the extremity draws an arch of 165 ° in the horizontal plane. The flexor and extensors of the GH joint control the movement. (48)

Rotational movement

When the upper extremity is held in the shoulder neutral position and the elbow is held at 90 ° flexion, the distal end of the extremity can draw 80 ° internal and 60 ° external rotation arch. When the shoulder is raised 90 ° in the frontal plane, the rotation capacity increases by 90 ° in external rotation and 70 ° in internal rotation. The primary muscles of internal rotation are pectoralis major, latissimus dorsi, and subscapularis. Teres major serves as a secondary rotator. The primary muscle of external rotation is infraspinatus. Teres minor and deltoid posterior fibers are assistant external rotators (48).

2.5. Subacromial Impingement Syndrome (SIS)

SIS occurs with compression and inflammation of starting from the supraspinatus tendon, subacromial bursa and biceps tendon in the subacromial space between humerus and coracoacroamial arch (Fig. 2.7.). It was first described by Neer in 1972 (3, 49, 50).

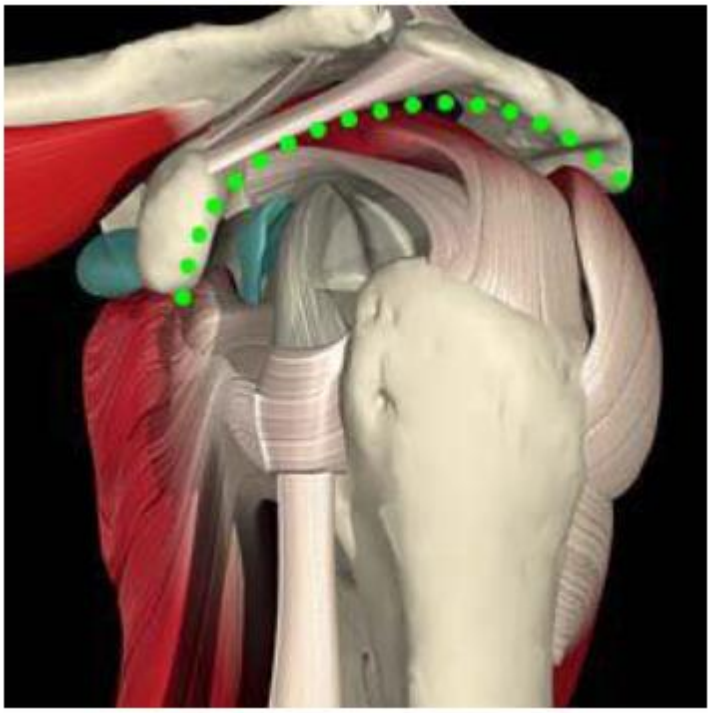


Figure 2.7. Coracoacromial Arch

2.5.1. SIS Etiopathogenesis

SIS etiology is usually multifactorial. It has been found that the SIS is mostly found in the young (under 25 years) and the middle age group (25-40 years) (51). Any situation that disrupts the relationship of subacromial structures can cause impingement. This is divided into 2 as intrinsic and extrinsic.

Intrinsic impingement: It consists of intrinsic factors. These include, changes in the vascularity of RC, degeneration, anatomical or bone anomalies, which are directly related to the subacromial space (Fig. 2.9). It is characterized by complete or partial rupture in tendons, which are formed by minor or major trauma of the tendons as a result of degenerative conditions.

Extrinsic impingement: Factors leading to contraction of the subacromial outflow form extrinsic causes (Fig. 2.9). It occurs as the result of tendon inflammation or degeneration occurring as the result of mechanical compression which is applied externally to the tendon. Morphology of the acromion, degenerative changes in the acromioclavicular joint, thickening or stiffening of the coracoacromial ligament, morphology of the coracoid process, presence of os acromiale and cinematic changes

around the shoulder (muscle imbalance and motor control problems of RC and scapulothoracic muscles, capsule tension scapulothoracic rhythm problems), inappropriate postural changes, inappropriate training positions, accelerating factors including occupational or environmental risks are included in extrinsic factors (5, 52, 53, 38).

The type of acromion is also an important reason for the development of SIS. Morphologically, there are 3 types of acromion: Type1 - flat, Type 2 - curved, Type 3 - hook form (Fig. 2.8.). Type 3 acromion is more closely associated with the SIS (54).

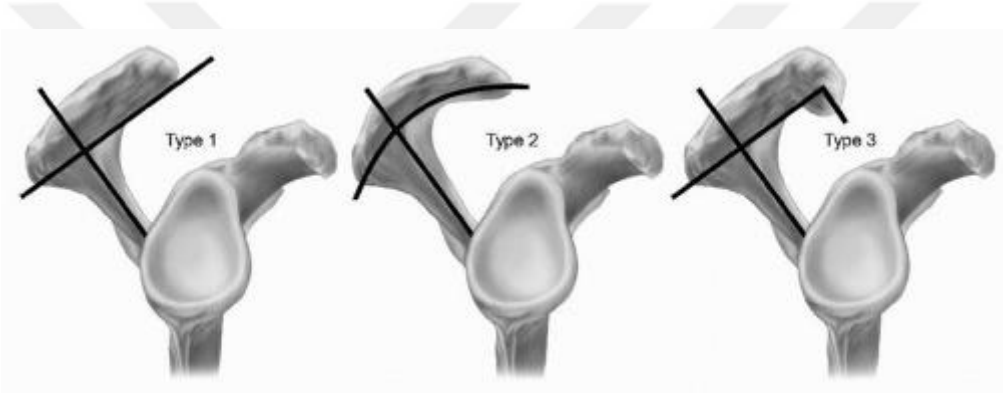


Figure 2.8. Types of Acromion

Vascular anatomy of RC is important due to its role in the pathogenesis of rupture formation. Through the anatomic studies, it is revealed that there is a hypovascular zone in a few centimeters close to insertion of supraspinatus tendon and degeneration and ruptures occur in this zone (38).

SIS also can be divided into two as primary and secondary impingement. Primary impingement is usually seen in middle-aged patients. It occurs as a result of mechanical impingement of the structures in the subacromial space.

Secondary impingement is more common in people with GH instability. GH instability causes GH laxity. The increase in external rotation angle, weakness of the scapulothoracic muscles and the weakness of the muscles responsible for the stability of

the GH joint are among the important factors leading to secondary impingement. (55, 56, 57).

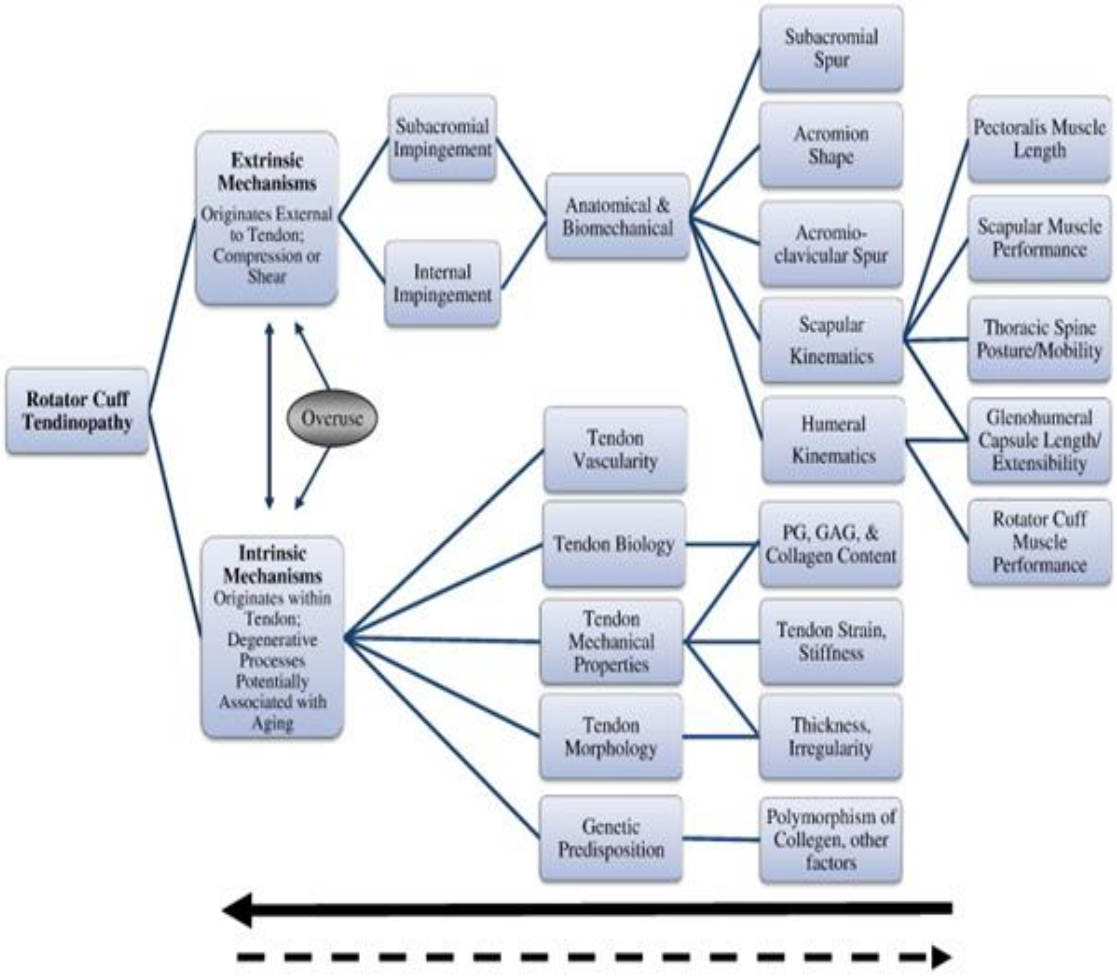


Figure 2.9. SIS Etiopathogenesis

2.5.2. SIS Symptoms and Neer Classification

SIS is the staging which is first developed by Dr.Neer in 1970s and defined as 3 phases.

Stage 1 (edema and hemorrhage): Although it is frequently observed in patients under 25 years of age, it can be seen in all ages. It is usually characterized by edema and hemorrhage of supraspinatus tendon and long head of biceps and it leads to fibrosis and thickening in subacromial bursa. Impingement occurs more as the result of this thickening. The painful arch test, Neer's impingement finding, the Hawkins test can be found positive. Sensitivity occurs with palpation in tuberculum majus and insertion

of supraspinatus tendon which on the anterior surface of acromion. There is bicipital sensitivity. At the same time, rupture may be seen in RC muscles at this stage. It is a reversible lesion and responds to conservative treatment (Table 2.3.).

Stage 2 (Fibrosis and tendinitis): It is frequently seen between the ages of 25-40. It is characterized by chronic inflammation. There are changes in supraspinatus tendon and fibrotic changes in subacromial bursa. Pains are more and affect activities of daily living (ADL). There is soft tissue crepitation. It may not always respond to conservative treatment (Table 2.3.).

Stage 3 (Bone changes and tendon ruptures): It is commonly seen in individuals over 40 years of age with complaints of intermittent and progressive shoulder pain. Partial or full-layer rupture in RC muscles, bicipital tendon rupture, acromion and tuberculum majus bone changes, osteophytic formations are seen. There is sensitivity in the acromioclavicular joint. Muscle weakness is found, especially in abduction and external rotation. Surgical indications are seen and surgery is indicated for patients who do not respond to conservative treatment, and anterior acromioplasty and RC repair are performed (Table 2.3.) (3, 55, 58, 59).

Stage	Features
I	Rotator cuff inflammation, edema and hemorrhage
II	Fibrosis and tendinitis
III	Partial or full-layer rupture
	IIIA Ruptures smaller than 1 cm
	IIIB Ruptures bigger than 1 cm
IV	Multiple tendon ruptures

Table 2.3. Neer Classification

2.5.3. SIS Clinical Assessment

Examination includes anamnesis, inspection, palpation of bone, joints and soft tissues, range of motion (ROM), specific tests, muscle tests, and neurological examination (muscle strength, reflex and sensory examination).

Anamnesis

When a patient applies with a complaint of shoulder pain, firstly pain character should be determined. If the pain starts slowly and is felt in the lateral part of the upper extremity or the deltoid area and if it increases with frontal elevation, rotator cuff tendonitis may be suspected (60, 61). In case of significant pain and weakness in overhead activities, SIS may be considered. Cervical pathology, thoracic outlet syndrome, compression neuropathy, and reflex sympathetic dystrophy may be associated with spanning pain in arm. Rotator cuff tendonitis or acromioclavicular joint pathology should be considered in the presence of night pain; chronic rupture of rotator cuff or capsulitis should be considered in the presence of constant and deep pain which increases with movement (60).

To know the past traumas and injury mechanism has an important role in making a diagnosis. To fall when the arm is extremely tight may result in shoulder instability in young people and results with rotator cuff rupture in the older people. Falling on the shoulder may cause rotator cuff and acromioclavicular joint damage. To learn the sport activities of the patient can provide detection of over use pathologies. The history and family background of the patient must be examined due to the diseases which can be accompanied by shoulder pathologies such as inflammatory rheumatoid diseases such as rheumatoid arthritis, cerebrovascular events, heart diseases and diabetes (62, 60). As addition to joint localized causes, shoulder pain may be caused by cervical and thoracic pathologies. Therefore, cervical and thoracic region should be evaluated during shoulder examination (62, 63).

Inspection

The patient must be evaluated in standing and sitting position and the posture should be evaluated from the anterior and posterior. The dressing and undressing of the patient must be observed to have an idea about patient's functional limitations (60, 32).

In the presence of deformity in the shoulder zone, the humerus or clavicle fracture or acromioclavicular joint separation should be considered. In the rupture of the long head of the biceps, swelling in the anterior region of the upper arm can be easily observed. If atrophy is observed in the supraspinatus and infraspinatus muscles of the patient, cervical root disorders, peripheral nerve pathologies and chronic RC injuries should be considered in the differential diagnosis. During elevation, scapulohumeral and scapulothoracic rhythm should be evaluated and the presence of asymmetry should be noted. The symmetry of the scapulae and shoulder zone should be observed, and the movement pattern of the periscapular region should be examined with shoulder movements. In addition, the conditions which may be accompanied such as winged scapula and scoliosis must be considered (60).

Palpation

Palpation should usually be started from the sternoclavicular joint and continued throughout the clavicle and acromion, bicipital tendon, supraspinatus, infraspinatus, spina scapula and trapezius muscle must be palpable bilaterally. Palpated structures should be evaluated in terms of sensitivity, temperature increase, swelling and muscle spasm (62).

Sensitivity may occur with palpation in the zone where the rotator cuff adheres to the tuberculum majus and minus. An excessive sensitivity is observed when pressed on the shoulder which held in the acute calcific tendinitis (60).

For myofascial pain in the shoulder and cervical area, trigger points should be considered and sensitive points should be considered for fibromyalgia syndrome (60).

Pain Assessment

The primary complaint in patients is pain. Pain is described during movements involving shoulder internal rotation and overhead activities such as reaching a high shelf, combing hair. Night pain which is seen in acute period makes think the inflammation. Pain is often on the anterior or lateral deltoid muscle (64). Mechanical pain caused by lying on the affected side is a common problem. These patients usually describe pain in the ROM between 70 ° -120 ° of shoulder abduction (64, 65). If there is pain above 120 °, acromioclavicular joint pathologies should be considered (66). Visual analog scale (VAS) can be used to evaluate pain severity (67, 68). In addition, the start

time, cause, factors that increase and decrease the pain, and the presence of night pain should be questioned.

Assessment of Joint Range of Motion (ROM) and Muscle Strength

Limitation in joint movements is not normally expected in the SIS. It is mostly related to pain in certain range of joint movement. Especially when passive joint motion is limited, different shoulder pathologies such as frozen shoulder should be considered. In the clinic, joint motion is most commonly evaluated using a standard goniometer. The normal range of motion of the shoulder joint is flexion 180 °, abduction 180 °, internal rotation 90 °, external rotation 90 ° (69).

Muscle strength is not significantly decreased in SIS (64). However, patients have difficulty in exposing the force due to the pain. Therefore, both shoulders should be compared and painful conditions should be determined in the evaluation. In the evaluation of muscle strength, manual muscle testing is one of the frequently preferred methods for being easy and practical application. However, there may be different results among whose applying the test (70).

Assessment of Scapular Stabilization

It is known that there are changes in the position and kinematics of scapula in SIS (71, 72, 73). Therefore, the scapular position and movements should be evaluated. The condition of the scapula should be observed in a static position and during bilateral arm elevation and abnormal movements or positions should be determined (74, 75). If there is scapular dyskinesia, the type should be noted. Scapular position and kinematics can also be evaluated by radiological methods (66). In impingement syndrome, scapular upward rotation, external rotation and posterior tilt movements were reported to be reduced (76).

Special Tests

Neer Test

In the test described by Neer, while the rotation of the scapula is prevented and impingement occurs in the supraspinatus tendon with elevation and anterior flexion of the shoulder. During this examination, wrinkling and dissatisfaction on the face are observed. This is regarded as a sign of impingement (77, 3, 78, 79).

Hawkins Test

It is a forced internal rotation of the shoulder with 90 ° anterior flexion of the humerus. Through this maneuver, pain occurs in the shoulder of patients (80, 78, 81, 79).

“Empty Can" Test (Supraspinatus Test, Jobe's Test)

The supraspinatus tendon is usually one of the tendons which are most affected by rotator cuff injuries. It can be tested with the resistance applied to the motion during the 90 ° shoulder elevation in scapular plane and full-grade internal rotation (thumb down, empty can position). In this position, the subacromial space narrows to the maximum degree, and symptoms such as pain and non-resistance to movement occur in the problematic supraspinatus tendon (80, 82, 83).

”Full Can” Test

In contrast to “Empty Can" test, it may be performed during 45 ° external rotation (thumb upwards, full can position). According to the Empty Can test, the gap in the subacromial space is more. Tuberculum majus is less impinged under the coracoacromial arch during internal rotation and the risk of pain formation is lower. Therefore, it is mentioned that it is a more reliable test for evaluating supraspinatus (80, 82, 83).

Impingement Test

%1 10%ml xylocaine (lidocaine) injection is applied to the subacromial space and the response of the patient is evaluated. If there is a significant decrease or disappearance of the pain after local injection, this is determined as a positive impingement test (78).

Assessment of Painful Arch

The test is considered positive if the pain occurs between 60 ° and 120 ° in the shoulder abduction of the cases in the evaluation of painful arch. It is observed that the pain decreases as the result of removal of tuberculum majus from acromion when the patients take their shoulders to external rotation. Thus, the degree of shoulder abduction can be increased (80, 78).

2.5.4. Imaging Methods in the Diagnosis of Subacromial Impingement Syndrome

Direct Radiography: Calcific lesions, GH and acromioclavicular osteoarthrosis and other skeletal pathologies can be seen. Shoulder radiography is normal at early stage. In the late periods of stage 3 and stage 2, cystic and sclerotic changes around the tuberculum majus, osteophytes, degenerative changes in the acromioclavicular joint, and narrowing of the subacromial space (below 7 mm) may be seen. Direct radiograms are taken in anteroposterior, 30 ° caudal and lateral scapular planes (62).

Ultrasonography: It is a preferred method for being easy to apply, cheap, noninvasive, having the opportunity to be comparable with the opposite shoulder and not involving radiation. Depending on the individual who is involved, the sensitivity can vary in rates of 63m100% in the detection of RC rupture. In stage 1, there is a non-homogenous echo pattern with diffuse echo reduction in the tendon, whereas in stage 2, there is a non-homogeneous appearance with increased echo pattern in place and irregular thinning of the tendon. There is no irregularity in the joint or bursal surface of the tendon and the tendon maintains its continuity. In stage 3, the continuity of the tendon is not observed, focal hypoechoic area in the tendon and liquid in the subacromial and subdeltoid bursa is observed (84). The sensitivity and specificity of the partial rupture are low when compared to the full-layer ruptures (85).

Arthrography: GH joint capsule, subscapular bursa, inferior axillary pouch and bicipital tendon are seen (62). It has good sensitivity in the detection of full-layer rupture and high-grade partial articular rupture. However, it is usually normal in the early stages of degeneration and in partial rupture. In addition, fibrosis is partially developed or partially healed full-layer ruptures are conditions that reduce its sensitivity (86).

Magnetic resonance imaging (MRI): It is a noninvasive method without radiation and has high soft tissue resolution and the capacity of multiplanar imaging. It has 80 %100% sensitivity and 88 %94% specificity in full-layer rupture of RC. In partial rupture, it has 82% sensitivity and 85% specificity (87, 88). However it is an expensive technique. Tendon volume increases in tendinosis and while moderate signal increase is observed in T1-weighted image, no signal change is observed in T2. In the advanced period of tendinosis, intrasubstance rupture starting from the inside of the tendon fibers becomes localized partial rupture and full layer rupture in joint and bursal surface. In partial ruptures, the hyperintense area within the tendon is observed in only one side of the tendon in T2-weighted image (89). In full-layer ruptures, the rupture occurs more in the zone where the tendon adheres to the bone, and edema is observed in fat-induced sequences of increased bone marrow edema within the adjacent humerus head (90).

