Original Investigation / Özgün Araştırma

The Effectiveness of Conservative Treatment on Subacromial Shoulder Pain: A Prospective and Observational Study for Functional Outcome

Subakromiyal Ağrılı Omuz Sorunlarında Konservatif Tedavinin Fonksiyonel Son Durum Üzerindeki Etkinliğinin Prospektif Gözlemsel Değerlendirimi

Ahmet Yılmaz, Safiye Tuncer

Ankara University, School of Medicine, Department of Physical Medicine and Rehabilitation, Ankara, Turkey

ABSTRACT

Objective: The purpose of this study was to evaluate the outcome of patients with shoulder subacromial pain problems who were treated with a specific physiotherapy and supervised exercise program.

Methods: Fifty patients with shoulder subacromial pain problem were included to conservative treatment program for three weeks (5 days/week) and treated with physiotherapy program consisting of superficial heat, deep heat and analgesic current and supervised range of motion and strengthening exercise program. The evaluations were done initially, at 3rd and 6th months period. The 6th month evaluations were considered as functional outcomes. The evaluations included pain scores, evaluation of pain (at rest, activity and night), total and subgroups of Constant scores, DASH scores, hand grip strength, and patient satisfaction ratios.

Results: The mean age was 50,5 years and 30 (%60) of the patients were female. The mean duration of symptoms were 14 months and 45 (%90) of the patients were at the subacute-chronic stage. At the end of the 6th month, the pain scores improved ($p<0.001$) and the number of the patients complaining from pain (at rest, activity and night) decreased ($p<0.001$). An increase for Constant scores ($p<0.001$) and a decrease for DASH scores ($p<0.001$) were determined and the score changes in both scales were also correlated ($p<0.01$). Similarly, hand grip strength improved significantly ($p<0.05$) and 41 (% 82) of the patients had a satisfactory result at the end of the study ($p< 0.001$).

Conclusion: These results indicate that a specific conservative treatment program is highly effective in shoulder subacromial pain problems.

Keywords: Exercise, impingement syndrome, clinical trial, conservative treatment, shoulder

ÖZET

Amaç: Bu çalışmada, subakromiyal ağrılı omuz sorunu olan hastalarda özgül bir fizyoterapi-rehabilitasyon programı şeklindeki konservatif tedavinin fonksiyonel son durum üzerindeki etkinliğini değerlendirmek amaçlanmıştır.

Yöntemler: Subakromiyal ağrılı omuz sorunu tanısı alan 50 hasta konservatif tedavi programına alınmış ve prospektif olarak izlenmiştir. Tedavi programı 3 hafta (5 gün/hafta) yüzeyel ısı, derin ısı ve analjezik akımdan oluşan pasif fizyoterapi, gözetimli ünite egzersizleri ve izlemli ev egzersizleri şeklinde düzenlenmiştir. Hastalar başlangıç, 3. ve 6. aylarda değerlendirilmiştir. Değerlendirmelerde ağrı skorları, istirahat, gece ve kullanma ağrısının varlığı, total Constant skoru ve altgrupları, total DASH skoru, el kavrama gücü değeri, ve hasta memnuniyeti gibi fonksiyonel ölçütler kullanılmıştır. 6. ay sonuçları son durum değerlendirimi olarak kabul edilmiştir.

Corresponding Author
Yazışma Adresi

Ahmet Yılmaz

Ankara Üniversitesi Tıp Fakültesi, Fiziksel Tıp ve Rehabilitasyon AD, Ankara, Turkey