Differential Diagnosis of Subacromial Impingement Syndrome

1. GH instability

2. Adhesive capsulitis

3. Acromioclavicular joint pathologies

4. GH degenerative arthritis

5. Peripheral nerve pathologies such as brachial plexus neuropathy, suprascapular nerve neuropathy

6. Cervical pathologies

7. Calcific tendinitis

8. Malignancies

9. Syringomyelia

10. Amyotrophic lateral sclerosis

11. Polymyositis

12. Snapping scapula

13. Thoracic outlet syndromes (91, 32)

Functional Assessment

Patients who experience shoulder problems may experience limitation in the activities for daily life or specific purposes. These patients may have problems in many functional activities such as self-care, dressing and hygiene and thus patients' expectations from treatment are to perform their functional activities. Therefore, patients' response to treatment should be evaluated with pain, strength, active and passive ROM as well as shoulder functions. Since objective measurements do not fully reflect the success of the surgical procedure or treatment approach, functional outcome measures that take into account the physical, psychological and social aspects of the patient's problem are also widely used.

The important point here is the clinical follow-up of patients with shoulder problems, the evaluation of results and their standardization. In functional evaluations applied to patients with shoulder problems, scales that are filled based on their own statements are used.

It is necessary to know the characteristics of the scales used in the evaluations. It is important to choose the most appropriate evaluation parameter for patients. Each of the methods used in the evaluation has its own advantages and disadvantages. A good evaluation parameter should be relevant, standard, valid, reliable, comprehensive, expressive, objective, easy to implement, repeatable and recordable (92, 93, 94, 95).

Sample Functional Scales

-The American Shoulder and Elbow Surgeons Standardized Shoulder Assessment (ASES)

-Disabilities of The Arm, Shoulder and Hand Questionnaire (DASH) and Quick DASH

-The Upper Extremity Functional Index (UEFI)

-Shoulder Pain and Disability Index (SPADI)

-Simple Shoulder Test (SST)

-Constant (Murley) Score (CS)

-University of California at Los Angeles (UCLA) Shoulder Rating Scale (96)

Shoulder Pain and Disability Index (SPADI)

Purpose: Self-assessment of symptoms and function of the shoulder.

Settings: All domains, any disorders of the shoulder joint.

Versions: Original version published in 1991 (97). No revisions.

Content and number of items: 13 items (total score): 5 items for pain and 8 for function (subscores).

Response options/scale: All SPADI items are originally scored on a visual analog scale (VAS) from no pain/no difficulty to worst pain imaginable/so difficult required help. The VAS line was divided into 12 equal intervals to obtain a 12-point numerical rating scale ranging from 0 (best) to 11 (worst) (97). Later versions used the 12-point or an 11-point NRS (0–10) without a VAS line (98).

Recall period for items: 1 week.

Method of administration: Self-assessment.

Time to complete: 2–3 minutes.

Score interpretation: Originally, 0 = best and 100 =worst. A reverse scale from 0 = worst to 100 = best (100 = original score) is also often used to compare with other scores.

Strengths: The SPADI is the most responsive shoulder instrument and has been tested in numerous settings. It is short; it is easy to understand, complete, and analyze; and no costs are involved in obtaining it.

Caveats and cautions: Criterion and construct validity showed some weaknesses in factor.The original 12-item numerical rating scale (where 0 = best and 11 = worst) is uncommon. Only 1 item assesses overhead work or heavy use of the shoulder, which may produce ceiling effects.

Clinical usability: Very good for short and responsive assessment in all shoulder conditions. Easy to interpret.

Research usability: Most responsive shoulder tool. Recommended for every set of shoulder assessments.

The American Shoulder and Elbow Surgeons Standardized Shoulder Assessment (ASES)

Purpose: Developed to "represent a state-of-the-art questionnaire with three key features:

1) Ease of use

2) Method of assessing activities of daily living (ADL) and

3) Inclusion of a patient self-evaluation section," approved by the ASES Research Committee in 1994 (99) to be applicable to all shoulder patients regardless of diagnosis.

Content and number of items: Patient self-assessment section (patient-ASES [pASES]) and a section to be completed by the examiner (clinical-ASES [cASES] or, more precisely, ASES-examiner). The patient-ASES form is divided into 3 sections: pain (6 items), instability (2 items), and ADL (10 items for both sides each). The clinical-ASES has 4 parts (each for left and right): range of motion (5 items, each passive and active), signs (11 items), strength (5 items), and instability (8 items + 1 open question).

Response options/scale: Binary (yes/no) answers for pain and instability, visual analog scales (VAS) for pain and instability (where 0 = best and 10 = worst), and 4-point ordinal Likert scale for function (where 0 = unable to do, 1 = very difficult, 2 = somewhat difficult, and 3 = not difficult).

Recall period for items: 1 week.

Method of administration: Self-assessment.

Time to complete: 3 minutes (pASES).

Score interpretation: 0 = worst and 100 = best.

Strengths: Recommended by the ASES and, by that, widespread use, especially in American centers. The ASES showed good reliability, high construct validity, and high responsiveness.

Caveats and cautions: Mix of scales (binary, Likert, VAS). Limited content, especially criterion validity.

Clinical usability: Helpful combination of self- and clinical assessment.

Research usability: Good applicability for research and good responsiveness. Slightly longer than and less frequently used as the Shoulder Pain and Disability Index. Some methodologic weaknesses.

Constant Murley Score (CMS)

Purpose: "The method records individual parameters and provides an overall clinical functional assessment, applicable irrespective of details of the diagnostic or radiological abnormalities, sufficiently sensitive to reveal even small changes in function" (100). Introduced in 1987 (100). Revision in 2008 (101).

Content and number of items: The score consists of 4 domains: pain (1 item), activities of daily living (ADL; 3 items for activity level, i.e., work, sports, sleep, 1 item for hand positioning, i.e., rotation), mobility (4 items: forward and lateral abduction/elevation, external and internal rotation), and power/strength (1 item). Pain and ADL 1–3 are interviewed from the patient (i.e., self-assessed); all other items are examiner assessed.

Response options/scale: Pain item: originally 4 Likert levels, visual analog scale in the revised version, where 0 = maximal pain and 15 = no pain. ADL: Likert scales, where 0 = worst and 5 = best for each item. Mobility: active, pain-free range of elevation: +2 points per 30°, where 0 = worst and 10 = best for each item; position of hand: 0 = worst to 10 = best.

Recall period for items: 1 week.

Method of administration: Clinical examination plus patient interview (self-assessment). Retrospective data extraction from the case history is not reliable, especially not for the patient's self-assessment items.

Time to complete: 5–7 minutes.

Score interpretation: 0 = worst and 100 = best function.

Strengths: The CS covers the clinically most relevant domains and shows high responsiveness. It is highly accepted throughout the clinical community in the fields of arthroplasty, rotator cuff disease, shoulder trauma, and fractures.

Caveats and cautions: There are sparse, and in some parts, no data about reliability and validity (except construct validity). Intertester reliability was shown to be low. Different versions and measurement methodologies lead to problems when comparing data.

Clinical usability: The CS is in widespread clinical use. It is not suitable for patients with instability conditions. Due to lack of testing data or insufficient measurement properties, caution is necessary for measurement at an individual patient level.

Research usability: Limited due to the caveats, especially insufficiently testing of validity.

Simple Shoulder Test (SST)

Purpose: To assess functional disability of the shoulder (102).

Content and number of items: Total score of 12 items: 2 about function related to pain, 7 about function/strength, and 3 about range of motion. No subscales.

Response options/scale: Dichotomous responses: 1 = yes (function possible) and 0 = no.

Recall period for items: Actual/at the moment of assessment.

Method of administration: Self-assessment.

Time to complete: 2–3 minutes.

Score interpretation: 0 = worst and 100 = best function.

Strengths: Very short and easy to use. Good construct validity.

Caveats and cautions: Substantial lack of criterion validity (testing data).

Clinical usability: Easy to use; widespread use in the US. Due to lack of testing data or insufficient measurement properties, caution is necessary for measurement at an individual patient level.

Research usability: Limited due to lack of non-English versions and the caveats.

2.5.5. Treatment Methods in Subacromial Impingement Syndrome

SIS treatment is conservative in the ratio of 90-95%. For effective treatment, it is important to determine the factors causing impingement and to establish personal rehabilitation programs. When the literature is considered, RC strengthening (103, 104), stretching (105, 106, 107) and exercises to increase normal joint movement (108), various mobilization techniques (108, 106, 6), electrotherapy modalities such as TENS (109, 110), taping techniques and home exercise programs can be seen (108, 111).

Cold Application

It is applied in acute condition and in periods when the complaints are severe. 10 -20 minutes of ice application to be applied after the activity and exercise that causes symptoms, decreases the risk of inflammation (112). The benefits of cold such as increasing the pain threshold, slowing the speed of the nerve conduction and pain killer effect and gate-control theory mechanisms are used (113).

Superficial Hot Application

It may be preferred in sub-acute and chronic period in order to benefit from muscle relaxation and analgesic effects, especially before exercise. Superficial heaters such as hot pack (HP) and infrared are used. As a result of local heat application, vasodilatation occurs, metabolism accelerates, collagen tissue viscoelasticity increases, muscle spasm dissolves and pain decreases (114).

Iontophoresis

It is the process of absorbing some ions into human body through galvanic current. Corticosteroids and local anesthetics can be given under the anode. The current dose should be below 5mA (115).

Ultrasound

Ultrasound is a physical agent based on the application of mechanical energy produced by sound waves with frequencies between 85 KHz and 3 MHz, at a density of 0 to 3 W / cm ^{2}. Ultrasound have been the preferred treatment modality for musculoskeletal injuries for the last 30 years in physiotherapy. As a result of the pressure change in the tissues caused by ultrasound waves, the mechanical reaction of the tissue leads to micro massage as in compression and dilatation. By increasing the fluid exchange and absorption between the cells, the membrane permeability is increased. As a result of the separation of collagen fibers and softening of the collagen tissue, the adherent tissues are become loose and adhesions are resolved. The size of the area to be treated, the duration of treatment, the severity of the energy, the frequency of treatment and the total treatment session should be taken into account (116, 117).

Laser

Laser is a noninvasive, nonionizing, monochromatic electromagnetic high concentrated light beam. Recently, low level laser therapy has been widely used in various rheumatologic and musculoskeletal disorders which have analgesic, anti-inflammatory and biostimulating effects. Low level laser therapy induces cell proliferation, collagen synthesis, protein replication, tissue reparation (118, 119).

Transcutaneous Electrical Nerve Stimulation (TENS)

The main principle of TENS application is the application of intermittent electrical currents applied to the skin via superficial electrodes in order to stimulate afferent A-delta fibers with thick caliber that play a role in reducing pain. TENS application is a noninvasive analgesic technique and is frequently used in musculoskeletal pain. It has 4 different current intensities. Current types:

• Conventional TENS

• Acupuncture type TENS

• Burst type TENS

• Module TENS

Conventional TENS

Electrical current is short-term and has high-frequency and it has the feature of being easily tolerated. The modulation mechanism is based on the gate control mechanism. The frequency is 50-100 Hz and each pulse duration is 20-60 ms. The current intensity is increased until the patient receives a comfortable sensation without contraction in the muscle. Conventional TENS is more commonly used in acute conditions and around the joints. Therefore, it is frequently preferred in the treatment of SIS (120).

Taping

Today, taping is used in the treatment and rehabilitation of musculoskeletal pathologies. Taping techniques which aims to change primary muscle activity have been widely used in the management, prevention and treatment of neuromusculoskeletal injuries which have been adversely affected not only for sportive injuries but also for muscle imbalance, unstable joints and neural control (121). Kinesio Taping techniques (KTT) and Rigid Taping techniques are among the taping options applied for different purposes with special techniques in the treatment of SIS (121, 122).

Kinesio Taping Technique (KTT)

KTT was developed by Dr.Kenzo Kase. According to Dr.Kase, muscle dysfunction is one of the major problems of musculoskeletal system.

KTT is used to improve the function of the muscle by supporting the weak muscles, affect the lymphatic fluid and the blood circulation, reduce the pain by stimulating the neurological system and correct the defective alignment of the joints. It is stated that KTT applications have an effect on nerve, musculoskeletal and circulatory system, especially on muscle tissue and metabolism and thus it is important in accelerating healing with its contribution to circulation and painless movement.

KTT application creates pressure on the skin and stretches the skin. This external loading stimulates cutaneous mechanoreceptors and causes physiological changes in the

taped area. KTT increases blood and lymphatic fluid circulation by increasing the distance between the skin and the interstitial area.

The role of KTT on the mechanism of pain is explained by different mechanisms such as edema and reduction of inflammation and activating inhibitory mechanisms provided by descending means and the gate control mechanism by sensory stimulation, and the analgesic effect by regulating superficial and deep fascia functions (122, 123, 124).

Factors affecting the success of the technique are to know the anatomy of the musculoskeletal and circulatory systems and to apply the appropriate techniques. There are different application techniques in KTT application. Muscle technique, mechanical correction technique are among them (122).

Rigid Taping (McConnell Taping)

The shoulder joint is a joint consisting of many soft tissues and surrounding soft tissues affects its control. In particular, weak muscle control around the scapula and the immobile of the thoracic spine significantly affect the function of the shoulder joint by reducing joint and soft tissue mobility. Thus, the shoulder joint becomes open to instability and impingement problem. The main purpose of the McConnell technique; to support ligament, joint capsule and tissues without active movement, increase proprioception, to take load from painful tissues, to inhibit excessive muscle activation and to facilitate to weak muscles (121).

In SIS, supraspinatus McConnell taping technique among rigid taping techniques and shoulder McConnell humeral head relaxation technique are applied. McConnell taping technique is applied together with the prototype, which is a very hard, sticky wool web. Hypoallergenic tape is adhered to the base for avoiding any irritation before tape application. Through McConnell humeral head relaxation technique, it is possible to increase the existing area for soft tissues. The purpose of taping is to increase the area between the acromion and the elevated humerus by elevating the humeral head from the anterior angle superior and posterior (125).

Exercise

It is necessary to start treatment as soon as possible to reduce the subacromial inflammation, which is the general aim of conservative treatment, to allow the healing

of rotator cuff muscles, to reduce pain and to restore shoulder function. The treatment of SIS includes reduction of pain and inflammation of joint and soft tissues, elimination of mobility disorders, correction of scapulohumeral rhythm, re-functionalization of posture and movement, increase of strength and endurance, regulation of ADL, ergonomic modifications and patient education. In this context, a fast and smoothly planned treatment program increases the return and functionality of individuals (118, 126, 127). Although the basic treatment principle in the SIS is the same, the stage of the etiology and the SIS may cause minor changes in the treatment program.

Manual Treatment (MT)

Chiropractic called as manual therapy is a very old treatment method. It includes both diagnosis and treatment techniques. Manual therapy, which allows the patient to perform shoulder joint movements easily by reducing the symptoms, is frequently preferred in recent years for the treatment of musculoskeletal injuries and functional disorders. Manual therapy is also defined as reflex therapy. Studies showing that the reflex reactions created by the mobilization of joint structures are useful in terms of pain and functionality are included in the literature. Since the primary and secondary causes of the syndrome are also included in the treatment, the mobilization techniques which frequently used in the SIS reduce the recurrence rate of the impingement. The general aim of the manual treatment is to provide restructuring, accelerate the opening of adhesions, provide painless function and accelerate the return to the daily and / or sports life of the person by increase the healing capacity of the tissue (51, 106). Manual treatment techniques are divided into soft tissue and joint techniques. Soft tissue techniques are performed as massage, muscle relaxation, stretching and exercise, joint techniques are performed as traction, glide, stretching and exercise.

Studies showing that the application of manipulative treatment in all shoulder problems is useful in terms of duration of treatment, pain and functionality are included in the literature (128, 51, 129).

In one of these studies, Kachingwe et al. (52) divided 33 patients with SIS into 4 groups, exercise was performed by supervisor in the first group, exercise and GH mobilization were applied to the second group, mobilization with movement (MWM) from Mulligan techniques which movement-mobilization is combined and exercise was given to third group and only suggestions were given to fourth control group. As a result of the study, decreased pain, increased ROM, increased shoulder functions

evaluated by SPADI, and improvement in Neer and Hawkins tests were observed in all treatment groups. They reported that GH mobilization and MWM would be more effective with exercise.

There are many mobilization techniques developed for the shoulder. GH joint mobilization, scapular mobilization are among them.

Mulligan Mobilization Technique (MMT)

Manual therapy techniques are also used in the treatment of joint dysfunction. Mulligan Mobilization which is a kind of joint mobilization developed by Brain Mulligan, a New Zealand physiotherapist, is one of these manual therapy techniques. This technique was found by being arranged from physiological joint motion component among Kaltenborn principles. In this concept, the mobilization is applied in the position bearing load and in parallel to facet joint. Mobilization which was applied as combined with extremity movement in 1990s, is now applied as transvers gliding at the spinal level with active or passive joint motion in recent years. New applications allow more accurate identification of dysfunctional movements. Mulligan has attempted to improve positional errors and joint biomechanics in the joint face in cases of macro trauma or long-term micro trauma. MMT is a treatment method based on the normal movement and function of the joints and surrounding soft tissues without pain. It is a special manual therapy method applied by physiotherapists trained on this subject in order to correct the limitation of movement in the joint and to eliminate pain and functional disorders. Mulligan's theory is based on positional error, which develops secondary to the misalignment of the joint. Positional error can occur as a result of disruption in the surface of the joints, thinning in cartilage, and incompatibility in ligaments and capsules. According to the studies, MMT has effects which stimulate hypoalgesic and sympathetic nervous system. MMT is based on certain principles such as passive glide that will not cause pain or symptoms. Joint compression should not be performed. All glides must be in the treatment plane. All spinal mobilizations and mobilizations with movement should be performed at the positions where the load is carried. According to Mulligan, the gains at non-weighted positions are lost when the patient passes through vertical posture.

The effect of technique on increasing ROM and providing normal muscle function were determined. Through MMT, the joint replacements normal position and

the positional error is corrected. It is aimed to restore the movement by repositioning the bone. The main indication in this technique is increased pain, stiffness and weakness in movement. MMT is performed by requesting active movement of the patient while continuing the manual joint glide (130, 131, 132, 133). According to the general principles of Mulligan treatment, all techniques should be applied in the form that will not cause pain and should be applied to eliminate pain in a short time. Painless movement in the joint is aimed (134, 135).

MMT has the effect of reducing pain and improving functions immediately after treatment.

The principles of MMT treatment are:

1. For the application of MMT, pre-treatment evaluations should show at least one of the symptoms of decrease in ROM, pain with movement, pain in specific functional movements.
2. Painless passive joint mobilization is applied.
3. The therapist observes the patient for the presence of pain throughout the treatment. The gliding direction in which the painless movement is obtained creates the correct treatment plane.
4. Gliding in the joint such as ROM, muscle contraction and pain reduction are obtained.

The necessary parameters for the effectiveness of the MMT application are:

1) Principles

- Application of assistant glide: It is applied in lateral or anteroposterior direction according to the angle of the joint. Specific glide directions for joint and disease were determined in the studies.

-Physiological movement occurrence: According to the studies, the movement occurrence during MMT is painless.

-No pain: A decrease in pain means that the technique is applied correctly.

-Immediate impact: After the treatment, the patients' pain and ROM can be recovered immediately.

-Pressure application in end point: It is one of the important parameters of MMT. An indirect way to increase the effect is followed. Painless passive pressure at the end of the range of motion contributes to alleviation of pain.

2) Technical parameters:

-The number of repetitions: MMT is frequently performed with 10 repetitive. Alternatively, 2-10 repetitive applications can be made.

-Set number: 1 to 4 sets of application can be done, but often 3 sets are preferred.

-Frequency: In order to achieve usefulness, 19 sessions are frequently applied. There are also studies, made 3-6 sessions treatment. The sessions can be between 24-48 hours. It can be applied 1 times in 5 days, but it can be done 2 times in 1 day and in 3 weeks.

-The amount of power: The amount of power to be applied has not been determined.

-Resting periods: There are 15-60 seconds resting periods between the sets. Often 15-second rest breaks are used. In these applications, it was found that positive results were obtained for increasing the pain threshold.

3) Treatment result parameters (PILL)

The application effect is also referred to as 'PILL'.

Pain-free: Painless applied

Instant result: Taking instant results

Long: The effect will last longer

Lasting: The continuity of the result (136).

The Mulligan concept is completely painless. Passive glides and / or rotations applied by the therapist consist of active movement by the patient, pressure application at the last angles of the joint components. The reduction of pain depends on the angle of the applied glide and the amount of power. MMT is first applied in the cervical vertebrae and later in the extremity joints to be used for the treatment of all vertebral column and peripheral joint dysfunction.

While manual glide is obtained in the technique, the patient is asked to make active movement (127). It is a technique in which manual power is applied to move the joint during movement and muscle contraction is targeted together with completely painless movement. The applied manual power is in the direction of translation or rotation. According to studies, the decrease in pain leads to an increase in ROM and pain threshold (137, 138, 139, 140, 141, 142).

Features of Mulligan mobilization technique;

1. It is made in the positions with is carried functional weight.
2. The pressure at the end of the movement is painless.
3. Painless motion is obtained immediately after the session.

4. It is done along the joint plane.

5. Passive mobilizations which are combined with active, passive or resistant movements.

6. Maximum painless ROM is used.

7. Passive component (slip / rotation) is maintained throughout the range of motion and until it returns to its starting position

8. It can be applied on vertebral column and extremities.

9. The application is completely painless when done correctly.

The reason for the lack of any changes in symptoms after MMT depends on the following:

- Inappropriate technique
- Incorrect direction or power of mobilization
- Incorrect selection of the joint
- Incorrect selection of the spinal level
- Weak application skills
- Low communication with patients
- Discomfort in the local application area (143, 144, 23, 145, 146).