E-mail: ahmetzerrin@gmail.com

Received/Geliş Tarihi: 07.07.2014
Accepted/Kabul Tarihi: 04.02.2015

Bulgular: Hastaların yaş ortalaması 50.5 olup 30'u (%60) kadındı. Ortalama semptom süreleri 14 ay olan hastaların 45'i (%90) subakut-kronik dönemdeydi. 6 ay sonunda, ortalama ağrı skoru gelişti ($p<0.001$) istirahat, gece ve kullanma ağrısından yakınan hasta sayısı azaldı ($p<0.001$). Total Constant skorunda artış ($p<0.001$), total DASH skorunda ise azalma ($p<0.001$) saptandı ve bu iki skordaki değişimin birbiriyle korele olduğu bulundu ($p<0.01$). Benzer şekilde ortalama el kavrama gücü de istatistiksel olarak anlamlı bir şekilde yükseldi ($p<0.05$) ve çalışma sonunda 41 (%82) hasta tatmin edici bir sonuç elde etti ($p<0.001$).

Sonuçlar: Bu sonuçlar, özgül fizyoterapi ve egzersiz programı şeklinde uygulanan konservatif tedavi yaklaşımının subakromiyal ağrılı omuz sorunlarında etkin bir tedavi yöntemi olduğunu göstermektedir.

Anahtar sözcükler: Egzersiz, impingement sendromu, klinik çalışma, konservatif tedavi, omuz

Introduction

Following the back and neck pains, shoulder pain is the third commonest complaint in patients who are admitted to primary health services with musculoskeletal disorders (1). The most encountered cause of the shoulder pain is subacromial impingement syndrome (SIS) (2). Rotator cuff muscles, subacromial bursa, acromion and coracoacromial ligament play role in the pathogenesis of subacromial pain. Biceps muscle and the acromioclavicular joint are the other structures that may be responsible for the subacromial pain. Ischemia, inflammation and degeneration are defined as the mechanisms that create the pain (3,4). Subacromial pain can be induced by the maneuvers that narrow the subacromial space. When the arms are lifted up, subacromial structures are pressed by the coracoacromial ligament, 1/3 anterior edge of the acromion and the head of the humerus. This process increases the subacromial pressure and leads to pain in the shoulder (5,6). Increasing pain and limitation of shoulder motions restrict the patient socially and also cause loss of labor force.

There is no common diagnostic criteria for painful shoulder disorders, particularly for subacromial pain (7,8). Patient history, physical examination including inspection, palpation, measuring the range of movement and special tests and radiologic screening can be employed for the evaluation of shoulder. In the literature, there are different tests and maneuvers defined for the evaluation of shoulder (9,10).

The main aim of SIS treatment is to cease the inflammatory process, decrease the pain, preserve the normal range of movement and prevent the progressive degenerative changes. Prophilactic, conservative (11) or surgical treatment methods can be employed depending on the stage of the syndrome. There are various conservative treatment methods in the management of this syndrome including resting, non steroidal anti-inflammatory drugs (NSAID) (12), deep or surface heating, laser, electromagnetic field treatments, subacromial steroid injections and therapeutic exercises (13).

Since SIS is a very frequent and functionally restrictive disorder, it is particularly important to determine the effective conservative treatment regimen. This study aimed to observe the effectiveness of the conservative treatment on patients with SIS within a six-month follow-up period.

Material and Method

Patients

Fifty patients who were admitted to Ankara University School of Medicine, Physical Medicine and Rehabilitation Department, Orthopedics and Sports Injury Rehabilitation Unit with the complaint of subacromial shoulder pain between June 2004 and June 2007 were followed prospectively for 6 months. Since the study was an observational study, no experimental patient group or environment was created.

Since the subacromial shoulder pain (primarily subacromial impingement) is a clinic entity that includes increasing shoulder or upper arm pain with movement, limitation in shoulder movements and loss of upper arm strength due to rotator cuff irritation. The diagnoses were based on symptoms, physical examination and radiological imaging. The typical symptom is the pain located on anterolateral side of the acromion. It frequently spreads to the mid-lateral side of the humerus and increases at night, particularly while lying on the arm. Physical examinations revealed positive painful arc (14), Neer (15) and Hawkins (16) tests. Imaging studies were conducted with magnetic resonance imaging (MRI) (17).