Principles of treatment according to stages

- **Stage 1**

  -It is seen in 25 years and under

  -The patient has a hemorrhage and edema

  Clinical Table

  -Subacromial pain and tenderness

  -Painful arch

  -Positive impingement and Neer test

  -Pain in resistant abduction and external rotation

  Treatment principle

  -Reduction and destruction of inflammation

  -Patient education

  -Restoring proximal control

- **Stage 2**

  -It is seen in 25-40 years old

-Tendinosis, bursitis, fibrosis

Clinical Table

-Limitations of the capsular pattern of the G-joint

-Significant limitation in external rotation and abduction

-Less limitation in internal rotation

Treatment principle

-Restoring the capsular mobility of the GH joint

- **Stage 3**

-It is seen in 40 years old and above

- Formation of bone process, degenerate of tendon integrity

Clinical Table

- Loss of strength in external rotation and abduction

- Square shape acromion

Treatment principle

It is planned according to the size of the rupture

-1cm: Conservative treatment

-1-3cm: Conservative treatment, acromioplasty, mini-open repair

-3-5cm: Mini- open repair

-5cm: Open repair

Before starting the treatment program for extrinsic anatomic compression, it is foreseen to determine the actual cause of the problem and, if necessary, to perform the surgical treatment first. Conservative treatment program is started later.

In the treatment of intrinsic anatomic impingement, firstly stability exercises and in the second stage RC strengthening exercises are preferred.

In the treatment of subacromial impingement syndrome, which is due to functionally overuse, first of all, movement modification is made and then exercise therapy is started.

SIS which consist of intrinsic tendinopathy is usually seen in elderly patients Because these patients will be difficult to participate in exercise therapy, these patients should be followed up more frequently and analgesic, nonsteroidal anti-inflammatory drugs (NSAIDs) and physiotherapy modalities are preferred more frequently in

treatment (147, 148). The treatment according to the stage of the disease is summarized below.

Acute Term

The aim of this period is to eliminate pain and inflammation, prevent muscle atrophy and to try to normalize the shoulder arthrokinematic by providing painless ROM. In this period, the rest of the region is recommended, and activities that increase pain and symptoms should be avoided (149). In particular, overhead activities which over 90 ° flexion of the shoulder should be prevented in this period (147, 148).

Treatment Protocol:

-Codman exercises
-Active assisted ROM exercises
-Isometric strengthening exercises (external rotators, biceps, deltoid muscles)
-Strengthening exercises for scapular stabilizers (rhomboid, trapezoidal, serratus anterior, latissimus dorsi, pectoralis major)
-Neuromuscular control exercises
-Joint mobilizations in the scapular plan
-Cold application
-Electrotherapy modalities (TENS, phonophoresis, iontophoresis, high voltage galvanic current)
-Patient training and activity modification

Other phase transition criteria

-Reduction of pain and symptoms
-Increasing the movement of the joints
-Having painful arch only in abduction
-Increased function of muscle (150).

Recovery Period

In this period, the aim is to increase the neuromuscular control and muscle strength with painless movement in ADL by normalizing the joint movement and shoulder arthrokinematic.

Treatment Protocol:

- Active ROM exercises in each plane
- Self-made joint capsule stretching exercises
- Strengthening exercises (supraspinatus, shoulder internal and external rotators, extension in the prone position, horizontal abduction, flexion up to 90 ° and abduction)
- Strengthening the scapular stabilizers
-Joint mobilizations
- Neuromuscular re-education exercises
-Endurance exercises
-Pain-killer physical agents, taping and electrotherapy modalities

Other phase transition criteria

- 70% muscle strength compared to the solid side
-To have full joint movement without pain

At the end of this period, throwing activities should be started and power, strength and endurance exercises should be increased and sports specific neuromuscular control should be provided.

Exercises

-High speed, high energy strengthening exercises
-Eccentric exercises in the diagonal pattern
-Isotonic strengthening exercises in all directions with increased resistance
-Special strengthening exercises for throwing at 90 ° abduction and external rotation positions
-Plyometric exercises
-Special exercises for sports

-Proprioceptive neuromuscular exercises
-Isokinetic exercises (150).

Protection Period

In this period, the aim is to prevent re-occurring injury with a high level of education. It is important to maintain patient training and to ensure the continuity of the necessary modifications for recurrent activities to improve the symptoms by affecting the shoulder arthrokinematic. Therefore, the patient's exercises should be continued during this period (150).

Surgical Methods

Patients in stages 1 and 2 of the SIS respond to conservative treatment methods such as mild exercise, medical therapy such as NSAIDs, and subacromial or intra-articular injection especially corticosteroids. Surgical intervention is considered for patients with stage 2 SIS that does not benefit from conservative treatment and with stage 3 SIS. Open or arthroscopic subacromial decompression techniques are used in surgical treatment. In recent years, arthroscopic subacromial decompression, which is more advantageous than open surgery, has been used more frequently (25, 151). The routine procedure for all patients in both arthroscopic and open methods is anterior acromioplasty. In addition, coracoacromial ligament resection, spur excision in the acromioclavicular joint, bursectomy, distal clavicle resection and RC repair are performed in the cases required during surgery (152).

3. MATERIALS AND METHODS

This research is a single-blind randomized controlled trial. The study was conducted between 01.01.2018-01.06.2018 at Başkent University Istanbul Health Application and Research Center Physical Therapy and Rehabilitation Clinic. This study was approved by Başkent University Institutional Review Board and Ethics Committee (Project no: KA17/275) and supported by Başkent University Research Fund (App. 8.1.). In the biostatistics preliminary evaluation, it was determined that a total of 34 patients should be included in the study and 17 patients were eligible for each group. The patients who applied to Baskent University İstanbul Health Application and Research Center Physical Therapy and Rehabilitation Clinic with the complaint of shoulder pain and among the patients who were referred to the outpatient physiotherapy and rehabilitation program by the physician of physical therapy and rehabilitation were included in the study.

Inclusion Criteria of Cases:

1. Being between the ages of 18-65

2. Having shoulder pain for at least 4 weeks

3. No corticosteroid treatment in the recent one year

4. Not having neurological deficits in the upper extremity

5. Absence of upper extremity fracture

6. Absence of acute cervical pathology

7. Absence of cardiovascular diseases preventing rehabilitation

8. Absence of any surgery related to the shoulder

9. Not having physical therapy and rehabilitation program for the shoulder in the last 6 months

10. Not having diagnosis of adhesive capsulitis

Exclusion Criteria of Cases:

1. Being under 18 years old, older than 65 years old

2. Having shoulder pain in less than 4 weeks

3. To have received regional injection to the shoulder in the recent one year

4. Having neurological deficits in the upper extremity

5. Presence upper extremity fracture

6. Presence of acute cervical pathology

7. Presence of cardiovascular diseases preventing rehabilitation

8. Presence of any surgery related to the shoulder

9. Having physical therapy and rehabilitation program for the shoulder in the last 6 months

10. Having diagnosis of adhesive capsulitis

In our study, the total number of randomized patients was 40. 2 of these patients refused to participate in the study and 4 patients had discontinued their treatment because of special reasons (Fig. 3.1). No side effects were seen in the treatment processes.

A total of 34 patients were included in the study. Patients were divided into two groups as conservative treatment (CT) group and mulligan mobilization (MM) group. Randomization was obtained using the www.randomizer.org resource.

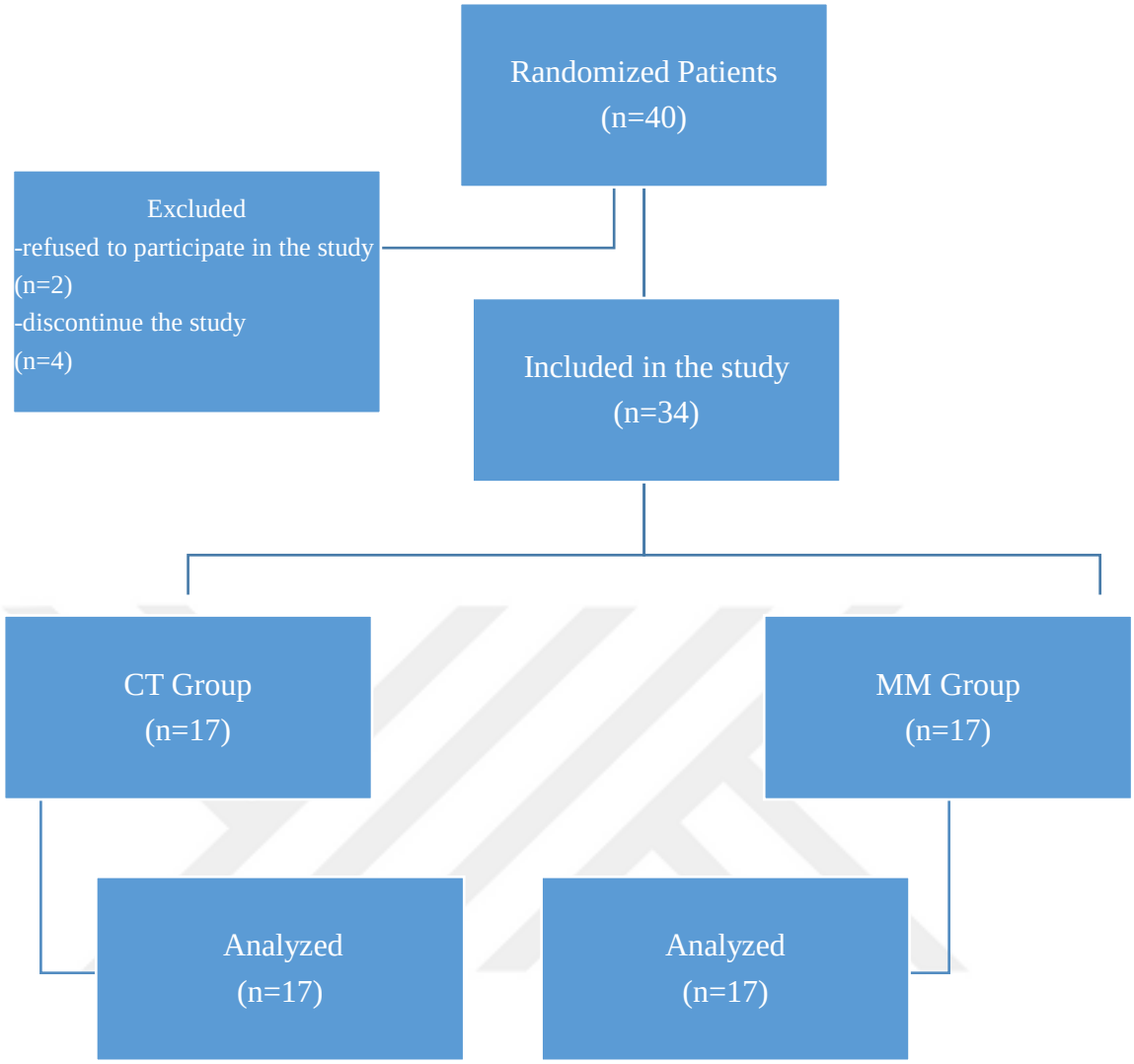


Figure 3.1. Research flow chart

HP, TENS, Codman exercises, ROM and strengthening exercises were applied to 17 cases taken to the CT group. Mulligan mobilization was applied to 17 cases taken to the MM group in addition to the treatment applied in the conservative treatment group. In addition, the patients of the two groups continued their exercise as a home exercise program. Patients were included in physical therapy and rehabilitation program for a total of 14 sessions 3 times a week. After the demographic data of the patients were recorded, pain, range of motion, muscle strength and functional status of the cases were evaluated before and just after the treatment. VAS (App. 8.2.) was used to evaluate the pain of the cases. Shoulder abduction, flexion, internal and external rotation range of motions were measured passively and actively by using goniometry. Manual

muscle test for shoulder abduction, flexion, internal rotation and external rotation movements was measured. Functional status assessment was made with the DASH (App. 8.3.). All patients included in the study were treated by the fixed physiotherapist. All the evaluation parameters of the patients before and after treatment were performed by a different physiotherapist. The physiotherapist who did the assessments did not know which group the patients were in. This study is a randomized controlled study in which the evaluator is blind. During the study, patients were not given any medical treatment to reduce their pain.

3.1. Methods

3.1.1. Assessment

The participants who wanted to participate in this study read the information form issued about the applications and measurements to be made before the study and signed the participant consent form (App. 8.4.) with the observer.

Anamnesis

The socio-demographic characteristics of all cases were evaluated by mutual interview method. As a result of this evaluation, information about age, gender, education, dominant side, affected side, medical history of the patients were recorded (App. 8.2.).

Pain assessment

VAS was used to determine the level of pain in the patients. VAS values of all patients were recorded at rest, at night, during activity. The patients were asked to mark the severity of rest, activity and night pain on a horizontal line of 10 centimeters (cm). The point marked on the line was measured with a ruler and the VAS value was recorded in cm (153) (Fig. 3.2.).

0 ——————————————————————— 10cm

Pain free maximum pain

Figure 3. 2. Visual Analogue Scale (VAS)

Assessment of Shoulder Joint Range of Motion

Goniometric measurements for shoulder flexion, abduction, internal and external rotation were performed to evaluate shoulder ROM. The measurements were performed using a universal goniometer. Shoulder flexion, abduction, internal and external rotation movements were measured in supine position. Measurements were recorded in degrees (App. 8.2.) (80, 154, 155, 156). ROM values of American Society of Orthopedic Surgeons were accepted as standard (157).

Manual Muscle Strength

In order to determine muscle strength, the manual muscle test developed by Lovett has been applied. The patient was instructed to hold the arm at the end of its available range while the physiotherapist provides opposing manual resistance. Muscle strength was graded according to the resistance of the patients (App. 8.2.) (154).

DASH

It was used to evaluate shoulder function. This questionnaire is a questionnaire which measures physical disability and symptoms in all upper extremity disorders. This is a questionnaire that the patient answers. DASH questionnaire consists of 3 parts. The first section consists of 30 questions, the 21 questions included the patient's difficulty in the ADL, 5 questions evaluated symptoms (pain related to pain activity, tingling, stiffness, weakness), and each of the remaining 4 questions evaluated social function, work, sleep, and patient's self-confidence. This first section determines the patient's function / symptom (DASH-FS) score. In addition to these first 30 questions, there is 4 questions and optionally answerable business model (DASH-W) determines the patient's disability in working life. Again, there is a high-performance athletes-

Musicians Model (DASH-SM) which consist of 4 questions and determines the level of disability of athlete or musician patients. In all questions, the patient signs the appropriate response in his 5-point Likert system (1: no difficulty, 2: mild difficulty, 3: moderate difficulty, 4: extreme difficulty, 5: not at all). According to the results of the DASH questionnaire, a result of 0-100 is obtained from each section (0 = no disability, 100 = maximum disability) (158, 159). (App. 8.3.) The part for athletes and musicians was not implemented.

3.1.2. Treatment Program

The patients in both groups were included in the treatment 3 times a week for a total of 14 sessions. The treatments were administered by a single physiotherapist.

Conservative treatment group

20 minute of HP application and 20 minute of TENS application were applied to patients in the conservative treatment group. Then, the patients performed the exercises under the supervision of physiotherapist. The patients were asked to perform their exercise program at home, with 2 sets and 10 repetitive daily.

As a training program, a combined program consisting of normal joint motion exercises and strengthening exercises was prepared. Codman exercises were initially performed to increase normal ROM (Fig. 3.3., 3.4., 3.5.). Then Wand exercises (Fig. 3.6., 3.7., 3.9.), towel stretch exercise (Fig. 3.8.), finger-ladder exercises (Fig. 3.10., 3.11.) and shoulder wheel exercises were performed. Isometric exercises were performed in the direction of flexion, abduction, extension, internal and external rotation as strengthening exercises and exercises were performed with thera band of medium hardness in the same directions (Fig. 3.12., 3.13., 3.14., 3.15.). Exercises were constructed in a single set and 10 repetitions.

Figure 3.3. Codman Exercise 1

Figure 3.4. Codman Exercise 2

Figure 3.5. Codman Exercise 3

Figure 3.6. Wand Exercise-Flexion

Figure 3.7. Wand Exercise-Abduction

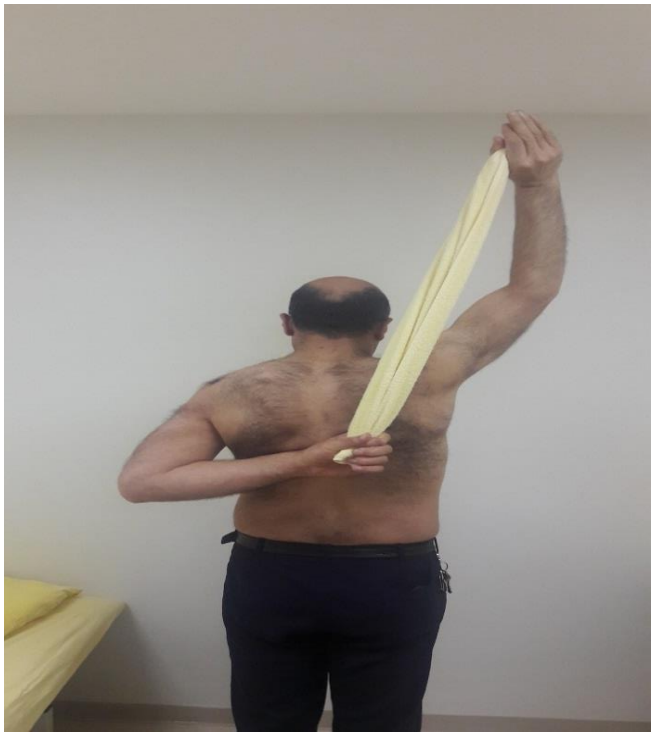


Figure 3.8. Towel Stretch Exercise-Internal Rotation

Figure 3.9. Wand Exercise-External Rotation

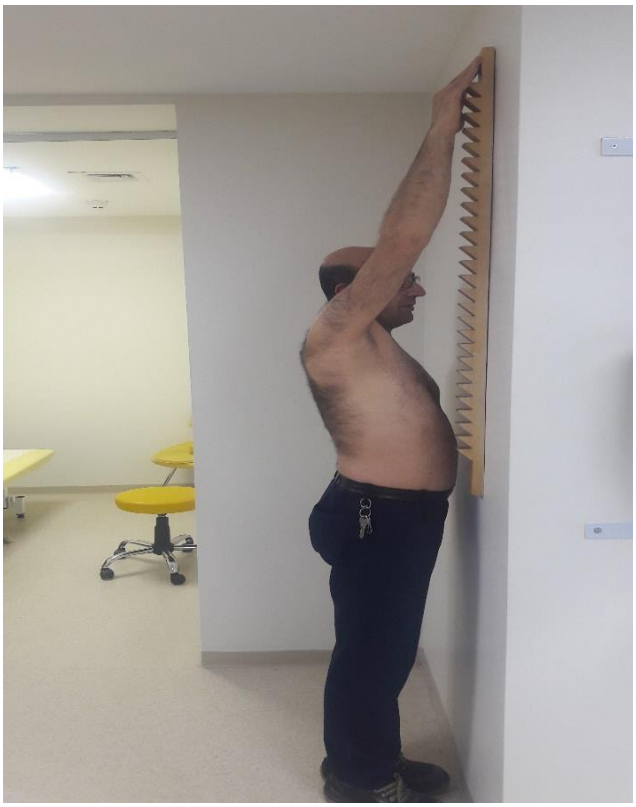


Figure 3.10. Finger Ladder Exercise-Flexion

Figure 3.11. Finger Ladder Exercise-Abduction

Figure 3.12. Strengthening with Thera-Band-Flexion

Figure 3.13. Strengthening with Thera-Band-Abduction

Figure 3.14. Strengthening with Thera-Band-Internal Rotation

Figure 3.15. Strengthening with Thera-Band-External Rotation

Mulligan Mobilization Group:

In the Mulligan mobilization group, 4 different applications were made from the Mulligan mobilization technique in addition to the electrotherapy and exercise program applied to the patients in the conservative treatment group. Mobilizations were made to be 2 sets and 10 repetitions. In all these mobilizations attention was paid to the movements being painless.

1- Mobilization with movement (MWM) for shoulder elevation in abduction

In the patient who received treatment from the right shoulder:

The patient is seated. The therapist was stood on the left side of the patient, with his right hand over the left scapula of the patient and the thenar part of his left hand over the humerus head of the patient. Physiotherapist avoided pressure over the sensitive coracoid process by being just below and medial to it (Fig. 3.16.). Physiotherapist asked the patient to raise his arm up from his side while he applied a posterolateral and slightly down gliding force over the head of the humerus with his left hand.

2- Mobilization with movement (MWM) for shoulder flexion in supine position

In the patient who received treatment from the left shoulder:

The patient was lay supine position. Physiotherapist at the head of the bed grasped the humerus with one hand and the forearm with the other on the effected side. Physiotherapist pushed down along the shaft of the humerus while the patient tried to raise his arm (Fig. 3.17.). Thus, the head of the humerus was glided to posterior on the glenoid.

Figure 3.16. MWM for Shoulder Elevation in Abduction

Figure 3.17. MWM for Shoulder Flexion in Supine Position

Figure 3. 18. MWM for Internal Rotation 1

3- Mobilization with movement (MWM) for internal rotation

In the patient who received treatment from the right shoulder:

Physiotherapist, stood facing the patient's right side and placed his right thumb in the bend of patient’s flexed right elbow. Physiotherapist placed the web between his finger and thumb in the patient’s axilla, obliquely to stabilize the scapula. Physiotherapist glided the head of the humerus down in the glenoid fossa while his left hand was stabilising the scapula. Then had the patient internally rotate his shoulder, with the help of the other hand, while physiotherapist adducted patient’s upper arm using his abdomen (Fig. 3.18.).

Figure 3.19. MWM for Internal Rotation 2

4- Mobilization with movement (MWM) for internal rotation

In the patient who received treatment from the left shoulder:

Physiotherapist stood to the left side of the patient and cup his left hand around the proximal end of the humerus and his right hand stabilized the scapula. Then with his hands in this position pulled the humeral head slightly down and back in the glenoid fossa. Physiotherapist maintained this correction and had the patient repeatedly internally rotate. Physiotherapist's forearm helped to maintain the abduction (Fig. 3.19.).

3.1.3. Statistical Analysis

The data obtained were analyzed using Statistical Package for Social Sciences (SPSS) 22.0. Descriptive data were presented as mean, standard deviation and percentile when evaluating the study data. According to the normal distribution characteristics of the data; Non-parametric Mann Whitney U test was used to analyze the differences between the groups. In the cases where continuous variables can fulfill the assumptions of parametric test, independent two group t-test (Student's t test) was applied to compare the two independent groups. Wilcoxon or Paired T Test was applied to analyze the differences between the dependent groups. The correlation coefficients and the statistical significance were calculated by Spearman's test for the relationships between the variables, at least one of which was not normally distributed or ordinary. The results were evaluated at 95% confidence interval and $p < 0.05$ at significance level.

4. RESULTS

The mean age of the conservative group was 56.11 ± 8.28 years, and the mean age of the group receiving mulligan mobilization was 50.88 ± 9.47 years. No statistically significant difference was found between the groups (p> 0.05). Of the conservative group, 10 (58.8%) were female and 7 (41.2%) were male and of the mulligan mobilization group, 11 (64.7%) were female and 6 (35.3%) were male. There was no statistically significant difference between the groups in terms of gender (x2 = 0.125, p = 0.72). Table 1 shows other demographic data of the groups. In the conservative group, the dominant side (right hand) was 14 (82.4%), and the right shoulder taken for treatment was 10 (58.8%) and in the mulligan mobilization group, the dominant side (right hand) was 13 (76.5%), and the right shoulder taken for treatment was 9 (52.9%). In the conservative and mulligan mobilization groups, a statistically moderately significant positive correlation was found between the dominant side and the treated side (r = 0.55, p = 0.02; r = 0.58, p = 0.01, respectively) (Table 3.1.).

Table 3.1. Clinical Characteristics of Study Population

CT Group: Conservative Treatment group, MM Group: Mulligan Mobilization group

CHARACTERISTIC	CT Group (*n*= 17)	MM Group (*n*= 17)	*P*
Age (years) (mean ± standard deviation)	56.11±8.28	50.88±9.47	0.096
Gender (female / male) n (%)	10 (58.8)/7(41.2)	11 (64.7)/6 (35.3)	0.72
Dominant side (right / left) n (%)	14 (82.4)/3(17.6)	13 (76.5)/4 (23.5)	0.671
Affected side (right / left) n (%)	10 (58.8)/7(41.2)	9 (52.9)/8 (47.1)	0.730
Accompanying Diabetes Mellitus n (%)	3 (17.6)	6 (35.3)	0.24
Accompanying Hypothyroidism n (%)	3 (17.6)	5 (29.4)	0.41

No statistically significant difference was found between the groups when the before treatment VAS night parameter was compared (p = 0.569). There was a statistically significant difference in intra-group, after treatment VAS night parameters (CT group p = 0.000, MM group p = 0.000). There was a statistically significant difference between the groups in favor of MM group when VAS night parameters were compared after treatment (p = 0.008). When the difference between the values of the groups before and after treatment was compared, a statistically significant difference was found in favor of MM group in VAS night gain parameter (p = 0.016) (Table 3.2.).

Table 3.2. Results of Pain Assessment of the Study Population [mean ± standard deviation (median)]

CT: Conservative Treatment group, MM: Mulligan Mobilization group, VAS: Visual analog scale

CHARACTERISTIC	CT Group (*n*= 17)	MM Group (*n*= 17)	*Pα*
VAS/Resting			
Before treatment	3.41±2.14 (3)	2.58±1.94 (3)	0.433
After treatment	0.89±1.20	0.66±1.07	0.634
P2	**0.000**	**0.001**	
P3			0.270
VAS/Night			
Before treatment	6.23±2.14	5.78±2.37	0.569
After treatment	3.07±1.87	1.34±1.63	**0.008**
P2	**0.000**	**0.000**	
P3			**0.016**
VAS/Activity			
Before treatment	6.72±2.21 (6.7)	7.28±1.82 (8)	0.357
After treatment	3.31±2.51 (3.5)	2.03±1.75 (1.5)	0.193
P2	**0.000**	**0.000**	
P3			**0.003**

Pα student t test comparison between groups

P2 paired t test before and after treatment within each group

P3 is the difference between values before and after treatment different in terms of groups

No statistically significant difference was found between the groups when the before treatment VAS resting parameter was compared (p = 0.433). There was a statistically significant difference in intra-group after treatment VAS resting parameters (CT group p = 0.000, MM group p = 0.001). No statistically significant difference was found between the groups when VAS resting parameters were compared after treatment (p = 0.634). When the difference between the values of the groups before and after treatment was compared, no statistically significant difference was found in the VAS resting gain parameter (p=0.270) (Table 3.2.).

No statistically significant difference was found between the groups when the before treatment VAS activity parameter was compared (p = 0.357). There was a statistically significant difference in intra-group after treatment VAS activity parameters (CT group p = 0.000, MM group p = 0.000). No statistically significant difference was found between the groups when VAS activity parameters were compared after treatment (p = 0.193). When the difference between the values of the groups before and after treatment was compared, a statistically significant difference was found in favor of MM group in VAS activity gain parameter (p = 0.003) (Table 3.2.).

Table 3.3. DASH Score Results of the Study Population [mean ± standard deviation (median)]

CT: Conservative Treatment group, MM: Mulligan Mobilization group, DASH: Disabilities of Arm, Shoulder and Hand

CHARACTERISTIC	CT Group (*n*= 17)	MM Group (*n*= 17)	*Pα*
DASH			
Before treatment	54.32±13.87 (52.50)	51.71±5.88 (50.80)	0.586
After treatment	19.71±17.55 (13.30)	15.87±10.86 (14.20)	0.865
P_2	**0.000**	**0.000**	
P3			0.843

Pα Mann-Whitney test comparison between groups

P2 Wilcoxon test before and after treatment within each group

P3 is the difference between values before and after treatment different in terms of groups

There was no statistically significant difference between the groups when compared with before treatment DASH score (p = 0.586). When the DASH scores were compared after treatment in intra-group, a statistically significant difference was found (CT group p = 0.000, MM group p = 0.000). No statistically significant difference was found between the groups when DASH score were compared after treatment (p=0.865). When the difference between the values of the groups before and after treatment was compared, no statistically significant difference was found in the DASH score parameter (p=0.843) (Table 3.3.).

No statistically significant difference was found between the groups when the before treatment active flexion parameter was compared (p=0.734). There was a statistically significant difference in intra-group after treatment active flexion parameters (CT group p=0.001, MM group p=0.000). No statistically significant difference was found between the groups when active flexion parameters were compared after treatment (p=0.838). When the difference between the values of the groups before and after treatment was compared, no statistically significant difference was found in the active flexion gain parameter (p=0.484) (Table 3.4.).

No statistically significant difference was found between the groups when the before treatment passive flexion parameter was compared (p=0.865). There was a statistically significant difference in intra-group after treatment passive flexion parameters (CT group p=0.004, MM group p=0.000). No statistically significant difference was found between the groups when passive flexion parameters were compared after treatment (p=0.394). When the difference between the values of the groups before and after treatment was compared, a statistically significant difference was found in favor of MM group in passive flexion gain parameter (p = 0.046) (Table 3.4.).

Table 3.4. Results of Flexion Range of the Study Population [mean ± standard deviation (median)]

CT: Conservative Treatment group, MM: Mulligan Mobilization group

CHARACTERISTIC	CT Group (*n*= 17)	MM Group (*n*= 17)	*Pα*
Active Flexion			
Before treatment	137.76±28.44 (130)	137.47±15.79 (130)	0.734
After treatment	159.29±21.74 (170)	162.11±12.04 (163)	0.838
P2	**0.001**	**0.000**	
P3			0.484
Passive Flexion			
Before treatment	151.29±23.24 (150)	148.00±16.35 (145)	0.865
After treatment	166.58±18.67 (175)	174.70±7.03 (178)	0.394
P2	**0.004**	**0.000**	
P3			**0.046**

Pα student t test comparison between groups

P2 paired t test before and after treatment within each group

P3 is the difference between values before and after treatment different in terms of groups

No statistically significant difference was found between the groups when the before treatment active abduction parameter was compared (p=0.586). There was a statistically significant difference in intra-group after treatment active abduction parameters (CT group p=0.001, MM group p=0.000). No statistically significant difference was found between the groups when active abduction parameters were compared after treatment (p=0.563). When the difference between the values of the groups before and after treatment was compared, no statistically significant difference was found in the active abduction gain parameter (p=0.162) (Table 3.5.).

No statistically significant difference was found between the groups when the before treatment passive abduction parameter was compared (p=0.812). There was a statistically significant difference in intra-group after treatment passive abduction

parameters (CT group p=0.001, MM group p=0.000). No statistically significant difference was found between the groups when passive abduction parameters were compared after treatment (p=0.259). When the difference between the values of the groups before and after treatment was compared, no statistically significant difference was found in the passive abduction gain parameter (p=0.051) (Table 3.5.). However, it was observed that the increase was more pronounced clinically.

Table 3.5. Results of Abduction Range of the Study Population [mean ± standard deviation (median)]

CT: Conservative Treatment group, MM: Mulligan Mobilization group

CHARACTERISTIC	CT Group (*n*= 17)	MM Group (*n*= 17)	*Pα*
Active Abduction			
Before treatment	108.05±45.93 (95)	102.70±17.80 (100)	0.586
After treatment	133.35±36.19 (130)	139.11±22.37 (140)	0.563
P2	**0.001**	**0.000**	
P3			0.162
Passive Abduction			
Before treatment	121.94±40.96 (115)	116.11±19.81 (110)	0.812
After treatment	148.41±27.43 (150)	159.76±17.38 (163)	0.259
P2	**0.001**	**0.000**	
P3			0.051

Pα student t test comparison between groups

P2 paired t test before and after treatment within each group

P3 is the difference between values before and after treatment different in terms of groups

No statistically significant difference was found between the groups when the before treatment active internal rotation parameter was compared (p=0.586). There was a statistically significant difference in intra-group after treatment active internal rotation parameters (CT group p=0.008, MM group p=0.001). No statistically significant difference was found between the groups when active internal rotation parameters were

compared after treatment (p=0.231). When the difference between the values of the groups before and after treatment was compared, a statistically significant difference was found in favor of MM group in active internal rotation gain parameter (p = 0.036) (Table 3.6.).

No statistically significant difference was found between the groups when the before treatment passive internal rotation parameter was compared (p=0.563). There was a statistically significant difference in intra-group after treatment passive internal rotation parameters (CT group p=0.012, MM group p=0.001). No statistically significant difference was found between the groups when passive internal rotation parameters were compared after treatment (p=0.259). When the difference between the values of the groups before and after treatment was compared, no statistically significant difference was found in the passive internal rotation gain parameter (p=0.158) (Table 3.6.).

Table 3.6. Results of İnternal Rotation Range of the Study Population [mean ± standard deviation (median)]

CT: Conservative Treatment group, MM: Mulligan Mobilization group

CHARACTERISTIC	CT Group (*n*= 17)	MM Group (*n*= 17)	*Pα*
Active Internal Rotation			
Before treatment	63.23±24.74 (60)	59.29±15.97 (60)	0.586
After treatment	74.29±16.38 (80)	81.58±10.41 (85)	0.231
P2	**0.008**	**0.001**	
P3			**0.036**
Passive Internal Rotation			
Before treatment	71.11±19.93 (75)	68.47±14.68 (75)	0.563
After treatment	83.82±9.10 (90)	88.64±3.33 (90)	0.259
P2	**0.012**	**0.001**	
P3			0.158

Pα student t test comparison between groups

P2 paired t test before and after treatment within each group

P3 is the difference between values before and after treatment different in terms of groups

No statistically significant difference was found between the groups when the before treatment active external rotation parameter was compared (p=0.892). There was a statistically significant difference in intra-group after treatment active external rotation parameters (CT group p=0.001, MM group p=0.001). No statistically significant difference was found between the groups when active external rotation parameters were compared after treatment (p=0.413). When the difference between the values of the groups before and after treatment was compared, no statistically significant difference was found in the active external rotation gain parameter (p=0.218) (Table 3.7.). However, it was observed that the increase was more pronounced clinically.

Table 3.7. Results of External Rotation Range of the Study Population [mean ± standard deviation (median)]

CT: Conservative Treatment group, MM: Mulligan Mobilization group

CHARACTERISTIC	CT Group (*n*= 17)	MM Group (*n*= 17)	*Pα*
Active External Rotation			
Before treatment	48.23±31.76 (45)	49.41±22.46 (45)	0.892
After treatment	61.64±25.71 (68)	70.41±19.09 (80)	0.413
P2	**0.001**	**0.001**	
P3			0.218
Passive External Rotation			
Before treatment	51.88±31.22 (52)	58.52±21.63 (50)	0.586
After treatment	72±20.53 (80)	78.82±14.84 (85)	0.322
P2	**0.003**	**0.001**	
P3			0.277

Pα student t test comparison between groups

P2 paired t test before and after treatment within each group

P3 is the difference between values before and after treatment different in terms of groups

No statistically significant difference was found between the groups when the before treatment passive external rotation parameter was compared (p=0.586). There was a statistically significant difference in intra-group after treatment passive external rotation parameters (CT group p=0.003, MM group p=0.001). No statistically significant difference was found between the groups when passive external rotation parameters were compared after treatment (p=0.322). When the difference between the values of the groups before and after treatment was compared, no statistically significant difference was found in the passive external rotation gain parameter (p=0.277) (Table 3.7.).

No statistically significant difference was found between the groups when the before treatment flexion muscle strength parameter was compared (p=0.51). There was a statistically significant difference between the groups in favor of MM group when the after treatment flexion muscle strength parameter was compared (p = 0.001) (Table 3.8.).

No statistically significant difference was found between the groups when the before treatment abduction muscle strength parameter was compared (p=0.74). There was a statistically significant difference between the groups in favor of MM group when the after treatment abduction muscle strength parameter was compared (p = 0.001) (Table 3.8.).

No statistically significant difference was found between the groups when the before treatment internal rotation muscle strength parameter was compared (p=0.19). There was a statistically significant difference between the groups in favor of MM group when the after treatment internal rotation muscle strength parameter was compared (p = 0.01) (Table 3.8.).

Table 3.8. Manual Muscle Strength Analysis

CT: Conservative Treatment group, MM: Mulligan Mobilization group

CHARACTERISTIC	CT Group (*n*=17)	MM Group (*n*=17)	*P*
Shoulder Flexion (stage 3/stage 4/ stage 5) n (%)			
Before treatment	1(5.9)/13(76.5)/3(17.7)	(0)/15(88.2)/2(11,8)	0.51
After treatment	0 (0)/8 (47)/9 (53)	0 (0)/0 (0)/17 (100)	**0.001**
Shoulder Abduction (stage 3/ stage 4/ stage 5) n (%)			
Before treatment	4(23.5)/10(58.9)/3(17.6)	0(0)/15(88.2)/2(11.8)	0.74
After treatment	0(0)/11(64.7)/6(35.3)	0(0)/2(11.8)/15(88.2)	**0.001**
Shoulder Internal Rotation (stage 3/ stage 4/ stage 5) n (%)			
Before treatment	3(17.6)/11(64.7)/3(17.7)	0(0)/13(76.4)/4(23.6)	0.19
After treatment	0(0)/5(29.4)/12(70.6)	0 (0)/0 (0)/17 (100)	**0.01**
Shoulder External Rotation (stage 3/ stage 4/ stage 5) n (%)			
Before treatment	4(23.5)/10(58.9)/3(17.6)	0(0)/14(82.4)/3(17.6)	0.09
After treatment	0(0)/4(23.6)/13(76.4)	0 (0)/0 (0)/17 (100)	**0.03**

No statistically significant difference was found between the groups when the before treatment external rotation muscle strength parameter was compared (p=0.09). There was a statistically significant difference between the groups in favor of MM group when the after treatment external rotation muscle strength parameter was compared (p = 0.03) (Table 3.8.).

5. DISCUSSION

The aim of this study was to investigate the effects of manual therapy techniques on pain, range of motion, muscle strength and function in addition to the conservative physiotherapy program in individuals with SIS.

Age is one of the important factors that may affect treatment outcomes. Looking at the age of the SIS, Brox et al. in their study with 125 patients, patients with rotator cuff pathology for three months ranged between 18-66 years (160). Çelik et al. the mean age of their study was reported to be 51 (161), Kaya et al. the mean age of their study was reported to be 56 (162) years. Hallaçeli et al. reported the age range of the SIS as 36-66 years in their study (163).

Findings related to the SIS increase with age. As age progresses, degenerations occur in the shoulder joint. Increased degenerative changes in joint structures, impaired nutrition causes the development of SIS (163).

The mean age of the patients included in this study was 56.11 years in the CT group and 50.88 years in the MM group. The mean age of the cases was similar to other studies.

When the literature is examined, it is seen that the SIS is more common in women in many studies (51, 161, 164, 165). Hallaçeli et al. the ratio of females to males was reported to be 33/7 in 40 patients with SIS in their study (163). This rate is reported to be 27/13 in the study by Özcan and Tiner (166). Hakgüder et al. in their study on 43 patients, the female-to-male ratio was reported as 31/12 (167). In our study, female / male ratio was found to be 10/7 in the CT group and female / male ratio was 11/6 in the MM group.

In the studies, dominant side involvement is seen more in the SIS (168). Dolunay et al. reported that right arm was dominant in 27 of 30 patients and the presence of right shoulder involvement in 18 of these 30 cases, left shoulder 12 (169). Morrison et al. (170), Post et al. (171), Wirth et al. (172) was found more dominant side involvement in their studies. In our study, the dominant side (right hand) in the CT group was 14, and the right shoulder taken for treatment was 10 people. In our study, in the CT group the dominant side (right hand) was found to be 14 patients, and the right shoulder taken for treatment was 10 patients and in the MM group the dominant side

(right hand) was found to be 13 patients, and the right shoulder taken for treatment was 9 patients. We believe that the high prevalence of dominant side involvement may be due to more exposure to microtrauma due to overuse.

The most common symptoms in the SIS are pain and limitation of motion (173, 174, 175, 176). In the SIS, it was reported that the pain is usually during the overhead activities, during the weight transport and causes sleep problems at night (177, 178). Pain due to musculoskeletal problems also affects functional activity performance. Therefore, the reduction of pain should be the primary target (161). Therefore, electrotherapy methods, exercise programs and manipulative treatment methods are frequently preferred in the treatment of SIS (118).

In our study, both treatment modalities were found to be effective in decreasing the symptoms of patients. However, when the groups were evaluated in terms of recovery rates, the results of Mulligan mobilization group were found to be more significant in pain, ROM and muscle strength parameters.

Ginn et al. investigated the long-term clinical outcomes of conservative treatment (exercise therapy, passive joint mobilization, electrotherapy) in patients with shoulder pain and in their study the decrease in pain was found to be statistically significant (179).

In a study of 48 patients with SIS by Baltacı et al. classical physiotherapy was applied to group 1, manipulative treatment in addition to classical physiotherapy was applied to group 2, and manipulative treatment was applied to group 3. As a result of the study, activity pain and night pain reduction levels were found to be statistically more significant in the second and third group compared to the first group (51).

In a study of 250 patients with shoulder pain by Bergman et al. in the first group classical physiotherapy was applied, in the second group manipulative treatment was applied. As a result of the study, they reported a significant decrease in pain levels in both groups (180).

In a study of 30 patients with SIS by Şenbursa et al. exercise program was applied to group 1, manual treatment with joint and soft tissue mobilization techniques was applied to group 2. As a result of the study, they reported a significant decrease in

pain in both groups, while the decrease in the manual treatment group was more significant than the exercise group (6).

Bergman et al. In their study on 150 patients with shoulder dysfunction and pain, they investigated the effectiveness of manipulative therapy and they applied general medical treatment and physiotherapy to the first group and manual treatment to the second group. In their evaluation after 12 and 52 weeks, the decrease in rest, movement and night pain was more significant in the manipulative treatment group. In our study, similar to the results determined by Bergman et al., the decrease in pain experienced during activity and the night pain was found to be significantly different in favor of the group that applied MWM as a manipulative treatment method (181).

Kachingwe et al. in their study on 33 patients with SIS, they applied only exercise in the first group, exercise with mobilization in the second group, MWM with exercise in the third group, and included the control group as the fourth group. As a result of the study, in the exercise-mobilization and exercise-MWM groups, they stated that the pain parameter had a more significant decrease compared to the other two groups (52).

Diercks et al. in their study to investigate the effect of manual mobilization and passive stretching; at the end of the 24-month follow-up, almost every patient reported a painless level (182).

In our study, VAS night and activity parameters showed more significant results in the MM group compared to the CT group. This may be due to inhibition of nociceptive stimulation via mechanoreceptors activated by MWM techniques and recovery of GH arthrokinematic. This opinion is dominant in the literature. Night pain complaints are very common in these patients. Therefore, the improvement in night pain is very important.

Functional evaluation is a frequently used method in order to determine the patient's quality of life and functionality in daily life in shoulder problems. Some of these measurement methods are for specific shoulder problems, while others are only for shoulder assessment. These scales examine the shoulder from different angles (physical, emotional, social, pain and function) (183).

Gummesson et al. (184) and Angst et al. (96) stated that DASH scale, when evaluating shoulder problems in terms of functionality, is a frequently used, reliable, easy to use, easy to analyze and interpret. DASH is a scale defined by the American Academy of Orthopedic Surgeons and is an assessment scale for the upper extremity. DASH mainly measures disability. It is a scale that can detect small and big changes in disability in musculoskeletal problems of upper extremity (96). Bot et al. in their study, they found that DASH, ASES and SPADI scales were most commonly used in the literature, but the best results in terms of clinical features were the DASH scale (185).

Shakeri et al. had evaluated the functional level with DASH in patients diagnosed with SIS. They had kinesio taping to the first group and had placebo taping to the other group. Re-evaluation was performed one week after taping and more functional improvement was reported in the treatment group (186).

In our study, DASH scale was used for the evaluation of functionality. As a result of the statistical analysis, there was a significant decrease in pre and post treatment values in intragroup comparisons, no significant results were found in the comparison between groups. We think that as a result of the treatment decreasing pain, increasing ROM and muscle functions are responsible for the increase in functionality.

Yang et al. investigated in their study of the effectiveness of three different mobilization techniques in the treatment of SIS, divided 28 cases into two groups, over the course of 12 weeks, they alternately applied three different mobilization techniques end-range mobilization (ERM), midrange mobilization (MRM) and mobilization with movement (MWM). It was applied 3 weeks MRM, the second 3 weeks ERM, the third 3 weeks MRM and the fourth 3 weeks MWM to the first group. It was applied 3 weeks MRM, the second 3 weeks MWM, the third 3 weeks MRM, the fourth 3 weeks ERM to the second group. In their evaluation at the end of 12 weeks, ERM and MWM were found to be more effective than MRM in terms of shoulder range and functionality. They stated that MWM was more successful in terms of correction of scapulohumeral rhythm than the other two methods (187).

In a study of 48 patients with SIS by Baltacı et al. classical physiotherapy was applied to group 1, manipulative treatment in addition to classical physiotherapy was applied to group 2, and manipulative treatment was applied to group 3. As a result of this study, they observed an increase in ROM in all groups and the use of manual

therapy with classical physiotherapy was found to be more effective in terms of decrease in pain and increase in normal joint movements in patients with SIS (51).

Placzek et al. applied GH joint manipulation to 31 patients with adhesive capsulitis. They investigated the increase in pain, functionality levels and ROM with short-term and long-term follow-up. They found that manipulation is a long-term effective method in adhesive capsulitis (188).

In the study performed by Şenbursa et al. on 30 patients with SIS, they applied exercise program to the first group and a combined exercise program with manual treatment to the second group. As a result of the study, it was stated that there was a significant increase in ROM in both groups, whereas the increase in the manual treatment group was more significant than the exercise group (6).

In the study performed by Teys et al. 11 male and 13 female patients were divided into three groups as control, placebo and study group. No manual technique was applied to the control group, placebo mobilization was applied to the placebo group without hand positioning and the MWM technique was applied to the study group. The ROM from the evaluated parameters was significant in favor of the group that applied MWM technique at just the end of the study (189).

In various studies in the literature, it has been reported that manual therapy techniques in combination with exercise in the treatment of patients with SIS are more effective than exercise therapy alone (190, 118, 191).

Djordjevic et al. in their study of 20 patients with SIS, they applied MWM and kinesio taping techniques to the first group and they applied exercise program to the second group. They made the evaluations at the beginning of the treatment, on the 5th and 10th days. They reported a significant increase in shoulder flexion and abduction range in both groups, but added that the MWM-kinesio taping group improved earlier than the exercise group (192).

Kachingwe et al. in their study on 33 patients with SIS, they applied only exercise in the first group, exercise with mobilization in the second group, MWM with exercise in the third group, and included the control group as the fourth group. As a result of the study, they reported that the exercise-MWM group had the highest percentage of change in the active ROM range compared to the other groups (52).

Delgado et al. in their study of 42 patients with SIS, they divided the patients into two groups: MWM and placebo. They reported that the increase in the range of motion was significantly higher in the MWM group compared to the placebo group (193).

Satpute et al. in their study on 44 patients with acute shoulder pain and limitation of movement, they applied the MWM-exercise-hot pack to the first group and applied the exercise-hot pack to the second group. At the end of the study, it was reported that there was an increase in the ROM in both groups but the increase in the MWM group was significantly higher (194).

Uparar and Shinde, in their study of 28 patients with supraspinatus tendinitis, randomized patients into two groups. They applied cold pack, US, TENS and exercise program to the first group and they applied MWM to the second group in addition to the treatment of the first group. As a result of the study, it was reported that the results of the MWM group in flexion and internal rotation ROM parameters were found to be statistically more effective than the other group (195).

In our study, there were statistically significant differences between active and passive degrees of flexion, abduction, internal and external rotation in the intragroup comparisons before and after treatment but no statistically significant differences were found between the groups. When the pre- and post-treatment values were evaluated in terms of recovery rates, there was a statistically significant difference in active internal rotation and passive flexion parameters in MM group compared to CT group. Our study showed similar results with the studies in the literature.

Previous studies have reported that changes in shoulder joint kinematics are associated with shoulder pain (196, 197, 198, 199). In the kinematic studies, it has been reported that the humeral head changes abnormally in the superior and / or anterior direction of the glenoid fossa in patients with SIS (200, 201, 202). This abnormal displacement of the humeral head causes narrowing of the subacromial space, compression of the structures passing through the subacromial space, resulting in pain and functional effects (203, 204). In addition, the MWM technique has been reported to stretch hardened soft tissues, increase the flexibility of the shoulder capsule and improve abnormal scapulohumeral rhythm (189).

In our study, we think that the statistically significant increase in range of motion in the MM group is due to the correction of joint kinematics, reduction of

positional error in the joint with postero-lateral glide applied, and the increase flexibility of joint capsule. In addition, we think that the statistically significant difference in the active internal rotation range in the MM group is due to using two different MWM techniques for internal rotation.

Brantingham et al. in their review study, they investigated the effect of manipulative treatment on shoulder pain and reported that the use of manipulative therapy in combination with kinetic chain exercises had a positive effect on pain, dysfunction and muscle strength parameters (205).

Ribeiro et al. in their study on 30 asymptomatic patients, they applied postero-lateral glide during shoulder abduction. They measured the electromyographic muscle activity of the supraspinatus, infraspinatus, posterior and middle part of the deltoid with and without postero-lateral glide. They found a decrease in the contraction rates of all muscles when the glide was applied. They stated that the decrease in muscle activity during abduction may be the result of change in joint mechanics and change in the afferent sensory input transmitted through the shoulder (206).

In the study performed by Şenbursa et al. on 30 patients with SIS, they applied exercise program to the first group and a combined exercise program with manual treatment to the second group. As a result of the study, a statistically significant increase in muscle strength was reported in the manual treatment group compared to the exercise group (6).

Şenbursa et al. in their study of 77 patients with supraspinatus tendinitis, they applied exercise program to the first group, exercise program and joint mobilization to the second group and home exercise program to the third group. As a result of the study, it was reported that there was a significant increase in shoulder muscle strength in all groups but the most development was seen in the mobilization group (207).

In a study performed by Bang et al. they investigated the effects of exercise with and without manual therapy and the increase of muscle strength was found to be statistically significant in both groups. However, in the group receiving manual therapy with exercise, it was stated that there was more improvement in muscle strength than the group receiving exercise therapy alone (106).

In our study, a statistically significant difference was found in favor of MM group when the parameters of flexion, abduction, internal rotation and external rotation muscle strength were compared between treatment groups. The decrease in muscle strength caused by pain showed improvement in parallel with the decrease in pain. In addition, patients with reduced pain and almost reached complete ROM have started strengthening exercises, which explains the increase in muscle strength. The results of our study were consistent with the literature.

Limitation of the Study

When we look at the limitations of our study, we think that one of them is the lack of a control group in the study. We consider that the study is done on a small number of patients and the absence of mid- and late-term follow-up of the patients as a limitation. We think that the absence of mid-term follow-up is a limitation since the main difference clinically is the earlier onset of recovery. Further studies on more patients will be more enlightening, while longer follow-up will more clearly reveal the validity of treatment effects and the accuracy of the results.

6. CONCLUSION

This study was conducted to investigate the effect of manual therapy techniques on pain and functionality in patients with SIS. As a result of the evaluations of the patients before and after the treatment, the obtained data were analyzed by appropriate statistical methods and the following results were obtained.

1. In the intragroup comparisons, resting, activity and night pain parameters improved in both groups according to the beginning of treatment. A significant difference was observed in the night pain parameter in favor of MM group in the comparison of post-treatment values between groups. When the recovery rates of rest, activity and night pain were compared with those obtained before the treatment, a significant difference was found in activity and night pain in favor of MM group.

2. In our study, the ROM of the joints were evaluated separately as active and passive. In the intra-group comparisons, both groups showed improvement in active and passive flexion, abduction, internal rotation and external rotation parameters. When the recovery rates obtained according to the beginning of treatment were compared, active internal rotation and passive flexion parameters were significantly different in favor of MM group.

3. When we look at the results of our study in terms of muscle strength values, a statistically significant difference was found in favor of MM group when flexion, abduction, internal rotation and external rotation muscle strength parameters were compared between treatment groups according to the beginning of treatment.

4. In our study, the evaluation of functionality was done by DASH scale. It has been determined that both treatment modalities affect the functional activity levels of the patients positively. There was a significant decrease in pre- and post-treatment values in intra-group comparisons but no significant results were found in the comparison between groups. These results showed that the two treatment methods applied had similar effects.

As a result, we think that the combined administration of Mulligan MWM technique with conservative treatment may provide more effective results in decreasing pain, increased ROM, muscle strength and functional activity in patients with SIS.

7. REFERENCES

1) Kibler W B. The role of the scapula in athletic shoulder function. *Am J Sports Med*, 1998; 26(2):325–337.

2) Luime L, Koes B, Hendriksen I, Burdorf A, Verhagen A, Miedema H, et al. Prevalence and incidence of shoulder pain in the general population; a systematic rewiew. *Scandinavian journal of rheumatology*, 2004; 33 (2): p. 73-81.

3) Neer, C.S. İmpingement lesions. *Clin Orthop*, 1983; 173: 70-77.

4) McClure P W, Michener L A ve Karduna A R. Shoulder function and 3-dimensional scapular kinematics in people with and without shoulder impingement syndrome. *Physical therapy*, 2006; 86 (8): p. 1075-1090.

5) Michener L A, McClure P W, Karduna A R. Anatomical and biomechanical mechanisms of subacromial impingement syndrome. *Clinical biomechanics*, 2003; 18 (5): p. 369-379.

6) Senbursa G, Baltacı G, Atay A. Comparison of conservative treatment with and without manual physical therapy for patients with shoulder impingement syndrome: a prospective, randomized clinical trial. *Knee Surg Sports Traumatol Arthrosc*, 2007; 15: 915–921.

7) Mcclure P W, Bialker J, Neff N, Williams G, Karduna A. Shoulder Function and 3-Dimensional Kinematics in People With Shoulder İmpingement Syndrome Before and After a 6-Week Exercise Program. *Physical Therapy*, 2004; 84(9): p. 832-48.

8) Morrison D, Frogameni A, Woodworth P. Non-operative treatment of subacromial impingement syndrome. *J Bone Joint Surg*, 1997. 79: 732–737.

9) Takeda Y, Kashiwaguchi S, Endo K, Matsuura T, Sasa T. The most effective exercise for strengthening the supraspinatus muscle: evaluation by magnetic resonance imaging. A*m J Sports Med*, 2002; 30: 374–381.

10) Zucherman JD, Gallagher MA, Cuomo F. The effect of instability and subsequent anterior shoulder repair on proprioceptive ability. *J Shoulder Elbow Surg*, 2003; 12(2): 105–109.

11) Machner A, Merk H, Becker R. Kinesthetic sense of shoulder in patients with impingement syndrome. *Acta Orthop Scand,* 2003; 74(1): 85–88.

12) Uhl T, Carver TJ, Mattacola CG. Shoulder musculature activation during upper extremity weight-bearing exercise. *J Orthop Sports Phys Ther*, 2003; 33(3): 109–117.

13) Yanagisawa O, Miyanaga Y, Shiraki H. The effects of various therapeutic measures on shoulder strength and muscle soreness after baseball pitching. *J Sports Med Phys Fitness,* 2003; 43(3): 189–201.

14) Decker MJ, Hintermeister RA, Faber KJ. Serratus anterior muscle activity during selected rehabilitation exercises. *Am J Sports Med*, 1999; 27(6): 784–791.

15) Conroy DE. and Hayes KW. The effect of joint mobilization as a component of comprehensive treatment for primary shoulder impingement syndrome. *J Orthop Sports Phys Ther,* 1998; 28(1): 3–14.

16) Morrison DS, Greenbaum BS, Einborn A. Shoulder impingement. *Orthop Clin North Am*, 2000; 31: 285–293.

17) Sabari JS, Maltzev I, Lubarsky D. Goniometric assessment of shoulder range of motion: comparison of testing in supine and sitting positions. *Arch Phys Med Rehabil,* 1998; 79: 647–651.

18) Mulligan B. *Manual Therapy "NAGS","SNAGS","MWMS" etc (5th edition ed.).* Wellington: Plane View Services Ltd. 2004.

19) Bisset L, Beller E, Jull G, Brooks P, Darnell R, Vicenzino, B. Mobilisation with movement and exercise, corticosteroid injection, or wait and see for tennis elbow: randomised trial. *British Medical Journal (Clinical Research Ed.),* 2006; *333*(7575): 939-945.

20) Collins N, Teys P, Vicenzino B. The initial effects of a mulligan's mobilization with movement technique on dorsiflexion and pain in subacute ankle sprains. *Manual Therapy*, 2004; *9*(2): 77-82.

21) Hall T, Hardt S, Schafer A, Wallin L. Mulligan bent leg raise technique—a preliminary randomized trial of immediate effects after a single intervention *Manual Therapy,* 2006; *11*(2): 130-135.

22) Paungmali A, O'Leary S, Souvlis T, Vicenzino B. Hypoalgesic and sympathoexcitatory effects of mobilization with movement for lateral epicondylalgia *Physical Therapy*, 2003; *83*(4): 374-383.

23) Vicenzino B, Paungmali A, Buratowski S, Wright A. Specific manipulative therapy treatment for chronic lateral epicondylalgia produces uniquely characteristic hypoalgesia. *Manual Therapy*, 2001; *6*(4): 205-212.

24) Beyazova, M., Gökçe-Kutsal, Y. *Fiziksel Tıp ve Rehabilitasyon.* Ankara: Güneş Kitabevi; 2000. p. 1437–1438.

25) Çetin, N.,Karataş, M. *Temel ve Uygulanan Kinezyoloji*. Ankara: Haberal Eğitim Vakfı; 2003.

26) Arıncı, K., Elhan, A. *Anatomi.* Ankara: Güneş Kitabevi; 1997.

27) 17: Tüzün, F., Eryavuz, M., Akarırmak, Ü. *Hareket Sistemi Hastalıkları.* Ankara: Nobel Tıp Kitabevleri; 1997. P. 193-210.

28) 12: Morrey, F. *Biomechanics of the Shoulder*, in The Shoulder, Rockwood, C.A., Matsen, F.A. W.B. Saunders Company: 1998. P. 233-276.

29) Dere, F. *Anatomi.* Adana: Okullar Pazarı Kitabevi; 1994. p. 45-117.

30) Çimen, A. *Anatomi.* Bursa: Bursa Uludağ Üniversitesi Basımevi; 1994. p. 45–117.

31) Williams, P., Warwick, R. *Gray's Anatomy, 36th Edition.* New York: Churchıll Livingstone, Longman Group Limited; 1980. p. 353-55.

32) Conger M. *Subakromiyal Sıkısma Sendromunun Konservatif Tedavisinde Mobilizasyon Egzersizlerinin Etkinliginin Arastırılması.* İstanbuİ, İstanbul Üniversitesi, 2003.

33) Odar Vİ. *Anatomi Ders Kitabı*. Ankara: Taş Kitabevi; 1986. p. 183-236.

34) Tibowe, J.E., Cunningham, R.B. ve Mcmahon, P.J. *Shoulder Anatomy and Biomechanics During Overhead Motions,* in The Shoulder and the Overhead Athlete, Krishnan,S.G., Hawkins, R.J., Warren R.F. Wolters Kluwer Company: Philadelphia; 2004.

35) Çelik, D. *Omuz Impingement Sendromunda Skapular Hareket Bozukluğunun ve Omurga Problemlerinin Rolü.* İstanbul, Marmara Üniversitesi Sağlık Bilimleri Enstitüsü, 2009.

36) Demirhan, M. and Goksan, M.A. Biomechanics of the shoulder joint and muscular control. *Acta Orthopaedica et Traumatologica Turcica,* 1993. 27 (3): p. 212-217.

37) Dutton, M. *Orthopaedic Examination, Evaluation & Intervention.* New York: McGraw Hill Professional; 2004.

38) Tyhrleigh –Strong G, Hirahara A. Rotator cuff disease. *Current Opinion in Rhemautology,* 2001; 13: 135-145.

39) Diamond, W. *Upper Extremity: Shoulder,* in: Manuel of Physical Therapy Practice, Myers, R.S. W.B. Saunders Company: Philadelphia. 1995. p. 789-838.

40) Jobe CM. *Gross Anatomy of the Shoulder.* in The Shoulder, Rockwood, CA., Matsen FA. W.B. Saunders Company: Philadelphia. 1998. p. 34-97.

41) Neer, C.S.*II. Shoulder Reconstruction,* WB Saunders Comp. Philadelphia: 1990.

42) Aksoy C. *Manipulatif Tedavi,* in: Tıbbi Rehabilitasyon, Oğuz H. Nobel Tıp Kitapevi: İstanbul. 1995. p. 219-240.

43) Çalış M, Akgün K, Birtane M. Diagnostic values of clinical diagnostic tests in subacromial impingement syndrome. *Ann Rheum Dis,* 2000. 59: p. 44-47.

44) Magee D.J., Reid D.C. *Shoulders Injuries,* in Athletic Injuries and Rehabilitation, Magee, D.J. W.B. Saunders Company: Philadelphia. 1996. p. 509-542.

45) Yelkovan, M. Subakromial Sıkışma Sendromunda Manyetik Alan Tedavisinin Etkinliğinin Araştırılması. İstanbul, İstanbul Üniversitesi Fizik Tedavi ve Rehabilitasyon Anabilim Dalı, 1998.

46) Daniels, I., Worthinghom, C. *Muscle Testing (techniques of manuel examination).* W.B. Sounders Company Philadelphia, 1980. p. 90-117.

47) Chung KW. *Anatomi Board Review*. Philadelphia: Wolters Kluwer Health; 2015. p. 17-59.

48) Dilek B, Subakromial Sıkışma Sendromu Olan Kişilerde Proprioseptif Egzersizlerin Etkinliği Üzerine Yapılan Randomize Kontrollü Bir Çalışma, İzmir, Dokuz Eylül Üniversitesi, 2010.

49) De Wilde, L., Plasschaert, F., Berghs, B., Van Hoecke, M., Verstraete, K. and Verdonk, R. Quantified measurement of subacromial impingement. *Journal of shoulder and elbow surgery*, 2003. 12 (4): p. 346-349.

50) Reddy, A.S., Mohr, K.J., Pink, M.M., and Jobe, F.W. Electromyographic analysis of the deltoid and rotator cuff muscles in persons with subacromial impingement. *J Shoulder Elbow Surg*, 2000. 9 (6): p. 519-523.

51) Baltacı, G., Beşler, A., Bayrakçı, V. and Ergun, E. Omuz sıkışma sendromunun konservatif tedavisinde manipulatif yöntemlerin etkisi. *Eklem Hastalik Cerrahisi*, 2002. 13: p. 27-33.

52) Kachingwe, A.F., Phillips, B., Sletten, E. and Plunkett, S.W. Comparison of manual therapy techniques with therapeutic exercise in the treatment of shoulder impingement: a randomized controlled pilot clinical trial. *Journal of manual&manipulative therapy*, 2008. 16 (4): p. 238-247.

53) Pribicevic, M. and Pollard, H. Rotator cuff impingement. *Journal of manipulative and physiological therapeutics*, 2004. 27 (9): p. 580-590.

54) Balke, M., Liem, D., Greshake, O., Hoeher, J., Bouillon, B. ve Banerjee, M. Differences in acromial morphology of shoulders in patients with degenerative and traumatic supraspinatus tendon tears. *Knee Surgery, Sports Traumatology, Arthroscopy*, 2014. p. 1-6.

55) Akgün, K. *Omuz Ağrıları*, in Hareket Sistemi Hastalıkları, F. Tüzün, M. Eryavuz and Ü. Akarırmak. Nobel Tıp Kitabevleri: İstanbul. 1997. p. 193-210.

56) Tokish, J.M., Krishnan, S.G. and Hawkins, R.J. *Clinical Examination of the Overhead Athlete: "Differential-Directed" Approach.* in The Shoulder and the Overhead Athlete, Krishnan, S. G., Hawkins R. J. and Warren R. F. USA: Lippincott Williams and Wilkins; 2004.

57) Klaiman MD. and Fink, K. *Upper Extremity Soft Tissue İnjuries,* in Physical Medicine&Rehabilitation Principles and Practice, J. Delisa. Tokyo: Lippincot Williams; 2005. p. 836-872.

58) Tsui, K.H.S. Shoulder impingement syndrome. *Hong Kong Bull Rheum Dis*, 2005; 5: 14-18.

59) Jobe, F.W., Schwarb, D.M., Wilk, E.K. and Andrews, J.R. *Rehabilitation of the Shoulder*, in Brotzman S. B. Clinical Orthopaedical Rehabilitation, USA: Mosby. 1999. p. 112-141.

60) Dalton SE. *The shoulder*, in: Rheumatology. 3rd Ed., Hochberg M, Silman A J, Toronto: Mosby, 2003. p. 615-630.

61) Arcuri SE. Rotator cuff pathology and subacromial impingement. *Nurse Pract;* 2000; 25: 65-66.

62) Sarpel T. *Omuz Ağrısı*, in Fiziksel tıp ve Rehabilitasyon, Beyazova M, Kutsal Y. Ankara: Güneş Kitapevi, 2000. p. 1437-1447.

63) Mitchell C, et al. Shoulder Pain: diagnosis and management in primary care. *BMJ*. 2005; 331: 1124-1128.

64) Wilk, K.E., Reinold, M.M.,Andrews, J.R. *The Athlete's Shoulder*. Philadelphia: Churchill Livingstone/Elsevier; 2009.

65) Escamilla, R.F., Hooks, T.R.,Wilk, K.E. Optimal management of shoulder impingement syndrome. *Open access journal of sports medicine*, 2013. 5: p. 13-24.

66) Baltacı, G. *Omuz Yaralanmalarında Rehabilitasyon*. Ankara: Pelikan Yayıncılık; 2015.

67) Ferreira-Valente, M.A., Pais-Ribeiro, J.L., Jensen, M.P. Validity of four pain intensity rating scales. *PAIN*, 2011. 152 (10): p. 2399-2404.

68) Williamson, A. and Hoggart, B. Pain: a review of three commonly used pain rating scales. *Journal of clinical nursing*, 2005. 14 (7): p. 798-804.

69) Kolber, M.J. and Hanney, W.J. The reliability and concurrent validity of shoulder mobility measurements using a digital inclinometer and goniometer: a technical report. *International journal of sports physical therapy*, 2012. 7 (3): p. 306-313.

70) Michener, L.A., Boardman, N.D., Pidcoe, P.E.,Frith, A.M. Scapular muscle tests in subjects with shoulder pain and functional loss: reliability and construct validity. *Physical therapy*, 2005. 85 (11): p. 1128-1138.

71) Oyama, S., Myers, J.B., Wassinger, C.A.,Lephart, S.M. Three-dimensional scapular and clavicular kinematics and scapular muscle activity during retraction exercises. *J Orthop Sports Phys Ther*, 2010. 40 (3): p. 169-179.

72) Tate, A.R., McClure, P.W., Kareha, S.,Irwin, D. Effect of the Scapula Reposition Test on shoulder impingement symptoms and elevation strength in overhead athletes. *J Orthop Sports Phys Ther*, 2008. 38 (1): p. 4-11.

73) Hung, C.-J., Jan, M.-H., Lin, Y.-F., Wang, T.-Q.,Lin, J.-J. Scapular kinematics and impairment features for classifying patients with subacromial impingement syndrome. *Manual therapy*, 2010. 15 (6): p. 547-551.

74) Tate, A.R., McClure, P., Kareha, S., Irwin, D.,Barbe, M.F. A clinical method for identifying scapular dyskinesis, part 2: validity. *J Athl Train*, 2009. 44 (2): p. 165-173.

75) Kibler, W.B., Uhl, T.L., Maddux, J.W., Brooks, P.V., Zeller, B.,McMullen, J. Qualitative clinical evaluation of scapular dysfunction: a reliability study. *Journal of Shoulder and Elbow Surgery*, 2002. 11 (6): p. 550-556.

76) Ludewig, P.M., Cook, T.M.,Nawoczenski, D.A. Three-dimensional scapular orientation and muscle activity at selected positions of humeral elevation. *Journal of Orthopaedic & Sports Physical Therapy*, 1996. 24 (2): p. 57-65.

77) Kibler, W.B. The role of the scapula in athletic shoulder function. *The American Journal of Sports Medicine*, 1998. 26(2): p. 325–337.

78) Botanlıoğlu, H., Kesmezacar, H., Erginer, R. and Babacan, M. Omuz sıkışma sendromunun konservatif tedavisi. *Gülhane Tıp Dergisi*, 2006. 48: p. 208-214.

79) Çelik, D., Sirmen, B. and Demirhan, M. Subakromiyal sıkışma sendromunda ağrı ile kas gücü arasındaki ilişkinin değerlendirilmesi. *Acta Orthopaedica et Traumatologica Turcica,* 2011. 45(2): p. 79-84.

80) Starkey, C. and Ryan, J. *The Shoulder and Upper Arm,* in Evaluation of Orthopedic and Athletic Injuries, Starkey, C. ve Ryan, J. USA: F.A.Davis Company. 2002. p. 424-489.

81) Hawkins, R.H. Clinical assessment of the shoulder. *The Canadian Journal of CME*, 2001. P. 87-99.

82) Itoi, E., Kido, T., Sano, A., Urayama, M. and Sato K. Which is more useful, the "full can test" or the "empty can test," in detecting the torn supraspinatus tendon? *The American Journal of Sports Medicine*, 1999. 27(1): p. 65-68.

83) Boettcher, C.E., Ginn, K.A. and Cathers, I. The 'empty can' and 'full can' tests do not selectively activate supraspinatus. *Journal of Science and Medicine in Sport,* 2009. 12: p. 435–439.

84) Thain LM. and Adler RS. Sonography of the rotator cuff and biceps tendon: technique, normal anatomy, and pathology. *J Clin Ultrasound*, 1999. 27: p. 446–58.

85) Allen GM. And Wilson DJ. Ultrasound of the shoulder. *Eur J Ultrasound*, 2001. 14: p. 3-9.

86) Braddom RL, *Üst Ekstremite kas iskelet sistemi ağrı sendromları.* ed. Arasıl T, Fiziksel Tıp ve Rehabilitasyon El Kitabı. Güneş Kitabevi: Ankara; 2005. P. 513–529.

87) Üstün EE., *İskelet sistemi Radyolojisi,* Güven Tıp Kitabevi: İzmir; 2003 p. 537–593.

88) Oxner KG. Magnetic resonance imaging of the musculoskelatal system: The shoulder. *Clin Orthop,* 1998. p. 95–101.

89) Vahlensieck M. MRI of the shoulder. *Eur Radiol,* 2000. 10: p. 242–9.

90) Anzilotti KF Jr, Schweitzer ME, Oliveri M, Marone PJ. Rotator cuff strain: a posttraumatic mimicker of tendonitis on MRI. *Skeletal Radiol*, 1996. 25: p. 555–8.

91) Elden H, Nacitarhan V, *Üst Ekstremite Kinezyolojisi, in* Tıbbi Rehabilitasyon, Oğuz H, Dursun E, Dursun N Ed. Nobel Tıp Kitabevleri: Ankara. 2004. p. 245-263.

92) Beaton DE. and Richards RR. Measuring function of the shoulder: A cross-sectional comparison of five questionnaires. *J Bone Joint Surg,* 1996.78A: p. 882-890.

93) Binkley J. *Functional Outcome Measures in Clinical Practice.* in Treatment and Evaluation of the Shoulder, Tovin BJ., Greenfield BH., eds. F.A. Davis Company: Philadelphia. 2001. p. 132-146.

94) Romeo AA, Bach BR Jr, O'Halloran KL. Scoring systems for shoulder conditions. *Am J Sports Med,* 1996. 24: p. 472-476.

95) Ayhan Ç. *Omuzu içeren üst ekstremite fonksiyon bozukluklarında kullanılan farklı anketlerin güvenirliğinin karşılaştırılması.* Ankara, Hacettepe Üniversitesi Sağlık Bilimleri Enstitüsü, 2004.

96) Angst, F., Schwyzer, HK. , Aeschlimann, A. , Simmen, BR. , Goldhahn, J. Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH) and Its Short Version (QuickDASH), Shoulder Pain and Disability Index (SPADI), American Shoulder andElbow Surgeons (ASES) Society Standardized Shoulder Assessment Form, Constant (Murley) Score (CS), Simple Shoulder Test (SST), Oxford Shoulder Score (OSS), ShoulderDisability Questionnaire (SDQ), and Western Ontario Shoulder Instability Index (WOSI). *American College of Rheumatology*, 2011. 63(11): p. 174-188.

97) Roach KE., Budiman-Mak E., Songsiridej N., Lertratanakul Y. Development of a Shoulder Pain and Disability Index. *Arthritis Care Res,* 1991. 4: p. 143–9.

98) Angst F, Goldhahn J, Pap G, Mannion AF, Roach KE, Siebertz D, et al. Cross-cultural adaptation, reliability, and validity of the German Shoulder Pain and Disability Index (SPADI). *Rheumatology (Oxford).* 2007; 46: 87–92.

99) Richards RR, An KN, Bigliani LU, Friedman RJ, Gartsman GM, Gristina AG, et al. A standardized method for the assessment of shoulder function. *J Shoulder Elbow Surg.* 1994; 3: 347–52.

100) Constant CR and Murley AH. A clinical method of functional assessment of the shoulder. *Clin Orthop Relat Res,* 1987. 214: p. 160–4.

101) Constant CR, Gerber C, Emery RJ, Sojbjerg JO, Gohlke F, Boileau P. A review of the Constant score: modifications and guidelines for its use. *J Shoulder Elbow Surg,* 2008. 17: p. 355–61.

102) Lippitt SB, Harryman DT, Matsen FA. *A Practical Tool for Evaluation of Function: The Simple Shoulder Test*, in: The Shoulder: A Balance of Mobility and Stability, Matsen FA, Fu FH, Hawkins RJ, editors. T Rosemont (IL): American Academy of Orthopedic Surgeons: 1993. p. 545–59.

103) Celik, D., Akyuz, G.,Yeldan, I. Comparison of the effects of two different exercise programs on pain in subacromial impingement syndrome. *Acta orthopaedica et traumatologica turcica*, 2009. 43 (6): p. 504-509.

104) McClure, P.W., Bialker, J., Neff, N., Williams, G.,Karduna, A. Shoulder function and 3-dimensional kinematics in people with shoulder impingement syndrome before and after a 6-week exercise program. *Physical therapy*, 2004. 84 (9): p. 832-848.

105) Faber, E., Kuiper, J.I., Burdorf, A., Miedema, H.S.,Verhaar, J.A. Treatment of impingement syndrome: a systematic review of the effects on functional limitations and return to work. *Journal of occupational rehabilitation*, 2006. 16 (1): p. 6-24.

106) Bang, M.D. and Deyle, G.D. Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. *Journal of Orthopaedic & Sports Physical Therapy*, 2000. 30 (3): p. 126-137.

107) McClure, P.W., Bialker, J., Neff, N., Williams, G.,Karduna, A. Shoulder function and 3-dimensional kinematics in people with shoulder impingement syndrome before and after a 6-week exercise program. *Physical therapy*, 2004. 84 (9): p. 832-848.

108) Trampas A. and Kitsios A. Exercise and manual therapy for the treatment of impingement syndrome of the shoulder: a systematic review. *Physical Therapy reviews,* 2006. 11: p. 125-142.

109) Van der Heijden, G.J., van der Windt, D.A.,de Winter, A.F. Physiotherapy for patients with soft tissue shoulder disorders: a systematic review of randomised clinical trials. *Bmj*, 1997. 315(7099): p. 25-30.

110) Soibam, I. *Comparative study on the effectiveness of ultrasound (us) to transcutaneous electrical stimulation (tens) in the treatment of periarticular shoulder pain (psp).* Bangalore, Rajiv Gandhi University, 2005.

111) Granviken, F. and Vasseljen, O. Home exercises and supervised exercises are similarly effective for people with subacromial impingement: a randomised trial. *Journal of physiotherapy*, 2015. 61 (3): p. 135-141.

112) Hawkings RJ, Abrams JS. Impingement Syndrome in the Absence of Rotator Cuff Tear (Stage 1 and 2). *Orthop Clin North Am.* 1987. 18: p. 373-382.

113) Tüzün F., *Soğuk Tedavisi*, in Hareket Sistemi Hastalıklarında Fiziksel Tıp Yöntemleri, Sarı H., Tüzün Ş., Akgün K. Nobel Tıp Kitapevi: İstanbul. 2002. p. 81-87.

114) Koyuncu H., *Yüzeyel Isıtıcılar*, in Hareket Sistemi Hastalıklarında Fiziksel Tıp Yöntemleri, Sarı H., Tüzün Ş., Akgün K. Nobel Tıp Kitapevi: İstanbul. 2002. p. 43-50.

115) Reid D.C. (1992). *Physical Modalities in Sports Injury Assesment and Rehabilitation Vol 3*, New York: Churchill Livingstone; 1992. p. 31-63.

116) Tuna, N. *Electroterapi.* İstanbul: Nobel Tıp Kitap Evi. 2001.

117) Kitchen, S. and Bazin, S. *Electrotherapy: Evidence Based Practice.* Edinburg: Churchill Livingstone. 2002.

118) Michener LA, Walsworth MK, Burnet EN. Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. *J Hand Ther.* 2004. 17: p. 152-64.

119) Ezzati A, Bayat M, Taheri S, Mohsenifar Z. Low-level laser therapy with pulsed infrared laser accelerates third-degree burn healing process in rats. *J Rehabil Res Dev.* 2009. 46: p.543-54.

120) Kitchen, S.and Bazin, S. *Clayton's electrotherapy* (10 bs.). London: Saunders. 1996.

121) Macdonald, R. *Pocketbook of taping techniques*. London: Elsevier Health Sciences. 2009.

122) Kase, K. *Clinical therapeutic applications of the Kinesio taping methods.* Tokyo: Kinesio Taping Assoc. 2003.

123) Kalichman, L., Vered, E. and Volchek, L. Relieving symptoms of meralgia paresthetica using Kinesio taping: a pilot study. *Archives of physical medicine and rehabilitation*, 2010. 91 (7): p. 1137-1139.

124) Çeliker, R., Güven, Z., Aydoğ, T., Bağış, S., Atalay, A., Yağcı, H.Ç. et al. Kinezyolojik Bantlama Tekniği ve Uygulama Alanları. *Türkiye Fiziksel Tıp ve Rehabilitasyon Dergisi*, 2011. 57 (4): p. 225-235.

125) Macdonald, R. *Taping techniques: principles and practice*. UK: Butterworth-Heinemann Medical. 2004.

126) Lazaro R. Shoulder impingement syndromes: implications on physical therapy examination and intervention. *J Jpn Phys Ther Assoc*, 2005. 8(1): p. 1-7.

127) Voight ML. and Thomson BC. The role of scapula in the rehabilitation of shoulder injuries. *J Athl Train*, 2000. 35(3): p. 364-372.

128) Blackburn, T., Boissonnault, W. and Bryan, J. *Orthopaedic Physical Therapy. New York: Churchill Livingstone,* 1989. p. 239-259.

129) Gamze, Ş. *Supraspinatus Tendinozisli Hastalarda Yumuşak Doku Manipulasyonun Etkinliği.* Ankara, Hacettepe Üniversitesi. 2006.

130) Todoroff, Todor., Velioğlu, Gürsel. *Manuel Tıp.* Ankara, Güneş Tıp Kitabevleri; 2009. p.1-12.

131) Moutzouri, M., Billis, E., Strimpakos, N., Kottika, P., Oldham, J.A. The effects of the Mulligan Sustained Natural Apophyseal Glide (SNAG) mobilisation in the lumbar flexion range of asymptomatic subjects as measured by the Zebris CMS20 3- D motion analysis system. *BMC Musculoskeletal Disorders*, 2008. 9: p. 131-140.

132) Aksoy, C., Sarı, H. *Manipulasyon, Masaj ve Traksiyon, Fiziksel Tıp ve Rehabilitasyon İlkeler ve Uygulamalar.* Ankara, Güneş Tıp Kitabevleri, 2007. p. 285-296.

133) McLean, S., Naish, R., Reed, L., Urry, S., Vicenzino, B. A pilot study of the manual force levels required to produce manipulation induced hypoalgesia. *Clinical Biomechanics*, 2002. 17: p. 304–8.

134) Exelby, L. The Mulligan concept: its application in the management of spinal conditions. *Man Ther.* 2002. 7(2): p. 64-70.

135) Exelby, L. Peripheral mobilizations with movement. *Man Ther.* 1996. 1: p. 118-126.

136) Hing, W., Bigelow, R., Bremner, T. Mulligan's mobilisation with movement: a review of the tenets and prescription of MWMs. *New Zealand Journal of Physiotherapy,* 2008. 36 (3): p. 144-164.

137) Vicenzino, B., Wright, A. Effects of a novel manipulative therapy technique on tennis elbow: a single case study. *Manual Therapy,* 1995. 1(1): p. 30–35.

138) O'Brien, T., Vicenzino, B. A study of the effects of Mulligan's mobilization with movement treatment of lateral ankle pain using a case study design. *Manual Therapy*, 1998. 3: p. 78–84.

139) Abbott, J. Mobilization with movement applied to the elbow affects shoulder range of movement in subjects with lateral epicondylalgia. *Manual Therapy*, 2001. 6: p. 170–177.

140) Abbott, J., Patta, C., Jensen, R. The initial effects of an elbow mobilization with movement technique on grip strength in subjects with lateral epicondylalgia. *Manual Therapy*, 2001. 6: p. 163–169.

141) Paungmali, A., O'Leary, S., Souvlis, T., Vicenzino, B. Hypoalgesic and sympathoexcitatory effects of mobilization with movement for lateral epicondylalgia. *Physical Therapy*, 2003. 83: p. 374–383.

142) Collins, N, Teys, P., Vicenzino, B. The initial effects of a Mulligan's mobilization with movement technique on dorsiflexion and pain in subacute ankle sprains. *Manual Therapy*, 2004. 9: p. 77–82.

143) Abbott, J.H. Effect of mobilization with movement on shoulder impairment and functional limitation: a case report. *The Journal of Manual and Manipulative Therapy*, 1998. 6(2): p. 208.

144) Folk, B. Traumatic thumb injury management using mobilization with movement. *Manual Therapy*, 2001. 6 (3): p. 178–182.

145) Horton, S.J. Acute locked thoracic spine: treatment with a SNAG. *Manual Therapy*, 2002. 7(2): p. 103–107.

146) Hsieh, C.Y., Vicenzino, B., Yang, C.H., Hu, M.H., Yang, C. Mulligan's mobilization with movement for the thumb: a single case report using magnetic resonance imaging to evaluate the positional fault hypothesis. *Manual Therapy*, 2002. 7(1): p. 44–49.

147) Çakmak A. Subakromiyal sıkışma sendromunda konservatif tedavi. *Acta Orthop Traumatol Turc.* 2003; 37(1): p. 112-118.

148) Morrison DS, Greenbaum BS. , Einhorn A. *Shoulder Impingement*, in The Orthopedic Clinics of North America, Conservative Management of Shoulder Injuries, Friedman RJ, ed. Philadelphia: W.B. Saunders, 2000. p. 285-293.

149) Greenfield BH. *Impingement Syndrome and Impingement-Related Instability*, in Physical Therapy of the Shoulder 5th ed, Donatelli RA. Missouri. Churchill and Livinstone, 2012. p. 185-206.

150) Chang WK. Shoulder impingement syndrome. *Phys Med Rehabil Clin N Am*, 2004. 15: p. 493-510.

151) Demirhan M, Akman Ş, Akalın Y. Omuz eklemi hastalıklarında preoperatif ve postoperatif skorlama. *Acta Orthop Traumatol Turc*, 1993. 27: p. 129-131.

152) Matsen FA, Arntz CT. *Subakromial Impingement*, in The Shoulder, Matsen, FA, ed. Rockwood, CA, Philadelphia, W.B Saunders Company, 1990. p. 623-642.

153) Downie, W., Leatham, P., Rhind, V., Wright, V., Branco, J. ve Anderson, J. Studies with pain rating scales. *Annals of the Rheumatic Diseases*, 1978. 37 (4): p. 378-381.

154) Otman, S.A., Demirel, H. and Sade, A. *Tedavi Hareketlerinde Temel Değerlendirme Prensipleri.* Ankara: Hacettepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Yayınları, 2003.

155) Edwards, T.B., Bostick, R.D., Greene, C.C., Baratta, R.V. and Drez, D. Interobserver and intraobserver reliability of the measurement of shoulder internal rotation by vertebral level. *Journal of Shoulder and Elbow Surgery*, 2002. 11(1): p. 40–42.

156) Hayes, K., Walton, J.R., Szomor, Z.L. and Murrell, G.A.C. Reliability of five methods for assessing shoulder range of motion. *The Australian Journal of Physiotherapy*, 2001. 47(4): p. 289–294.

157) American Academy of Orthopaedic Surgeons, *Joint Motion: Method of Measuring and Recording.* Chicago, 1965.

158) Düger, T., Yakut, E. ve Öksüz, Ç. Kol, Omuz, El Sorunları (Disabilities of the Arm, Shoulder and Hand-DASH) Anketi Türkçe uyarlamasının güvenirliği ve geçerliği. *Fizyoter Rehabil*, 2006. 17: p. 99-107.

159) Williams Jr, J.W., Holleman Jr, D.R. ve Simel, D. Measuring shoulder function with the Shoulder Pain and Disability Index. *The Journal of rheumatology*, 1995. 22 (4): p. 727-732.

160) Brox JI. Arthroscopic surgery compared with supervised exercises in patients with rotator cuff disease (stage II impingement syndrome). *BMJ,* 1993. 307: p. 889-903.

161) Çelik, D., Atalar, A.C., Sahinkaya, S. ve Demirhan, M. The value of intermittent ultrasound treatment in subacromial impingement syndrome. *Acta orthopaedica et traumatologica turcica,* 2004. 43 (3): p. 243-247.

162) Kaya, E., Zinnuroğlu, M. ve Tuğcu, I. Kinesio taping compared to physical therapy modalities for the treatment of shoulder impingement syndrome. *Clinical rheumatology,* 2011. 30 (2): p. 201 207.

163) Hallaçeli H, and Türeyen C. *Ameliyat Edilmiş Omuz Sıkışma Sendromunda Rehabilitasyon Sonuçlarımız,* in 5. Milli El Cerrahisi ve Üst Ekstremite Kongre Kitabı, Ege R, ed. Türk el cerrahi derneği, 1996. p. 117-119.

164) Bae, Y.H., Lee, G.C., Shin, W.S., Kim, T.H. and Lee, S.M. Effect of motor control and strengthening exercises on pain, function, strength and the range of motion of patients with shoulder impingement syndrome. *Journal of Physical Therapy Science,* 2011. 23 (4): p. 687-692.

165) Subaşı, V., Çakır, T., Arıca, Z., Sarıer, R.N., Filiz, M.B., Doğan, Ş.K. et al. Comparison of efficacy of kinesiological taping and subacromial injection therapy in subacromial impingement syndrome. *Clinical rheumatology*, 2016. 35(3): p. 741-6.

166) Özcan A, Tiner M. *Omuz Sıkışma Sendromunda Soğuk Lazer Tedavilerinin Karşılaştırılması,* in 5. Milli El Cerrahisi ve Üst Ekstremite Kongre Kitabı, Ege R, ed. Türk el cerrahi derneği, 1996. p. 123-125.

167) Hakgüder A., Taştekin N., Birtane M., Uzunca K., Zateri C., Süt N. Comparison of the Short-Term Efficacy of Physical Therapy in Subacromial Sıkışma Syndrome Patients with Stage 1 and 2 Magnetic Resonance Imaging Findings. *Turk J Rheumatol,* 2011. 26(2): 127-134.

168) McClure, P.W., Michener, L.A. and Karduna, A.R. Shoulder function and 3-dimensional scapular kinematics in people with and without shoulder impingement syndrome. *Physical therapy,* 2006. 86 (8): p. 1075-1090.

169) Dolunay ET, Can F. *Omuz impingement sendromunun fizik tedavi ve rehabilitasyonunda transvers friksiyon masajının etkisi.* Ankara, Hacettepe Üniversitesi, 1999.

170) Morrison, D.S., Frogameni, A.D. and Woodworth, P. Non-Operative treatment of subacromial impingement syndrome. *The Journal of Bone & Joint Surgery*, 1997. 79 (5): p. 732-737.

171) Post M, Cohen J. Impingement syndrome: a review of late stage II and early stage III lesions. *Clinical orthopedics and related research*, 1986. 207: p. 126-132.

172) Wirth M.A., Basamania C. Nonoperative management of full-thickness tears of the rotator cuff. *Orthop Clinics of North America*, 1997. 28: p. 59-67.

173) Luime, J. J., Koes, B. W., Hendriksen I. et al. Prevalence and incidence of shoulder pain in the general population; a systematic review. *Scandinavian Society for Rheumatology,* 2004 33: p.73–81.

174) İkiz, İ. *İmpingement sendromu olan hastalarda omuz kuşağı kasları ve skapular kasların kassal ve fonksiyonel değerlendirilmesi.* Ankara, Hacettepe Üniversitesi, 2008.

175) Umer, M., Qadir, I. and Azam, M. Subacromial impingement syndrome. *Ortpedic Reviews*, 2012. 4(18): p. 79-83.

176) Chul-Hyon, C., Hyuk-Jun, S., Ki-Cheor, B. et al. The impact of depression and anxiety on self-assessed pain, disability, and quality of life in patients scheduled for rotator cuff repair. *Journal of Shoulder and Elbow Surgery*, 2013. 22: p. 1160-1166.

177) Tekeoğlu, I., Ediz, L., Hız, O. et al. The relationship between shoulder impingement syndrome and sleep quality. *European Review for Medical and Pharmacological Sciences*, 2013. 17: p. 370-374.

178) Croft, P. Measuring up to shoulder pain. *Annols of the Rheumatic Disease*, 1998. 57: p. 65-66.

179) Ginn KA, Cohen ML. Conservative treatment for shoulder pain: prognostic indicators of outcome. *Arch Phys Med Rehabil*, 2004. 85: p. 1231-1235.

180) Bergman GJD, Winters JC, Heijden G. The effect of manipulation of the structures of the shoulder girdle as additional treatment for symptom relief and for prevention of

chronicity or recurrence of shoulder symptoms. *J Manipulative Physiol Ther*, 2002. 25: p. 543–549.

181) Bergman GJD, Winters JC, Groenier KH. Manipulative Therapy in Addition to Medical Car efor Patients with Shoulder Dysfonction and Pain. *Ann Intern Med.* 2004. 141: p. 432-439.

182) Dickens VA, Williams JL, Bhamra MS. Role of physiotherapy in the treatment of subacromial impingement syndrome: A Prospective Study. *Physiotherapy,* 2005. 91: p. 159-164.

183) Arroyo JS, Hershon SJ. et al. Special considerations in the athletic throwing shoulder. *Orthopedic Clinics of North America*, 1997. 28: p. 69-78.

184) Gummesson C., Atroshi I., Ekdahl C. The disabilities of arm, shoulder and hand (DASH) outcome questionnaire: Longitudinal construct validity and measuring self-rated health change after surgery. *BMC Musculoskelet Dis,* 2003. 4(1): p. 11.

185) Bot S.D., Terwee C.B., van der Windt D. A., Bouter L.M., Dekker J., de Vet H. C. Clinimetric evaluation of shoulder disability questionnaires: a systematic review of the literature. *Annals of the Rheumatic Dissease,* 2004. 63 (4): p. 335-341.

186) Shakeri, H., Keshavarz, R., Arab, A. ve Ebrahimi, I. Therapeutic Effect of Kinesio taping on Disability of Arm, Shoulder, and Hand in Patients with Subacromial Impingement Syndrome: A Randomized Clinical Trial. *J Nov Physiother*, 2013. 3 (161): p. 2.

187) Yang J, Chang C, Chen S, Wang SF. et al. Mobilization techniques in subjects with frozen shoulder syndrome: Randomized multiple-treatment trial. *Physical Therapy,* 2007. 87: p. 1307-1315.

188) Placzek JD, Roubal PJ, Freeman DC, Kulig K, Nasser S, Pagett BT. Long Term Effectiveness of Translational Manipulation for Adhesive Capsulitis. *Clin Ortop,* 1998. 356 (11): p. 181-191.

189) Teys P, Bisse L, Vicenzino B. The initial effects of a mulligan's mobilization with movment technique on range of movment and pressure pain threshold in painlimited shoulders. *Manual Therapy*, 2008. 13: p. 37-42.

190) Green S, Buchbinder R, Hetrick S. Physiotherapy interventions for shoulder pain. *Cochrane Database Systematic Reviews,* 2003.

191) Faber E, Kuiper JI, Burdorf A, Miedema HS, Verhaar JA. Treatment of impingement syndrome: a systematic review of the effects on functional limitations and return to work. *Journal of Occupational Rehabilitation,* 2006. 16: p. 7–25.

192) Olivera C. Djordjevic, Danijela Vukicevic, Ljiljana Katunac, Stevan Jovic. Mobilization With Movement Kinesiotaping Compared With a Supervised Exercise Program for Painful Shoulder: Results of a Clinical Trial. *Journal of Manipulative and Physiological Therapeutics,* 2012. 35 (6): p. 454-46.

193) Delgado-gil J.A. , Prado-Robles E. , Rodrigues-de-Souza D.P. , Cleland J.A. , Fernandez-de-las-Penas C. , Alburquerque-Sendin F. Effects of Mobilization With Movement on Pain and Range of Motion in Patients With Unilateral Shoulder Impingement Syndrome: A Randomized Controlled Trial. *Journal of Manipulative and Physiological Therapeutics,* 2015. 38 (4): p. 245-252.

194) Satpute K.H., Bhandari P., Hall T. Efficacy of Hand Behind Back Mobilization With Movement for Acute Shoulder Pain and Movement Impairment: A Randomized Controlled Trial. *Journal of Manipulative and Physiological Therapeutics,* 2015. 38(5): p. 324-334.

195) Uparkar D., Shinde S. Effect of Movement with Mobilization in Supraspinatus Tendinitis. *International Journal of Science and Research,* 2017. 6: p. 673-676.

196) Howell S, Galinat M, Renzi A, Marone P. Normal and abnormal mechanics of the glenohumeral joint in the horizontal plane. *The Journal of Bone and Joint Surgery,* 1988. 70-A: p. 227–32.

197) Ludewig PM, Cook TA. Alterations in shoulder kinematics and associated muscle activity in people with symptoms of shoulder impingement. *Physical Therapy,* 2000. 80: p. 276–91.

198) Ludewig PM, Cook TA. Translations of the humerus in persons with shoulder impingement symptoms. *Journal of Orthopaedic & Sports Physical Therapy,* 2002. 32: p. 248–59.

199) Halder AM, Zhao KD, O'Driscoll SW, Morrey BF, An KN. Dynamic contributions to superior shoulder stability. *Journal of Orthopaedic Research*, 2001. 19: p. 206–12.

200) Fu F, Harner C, KLein A. Shoulder impingement syndrome: a critical review. *Clinical Orthopaedics and Related Research*, 1991. 269: p. 162–73.

201) Kamkar A, Irrgang J. Nonoperative management of secondary shoulder impingement syndrome. *Journal of Orthopaedic & Sports Physical Therapy*, 1993. 17: p. 212–24.

202) Flatow E, Soslowsky J, Ticker J, Pawluk R, Hepler M, Ark J, Mow V, Bigliani L. Excursion of the rotator cuff under the acromion. Patterns of subacromial contact. *American Journal of Sports Medicine*, 1994. 22: p. 779–88.

203) Matsen F, Fu F, Hawkins R. The shoulder: a balance of mobility and stability. Rosemont, IL: *American Academy of Orthopaedic Surgeons*, 1993.

204) Grossman MG, Tibone JE, McGarry MH, Schneider DJ, Veneziani S, Lee TQ. A cadaveric model of the throwing shoulder: a possible etiology of superior labrum anterior-toposterior lesions. *J Bone Joint Surg Am*, 2005. 87: p. 824-31.

205) Brantingham J.W., Cassa T. K., Bonnefin D., Jensen M.,Globe G., Hicks M., Korporaal C. Manipulative Therapy for Shoulder Pain and Disorders: Expansion of a Systematic Review. *Journal of Manipulative and Physiological Therapeutics*, 2011. 34: p. 314-346.

206) Ribeiro D. C., Peduzzi de Castro M., Sole G., Vicenzino B. The initial effects of a sustained glenohumeral postero-lateral glide during elevation on shoulder muscle activity: A repeated measures study on asymptomatic shoulders. *Manual Therapy*, 2016. 22: p. 101-108.

207) Şenbursa, G., Baltacı G., Atay A. The effectiveness of manual therapy in supraspinatus tendinopathy. *Acta Orthop Traumatol Turc*, 2011. 45(3): p. 162-167.

8. APPENDICES

8.1. Ethical Approval

1993
BAŞKENT ÜNİVERSİTESİ
Tıp ve Sağlık Bilimleri Araştırma Kurulu

TS-EN-ISO 9001
KALİTE SİSTEM BELGESİ

Sayı : 94603339-604.01.02/ 40343 08/11/2017
Konu : Proje Onayı

FİZİK TEDAVİ VE REHABİLİTASYON ANABİLİM DALINA

Anabilim Dalınızda görev yapmakta olan Yrd. Doç. Dr. Pınar Öztop tarafından yürütülecek olan KA17/275 nolu "Omuz subakromial sıkışma sendromu olan bireylerde manuel terapi tekniklerinin ağrı ve fonksiyonellik üzerine etkisinin araştırılması" başlıklı araştırma projesi Kurulumuz ve Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu'nun 08/11/2017 tarih ve 17/89 sayılı kararı ile uygun görülmüştür. Projenin başlama tarihi ile çalışmanın sunulduğu kongre ve yayımlandığı dergi konusunda Kurulumuza bilgi verilmesini rica ederim.

e-imzalıdır
Prof. Dr. Hakan ÖZKARDEŞ
Kurul Başkanı

Not: Çalışma bildiri ve/veya makale haline geldiğinde "Gereç ve Yöntem" bölümüne aşağıdaki ifadelerden uygun olanının eklenmesi gerekmektedir.

— Bu çalışma Başkent Üniversitesi Tıp ve Sağlık Bilimleri Araştırma Kurulu ve Etik Kurulu tarafından onaylanmış (Proje no:…) ve Başkent Üniversitesi Araştırma Fonunca desteklenmiştir.

— This study was approved by Baskent University Institutional Review Board and Ethics Committee (Project no:…) and supported by Baskent University Research Fund.

Bu belge, 5070 sayılı Elektronik İmza Kanununa göre Güvenli Elektronik İmza ile imzalanmıştır.

Taşkent Caddesi (Eski 1. Cadde) 77. Sokak (Eski 16. Sokak) No:11 06490 Bahçelievler / Ankara
Birim Telefon No: 0 312 212 90 65 Faks No: 0 312 221 37 59
E-Posta: arastirma@baskent.edu.tr İnternet Adresi: www.baskent.edu.tr
Bilgi İçin: Lilifer TAŞBİLEK
Unvan: Sekreter
Telefon No: 2129065-2228

BAŞKENT ÜNİVERSİTESİ
GİRİŞİMSEL OLMAYAN KLİNİK ARAŞTIRMALAR ETİK KURULU

KARAR

KARAR TARİHİ	KARAR SAYISI	PROJE NO
08/11/2017	17/89	KA17/275

Fizik Tedavi ve Rehabilitasyon Anabilim Dalında görev yapmakta olan Yrd. Doç. Dr. Pınar Öztop tarafından yürütülecek olan olan KA17/275 nolu ve "Omuz subakromial sıkışma sendromu olan bireylerde manuel terapi tekniklerinin ağrı ve fonksiyonellik üzerine etkisinin araştırılması" başlıklı araştırma projesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu tarafından incelendi ve etik açıdan uygun olduğuna karar verildi.

- Prof. Dr. Hakan ÖZKARDEŞ
- Prof. Dr. Araş PİRAT — Katılmadı.
- Prof. Dr. A. Füsun ÖNER EYÜBOĞLU
- Prof. Dr. H. Seyra ERBEK — Katılmadı.
- Prof. Dr. Neslihan ARHUN
- Doç. Dr. Taner SEZER
- Yrd. Doç. Dr. Rıfat V. YILDIRIM

ASLI GİBİDİR
Lilifer TAŞBİLEK
Araştırma ve Etik Kurulu
Sekreteri

8.2. Participant Assessment Form

DEĞERLENDİRME TAKİP FORMU

Hastanın

Adı-Soyadı:

Yaşı:
Cinsiyeti:

Özgeçmiş:

-Kronik Hastalıklar:
-Kullanılan İlaçlar:
Soy geçmiş:

Hikâyesi:

VAS değeri:
Gece: ----------
İstirahat: ----------
Aktivite: ----------

Omuz Eklem Hareket Açıklığı Değerleri:

Aktif/Pasif

Fleksiyon:

Abduksiyon:

İnternal Rotasyon:

Eksternal Rotasyon:

Kas Kuvveti Değerlendirmesi:

Fleksiyon:

Abduksiyon:

İnternal Rotasyon:

Eksternal Rotasyon:

DASH Skoru:

8.3. DASH Questionnaire

KOL, OMUZ VE EL SORUNLARI ANKETİ

DASH-T

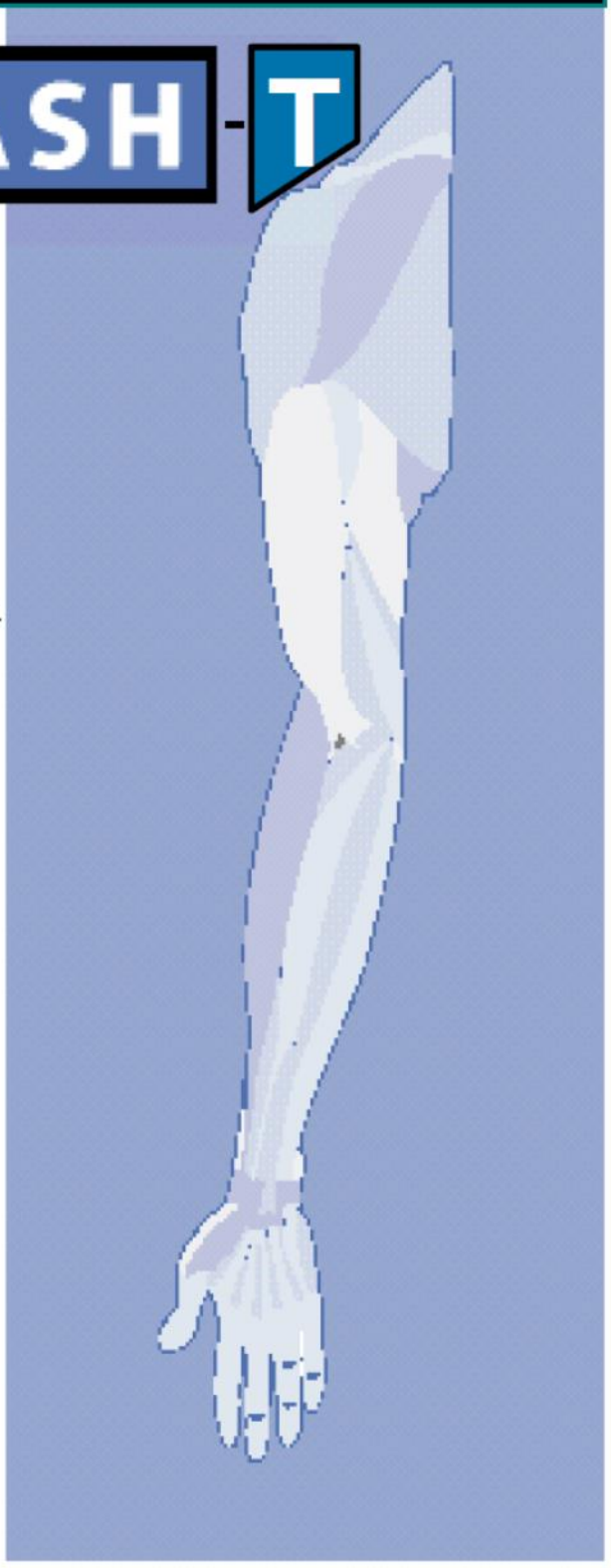
AÇIKLAMA

Bu anket bazı bedensel etkinlikleri yerine getirmenizin yanı sıra hastalık belirtilerinizi sormaktadır.

Her soruyu son haftadaki durumunuzu göz önüne alarak uygun numarayı yuvarlak içine almak suretiyle cevaplayınız.

Son hafta içinde bedensel etkinliği yapma fırsatınız olmadıysa,lütfen hangi cevabın en doğru olacağına göre en iyi tahmininizi yapınız.

Hangi el veya kolunuzu kullandığınızı dikkate almadan sadece bedensel etkinliği yapabilme becerinize göre uygun cevabı verin.



KOL, OMUZ VE EL SORUNLARI ANKETİ

Lütfen son hafta içindeki aşağıdaki etkinlikleri yapma yeteneğinizi uygun cevabın altındaki numarayı daire içine alarak sıralayınız.

	Zorluk Yok	hafif derecede zorluk	orta derecede zorluk	aşırı zorluk	hiç yapamama
1-Sıkı kapatılmış yada yeni bir kavanozu açmak	1	2	3	4	5
2-Yazı yazmak	1	2	3	4	5
3-Anahtarı çevirmek	1	2	3	4	5
4-Yemek hazırlamak	1	2	3	4	5
5-Zor açılan bir kapıyı iterek açma	1	2	3	4	5
6-Yukarıdaki bir rafa bir şey yerleştirmek	1	2	3	4	5
7-Ağır ev işleri yapmak (duvar silmek, yer silmek,tamirat yapmak vs.)	1	2	3	4	5
8-Bağ bahçe işleri yapmak,odun kesmek	1	2	3	4	5
9-Yatak yapmak	1	2	3	4	5
10-Alışveriş çantası yada evrak çantası taşımak	1	2	3	4	5
11-Ağır bir cismi taşımak (4.5 kg'den fazla.)	1	2	3	4	5
12-Yukarıdaki bir ampulü değiştirmek.	1	2	3	4	5
13-Saçları yıkamak veya kurulamak.	1	2	3	4	5
14-Sırtını yıkamak.	1	2	3	4	5
15-Kazak giymek	1	2	3	4	5
16-Yiyecekleri kesmek için bıçak kullanmak	1	2	3	4	5
17-Az çaba gerektiren eğlendirici işler (iskambil oynamak, örgü örmek vs.)	1	2	3	4	5
18-Kolunuzdan, omuzunuzdan veya elinizden güç aldığınız veya darbe vurduğunuz eğlenceye yönelik etkinlikler (önünüzde yerde bulunan bir konserve kutusu veya küçük bir taşa iki elinizle kavradığınız bir sopayla yandan vurmak,tenis oynamak,masa tenisi oynamak)	1	2	3	4	5
19-Kolunuzu serbestçe hareket ettirdiğiniz eğlendirici işler (suda taş kaydırmak, meyve taşlama, çelik çomak oynama)	1	2	3	4	5
20-Ulaşım ihtiyaçlarını kendi başına giderebilmek (bir yerden başka bir yere gitmek)	1	2	3	4	5
21-Cinsel faaliyetler	1	2	3	4	5

KOL, OMUZ VE EL SORUNLARI ANKETİ

	Hiç engel yok	Az engel	Orta derecede	Bir hayli	Aşırı
22-Son hafta süresince kol omuz yada el sorununuz aile arkadaşlar, komşular veya gruplarla normal sosyal etkinliklerinize *ne ölçüde* engel oldu	1	2	3	4	5

	Hiç kısıtlanmış Hissetmiyorum	Hafif derecede kısıtlı	Orta derecede kısıtlı	Çok kısıtlı	Bedensel etkinlik yapamıyorum
23-Son hafta süresince kol omuz yada el sorununuz nedeniyle işinizde yada diğer günlük etkinliklerde kısıtlandınız mı?	1	2	3	4	5

	Yok	Hafif	Orta derecede	Bir hayli	Aşırı
24-El, omuz ya da kol ağrınız	1	2	3	4	5
25-Herhangi belirli bir işi yaptığınızda el,omuz ya da kol ağrınız	1	2	3	4	5
26-El,omuz yada kolunuzdaki karıncalanma(iğnelenme)	1	2	3	4	5
27-El,omuz yada kolunuzdaki güçsüzlük	1	2	3	4	5
28-El, omuz yada kolunuzdaki hareket zorluğu	1	2	3	4	5

	Zorluk Yok	hafif derecede zorluk	orta derecede zorluk	aşırı zorluk uyuyamıyorum	O kadar zorluk var ki
29-Geçen hafta içinde el, omuz yada kol ağrınız nedeniyle uyumada ne kadar zorlandınız	1	2	3	4	5

	Kesinlikle Katılmıyorum	Katılmıyorum	Ne katılıyorum ne katılmıyorum	Katılıyorum	Kesinlikle katılıyorum
30-Kol, omuz veya el problemimden dolayı kendimi daha az yeterli, daha az yararlı hissediyor veya kendime daha az güveniyorum.	1	2	3	4	5

YÜKSEK PERFORMANS İSTEYEN SPORLAR-MÜZİSYENLER

Aşağıdaki sorular kol, omuz veya el sorununuzun müzik aleti çalmanıza, spor yapma veya her ikisine olan etkisi ile ilgilidir. Eğer birden çok spor yapıyor, müzik aleti çalıyorsanız (veya her ikisi de) bu etkinliklerden sizin için en önemli olanı göz önüne alarak cevaplayınız.

Lütfen sizin için en önemli olan müzik aleti veya sporu belirtiniz:.....

#Bir müzik aleti çalmıyor veya spor yapmıyorum(bu bölümü atlayabilirsiniz)

Lütfen son hafta içinde fiziksel yeteneğinizi en iyi tanımlayan numarayı yuvarlak içine alınız. Zorluğunuz oldu mu?

	zorluk yok	hafif derecede zorluk	orta derecede zorluk	aşırı zorluk	hiç yapamama
1-Spor yaparken veya müzik aleti çalarken her zamanki tekniğinizi kullanmada zorluğunuz oldu mu ?	1	2	3	4	5
2- Kolunuz, omuzunuz ve el ağrınız nedeniyle müzik aletinizi her zamanki gibi çalmada veya spor yapmada zorluğunuz oldu mu?	1	2	3	4	5
3- Müzik aletinizi istediğiniz kadar iyi çalmada, spor yapmada zorluğunuz oldu mu?	1	2	3	4	5
4- Her zamanki süre kadar bir müzik aleti çalarken veya spor yaparken zorluğunuz oldu mu?	1	2	3	4	5

İŞ MODELİ

Aşağıdaki sorunlar kolunuz, omuzunuz veya el sorununuzun işinizi yapma yeteneğiniz üzerindeki etkisini sormaktadır. (eğer ev hanımı iseniz soruları ev işlerini soruları ev işlerini düşünerek cevaplayınız.)

Lütfen işinizin/mesleğinizin ne olduğunu belirtin:.....

Çalışmıyorum (bu bölümü atlayabilirsiniz)

Lütfen son hafta içinde fiziksel yeteneğinizi en iyi tanımlayan numarayı yuvarlak içine alınız.

	zorluk yok	hafif derecede zorluk	orta derecede zorluk	aşırı zorluk	hiç yapamama
1-İşinizi yaparken her zamanki tekniğinizi kullanmada zorluğunuz oldu mu?	1	2	3	4	5
2-Kolunuz, omuzunuz veya el ağrınız nedeniyle işinizi her zamanki gibi yapmada zorluğunuz oldu mu ?	1	2	3	4	5
3- İşinizi canınızın istediği ölçüde yapmada zorluğunuz oldu mu?	1	2	3	4	5
4-İşinizi her zaman ki sürede bitirmede	1	2	3	4	5

8.4. Participant Consent Form

BAŞKENT ÜNİVERSİTESİ KLİNİK ARAŞTIRMALAR ETİK KURULU

BİLİMSEL ARAŞTIRMALAR İÇİN BİLGİLENDİRİLMİŞ GÖNÜLLÜ OLUR FORMU

LÜTFEN DİKKATLİCE OKUYUNUZ !!!

Bilimsel araştırma amaçlı klinik bir çalışmaya katılmak üzere davet edilmiş bulunmaktasınız. Bu çalışmada yer almayı kabul etmeden önce çalışmanın ne amaçla yapılmak istendiğini tam olarak anlamanız ve kararınızı, araştırma hakkında tam olarak bilgilendirildikten sonra özgürce vermeniz gerekmektedir. Bu bilgilendirme formu söz konusu araştırmayı ayrıntılı olarak tanıtmak amacıyla size özel olarak hazırlanmıştır. Lütfen bu formu dikkatlice okuyunuz. Araştırma ile ilgili olarak bu formda belirtildiği halde anlayamadığınız ya da belirtilemediğini fark ettiğiniz noktalar olursa hekiminize sorunuz ve sorularınıza açık yanıtlar isteyiniz. Bu araştırmaya katılıp katılmamakta serbestsiniz. Çalışmaya katılım **gönüllülük** esasına dayalıdır. Araştırma hakkında tam olarak bilgilendirildikten sonra, kararınızı özgürce verebilmeniz ve düşünmeniz için formu imzalamadan önce hekiminiz size zaman tanıyacaktır. Kararınız ne

1. ARAŞTIRMANIN ADI

Omuz subakromial sıkışma sendromu olan bireylerde manuel terapi tekniklerinin ağrı ve fonksiyonellik üzerine etkisinin araştırılması.

2. KATILIMCI SAYISI

Bu araştırmada yer alması öngörülen toplam katılımcı sayısı *34*'tür.

3. ARAŞTIRMAYA KATILIM SÜRESİ

Bu araştırmada yer almanız için öngörülen süre 6 hafta'dır.

4. ARAŞTIRMANIN AMACI

Bu araştırmanın amacı*;* omuz sıkışma sendromlu olgularda konservatif fizyoterapi programına ek olarak uygulanan manuel terapi tekniklerinin ağrı, eklem hareket açıklığı, kas kuvveti ve fonksiyon üzerine etkisini araştırmaktır.

5. ARAŞTIRMAYA KATILMA KOŞULLARI

Bu araştırmaya dahil edilebilmek için sahip olmanız gereken koşullar şu şekildedir;
-Klinik ve fizik muayene incelemelerine göre omuz sıkışma sendromu tanısı konulmuş olmak
-18-65 yaş arasında olmak,
-En az 4 haftadır omuz ağrınızın olması
-Son bir yıl içinde kortizon tedavisi almamış olmanız
-Ağrılı kolunuzda kuvvet veya his kaybının olmaması
-Ağrılı kolunuzda geçirilmiş kırık olmaması
-Boyun ağrınızın olmaması

-Fizik tedavi programını engelleyecek düzeyde kalp hastalığınızın olmaması
-Ağrılı kolunuzdan herhangi bir ameliyat geçirmemiş olmanız
-Son 6 ay içinde omuzunuzdan fizik tedavi programı görmemiş olmanız
-Donuk omuz tanısı olmamış olmanız

6. ARAŞTIRMANIN YÖNTEMİ

Doktorunuz tarafından Omuz Sıkışma Sendromu tanısı konulup, fizik tedavi ve rehabilitasyon programına alındıktan sonra 1. Grup ve 2. Grup olmak üzere rastgele 2 gruba ayrılacaksınız. 1. Gruptaki hastalara tedavi programı süresince sıcak paket uygulaması, düşük voltajlı elektrik akımı, omuz eklemi hareket açıklığını artırmaya ve güçlendirmeye yönelik egzersiz programı uygulanacaktır. 2. Gruptaki hastalara 1. Gruptaki tedaviye ek olarak fizyoterapist tarafından omuz bölgesine yönelik masaj benzeri bir uygulama (manuel terapi) yapılacaktır. Bu uygulamanın yapılmasının size herhangi bir zararı yoktur. Bu uygulamanın yapılmaması da tedavinizde herhangi bir eksikliğe sebep olmayacaktır. Tedaviye başlamadan önce, tedavinin ortasında ve tedavinin sonunda omuz ağrınızı, omuz eklem hareket açıklığını, omuz kas kuvvetini ve fonksiyonel durumunuzu değerlendirmek için size bir grup anket uygulanacaktır. Daha sonra 1. ve 2. Gruptan elde edilen sonuçlar karşılaştırılacaktır.

7. KATILIMCININ SORUMLULUKLARI

Yapılacak değerlendirme ve tedavi süresince araştırmacının direktiflerine uymalısınız.

8. ARAŞTIRMADAN BEKLENEN OLASI YARARLAR

Araştırmamız yalnızca bilimsel araştırma olup gönüllünün doğrudan yarar görmesi ya da tedavi seyrinin değişmesi beklenmemektedir. Ancak, bu araştırmadan elde edilen sonuçlar sizin gibi tanı almış diğer hastaların tedavisinin planlanmasında katkı sağlayacaktır.

9. ARAŞTIRMADAN KAYNAKLANABİLECEK OLASI RİSKLER

Araştırma sırasında size uygulanacak değerlendirme ve tedavilerin size vereceği herhangi bir riski, sakıncası yoktur.

10. ARAŞTIRMADAN KAYNAKLANABİLECEK HERHANGİ BİR ZARARLANMA DURUMUNDA YÜKÜMLÜLÜK / SORUMLULUK DURUMU

Araştırma nedeniyle bir zarar görmeniz söz konusu olursa, tedavi için gereken masraflar Başkent Üniversitesi tarafından karşılanacaktır.

11. ARAŞTIRMA SÜRESİNCE ÇIKABİLECEK SORUNLARDA ARANACAK KİŞİ

Uygulama süresince, zorunlu olarak araştırma dışı ilaç almak durumunda kaldığınızda Sorumlu Araştırıcıyı önceden bilgilendirmek için, araştırma hakkında ek bilgiler almak için ya da araştırma ile ilgili herhangi bir sorun, istenmeyen etki veya diğer rahatsızlıklarınız için herhangi bir saatte adresi ve telefonu aşağıda belirtilen ilgili hekime ulaşabilirsiniz.

İstediğinizde Günün 24 Saati Ulaşılabilecek Hekimin Adres ve Telefonları: Doç.Dr.Pınar Öztop Çiftkaya Başkent Üni. İstanbul Sağlık Uygulama ve Araştırma Merkezi Fizik Tedavi Ve Rehabilitasyon Bölümü Oymacı Sok. No:2 Altunizade İstanbul
İstediğinizde Günün 24 Saati Ulaşılabilecek Fizyoterapistin Adres ve Telefonları: Fzt.Emre Okan Aytaç Başkent Üni. İstanbul Sağlık Uygulama ve Araştırma Merkezi Fizik Tedavi Ve Rehabilitasyon Bölümü Oymacı Sok. No:2 Altunizade İstanbul

12. GİDERLERİN KARŞILANMASI VE ÖDEMELER

Bu araştırmaya katılmanız için veya araştırmadan kaynaklanabilecek giderler için sizden herhangi bir ücret istenmeyecektir. Hastalığınızın gerektirdiği tetkiklere ilave olarak yapılacak her türlü tetkik, fizik muayene ve diğer araştırma giderleri size veya güvencesi altında bulunduğunuz resmi ya da özel hiçbir kuruma ödetilmeyecektir.

13. ARAŞTIRMAYI DESTEKLEYEN KURUM

Araştırmayı destekleyen kurum Başkent Üniversitesi'dir.

14. KATILIMCIYA HERHANGİ BİR ÖDEME YAPILIP YAPILMAYACAĞI

Bu araştırmaya katılmanızla, araştırma ile ilgili çıkabilecek zorunlu masraflar tarafımızdan karşılanacaktır. Bunun dışında size veya yasal temsilcilerinize herhangi bir maddi katkı sağlanmayacaktır.

15. BİLGİLERİN GİZLİLİĞİ

Araştırma süresince elde edilen sizinle ilgili tıbbi bilgiler size özel bir kod numarası ile kaydedilecektir. Size ait her türlü tıbbi bilgi gizli tutulacaktır. Araştırmanın sonuçları yalnıza bilimsel amaçla kullanılacaktır. Araştırma yayınlansa bile kimlik bilgileriniz verilmeyecektir. Ancak, gerektiğinde araştırmanın izleyicileri, yoklama yapanlar, etik kurullar ve resmi makamlar tıbbi bilgilerinize ulaşabilecektir. Siz de istediğinizde kendinize ait tıbbi bilgilere ulaşabileceksiniz.

16. ARAŞTIRMA DIŞI BIRAKILMA KOŞULLARI

Uygulanan tedavi şemasının gereklerini yerine getirmemeniz, araştırma programını aksatmanız, gebe kalmanız veya araştırmaya bağlı veya araştırmadan bağımsız gelişebilecek istenmeyen bir etkiye maruz kalmanız vb. nedenlerle hekiminiz sizin izniniz olmadan sizi araştırmadan çıkarabilir. Bu durum size uygulanan tedavide herhangi bir değişikliğe neden olmayacaktır.

Ancak araştırma dışı bırakılmanız durumunda da, sizinle ilgili tıbbi veriler bilimsel amaçla kullanabilir.

17. ARAŞTIRMADA UYGULANACAK TEDAVİ DIŞINDAKİ DİĞER TEDAVİLER

Size konan tanı için uygulanabilecek, ancak bu araştırmanın gereği olarak size uygulanmayacak olan (varsa) diğer tedaviler ya da işlemler ve onlara ait yararlar ve olası riskler aşağıda belirtilmiştir.

Kortikosteroid tedavisi tedavi sürecinizin takibiyle gerekli görüldüğü takdirde hekiminiz tarafından uygulanabilir.

18. ARAŞTIRMAYA KATILMAYI REDDETME VEYA AYRILMA DURUMU

Bu araştırmada yer almak tamamen sizin isteğinize bağlıdır. Araştırmada yer almayı reddedebilirsiniz ya da herhangi bir aşamada araştırmadan ayrılabilirsiniz; araştırmada yer almayı reddetmeniz veya katıldıktan sonra vazgeçmeniz halinde de kararınız size uygulanan tedavide herhangi bir değişikliğe neden olmayacaktır.

Araştırmadan çekilmeniz ya da araştırıcı tarafından çıkarılmanız durumunda da, sizle ilgili tıbbi veriler bilimsel amaçla kullanılabilecektir.

19. YENİ BİLGİLERİN PAYLAŞILMASI VE ARAŞTIRMANIN DURDURULMASI

Araştırma sürerken, araştırmayla ilgili olumlu veya olumsuz yeni tıbbi bilgi ve sonuçlar en kısa sürede size veya yasal temsilcinize iletilecektir. Bu sonuçlar sizin araştırmaya devam etme isteğinizi etkileyebilir. Bu durumda karar verene kadar araştırmanın durdurulmasını isteyebilirsiniz.

(Katılımcının/Hastanın/Anne-Baba/Yasal Temsilcinin Beyanı)

Sayın Fzt. Emre Okan Aytaç tarafından Başkent Üniversitesi Tıp Fakültesi İstanbul Sağlık Uygulama ve Araştırma Merkezi Fizyoterapi ve Rehabilitasyon Bölümünce tıbbi bir araştırma yapılacağı belirtilerek bu araştırma ile ilgili yukarıdaki bilgiler bana aktarıldı. Bu bilgilerden sonra böyle bir araştırmaya "katılımcı" (denek) olarak davet edildim.
Eğer bu araştırmaya katılırsam hekim ile aramda kalması gereken bana ait bilgilerin gizliliğine bu araştırma sırasında da büyük özen ve saygı ile yaklaşılacağına inanıyorum. Araştırma sonuçlarının eğitim ve bilimsel amaçlarla kullanımı sırasında kişisel bilgilerimin özenle korunacağı konusunda bana gerekli güvence verildi.
Araştırmanın yürütülmesi sırasında herhangi bir sebep göstermeden araştırmadan çekilebilirim (Ancak araştırmacıları zor durumda bırakmamak için araştırmadan çekileceğimi önceden bildirmemim uygun olacağının bilincindeyim). Ayrıca, tıbbi durumuma herhangi bir zarar verilmemesi koşuluyla araştırmacı tarafından araştırma dışı tutulabilirim.
Araştırma için yapılacak harcamalarla ilgili herhangi bir parasal sorumluluk altına girmiyorum. Bana da bir ödeme yapılmayacaktır.

Araştırma uygulamasından kaynaklanan nedenlerle herhangi bir sağlık sorunumun ortaya çıkması halinde, her türlü tıbbi müdahalenin sağlanacağı konusunda gerekli güvence verildi. Bu tıbbi müdahalelerle ilgili olarak da parasal bir yük altına girmeyeceğim anlatıldı.

Bu araştırmaya katılmak zorunda değilim ve katılmayabilirim. Araştırmaya katılmam konusunda zorlayıcı bir davranışla karşılaşmış değilim. Eğer katılmayı reddedersem, bu durumun tıbbi bakımıma ve hekim ile olan ilişkime herhangi bir zarar getirmeyeceğini de biliyorum.

ARAŞTIRMAYA KATILMA ONAYI

Yukarıda yer alan ve araştırmaya başlanmadan önce gönüllüye verilmesi gereken bilgileri gösteren 4 sayfalık metni okudum ve sözlü olarak dinledim. Aklıma gelen tüm soruları araştırıcıya sordum, yazılı ve sözlü olarak bana yapılan tüm açıklamaları ayrıntılarıyla anlamış bulunmaktayım. Araştırmaya katılmayı isteyip istemediğime karar vermem için bana yeterli zaman tanındı. Bu koşullar altında, bana ait tıbbi bilgilerin gözden geçirilmesi, transfer edilmesi ve işlenmesi konusunda araştırma yürütücüsüne yetki veriyor ve söz konusu araştırmaya ilişkin bana yapılan katılım davetini hiçbir zorlama ve baskı olmaksızın büyük bir gönüllülük içerisinde kabul ediyorum. Bu formu imzalamakla yerel yasaların bana sağladığı hakları kaybetmeyeceğimi

GÖNÜLLÜ		**İMZASI**
İSİM SOYİSİM		
ADRES		
TELEFON		
TARİH		

VASİ (Varsa)		**İMZASI**
İSİM SOYİSİM		
ADRES		
TELEFON		
TARİH		

ARAŞTIRMACI		**İMZASI**
İSİM SOYİSİM ve GÖREVİ		
ADRES		
TELEFON		
TARİH		

ONAM ALMA İŞİNE BAŞINDAN SONUNA KADAR TANIKLIK EDEN KURULUŞ GÖREVLISI		**İMZASI**
İSİM SOYİSİM ve GÖREVİ		
ADRES		
TELEFON		
TARİH		

8.5. Curriculum Vitae

Kişisel Bilgiler

Adı	Emre Okan	**Soyadı**	Aytaç
Doğum Yeri	ANKARA	**Doğum Tarihi**	03.11.1986
Uyruğu	T.C.	**TC Kimlik No**	34685299398
E-mail	emreokanaytac@hotmail.com	**Tel**	5347430560

Öğrenim Durumu

Derece	Alan	Mezun Olduğu Kurumun Adı	Mezuniyet Yılı
Doktora			
Yüksek Lisans			
Lisans	Fizyoterapi ve Rehabilitasyon	**B**aşkent Üniversitesi	2011
Lise	-		

Bildiği Yabancı Dilleri	Yabancı Dil Sınav Notu (#)
İngilizce	

Başarılmış birden fazla sınav varsa(KPDS, ÜDS, TOEFL; EELTS vs), tüm sonuçlar yazılmalıdır

İş Deneyimi (Sondan geçmişe doğru sıralayın)

Görevi	Kurum	Süre (Yıl - Yıl)
Fizyoterapist	Başkent Üniversitesi İstanbul Hastanesi	2011-2019
		-

Bilgisayar Bilgisi

Program	Kullanma becerisi
Office	İyi

*****Çok iyi, iyi, orta, zayıf olarak değerlendirin

Bilimsel Çalışmaları

SCI, SSCI, AHCI indekslerine giren dergilerde yayınlanan makaleler

Diğer dergilerde yayınlanan makaleler

Uluslararası bilimsel toplantılarda sunulan ve bildiri kitabında (*Proceedings*) basılan bildiriler

Hakemli konferans/sempozyumların bildiri kitaplarında yer alan yayınlar

Diğer (Görev Aldığı Projeler/Sertifikaları/Ödülleri)