The patients included in the study had subacromial bursa and supraspinatus tendon pathology (subacromial impingement syndrome) with or without restriction in shoulder movements caused by capsular retraction secondary to the rotator cuff pathologies and/or concomitant bicipital tendinitis and acromioclavicular joint osteoarthritis. The patients with a systemic inflammatory illness, diabetes mellitus, a major trauma or massive rotator cuff tears were excluded.

Clinical Assessment

All patients with subacromial shoulder pain were evaluated prospectively at the 3rd and 6th months

following initial assessment. Patient satisfaction was evaluated with how the shoulder disorder was affecting the general health status, and the patients were asked if they were satisfied or not.

Pain

The shoulder pains at rest, during activity and at night were recorded. Active shoulder pain was assessed by using visual analog scale (VAS) (0-10; 0 being no pain, 10 being the worst pain). (18-20).

Functional Evaluation

Constant Score is an assessment scale that evaluates the general or functional state of the normal, sick or treated shoulder and can be used regardless of diagnostic and radiologic abnormalities (21-23). This scale consists of subjective parameters evaluating the pain (15 points) and daily living activities (20 points); and objective parameters evaluating the range of motion (40 points) and shoulder strength (25 points). The maximum score is 100 points for a young healthy person. The pain score is recorded as the most severe pain the patient has experienced independent of the existence or absence of a physical activity or part of the day (0 point for severe, 5 points for moderate, 10 points for mild and 15 points for no pain). Daily living activity score includes full work (4 points), full recreation/sport (4 points), unaffected sleep (2 points) and maximum arm positioning without pain up to waist, xiphoid, neck, top of head and above head (from 2 to 10 points). The angles of pain-free active range of motion (ROM) for forward flexion, lateral elevation, and internal and external rotation movements were measured by goniometer while the patient was sitting. The maximum strength point is 25 that can be taken in the Constant Score. A spring balance was attached to the distal forearm while the patient was standing still. The arm was in 90° of flexion, and the shoulder was in 30° of horizontal abduction while the elbow was straight, and the palm was facing down. The patient was asked to maintain this resisted elevation for 5 seconds. This procedure was repeated three times immediately one after another. The mean of the performances was recorded in pound (lb.). Since the measurement should be pain-free, in any pain involvement, the patient got 0 point. The patient who could not achieve 90 degrees of elevation in the scapular plane got 0 point.

Disability of the Arm, Shoulder and Hand (DASH) is designed to measure physical disability and symptoms in a heterogeneous population including both males and females; people who set low, moderate, or high demands on their upper limbs during their daily lives (work, leisure, self-care); and people with a variety of upper-limb disorders (24-29). It is a self-report questionnaire scored in two components: the disability/symptom questions (30 items, scored 1-5) and the optional high performance sport/music or work section (4 items, scored 1-5). Patients are asked to fill in all sections based on their ability to perform particular activities over the previous week; only one answer for each question. At least 27 of the 30 items must be completed for scoring. Minimum score (0 point) is given for no disability and 100 points for maximum disability. Minimum detectable change (MDC): 12.7 points; current literature holds 12.7 points to be the minimal change in score that should be considered statistically significant at 95% confidence interval. Minimum clinically important difference (MCID): 15 points; this represents the change in score needed to be considered clinically significant.

Reliable and valid evaluation of hand strength is considered to be an objective index for general upper body strength. Hand grip strength was assessed by using Jamar dynamometer with shoulder adduction; elbow flexed at 90°, forearm and hand at neutral position while the patient was sitting (30-32).

Treatment

The aim of the treatment was to relieve the pain, keep the range of motion functionally sufficient, restore the power balance of shoulder girdle muscles and make the patient independent as much as possible. A treatment protocol including superficial (cold pack or hot pack for 15 minutes) and then deep (ultrasound, 1.5 watt/cm2, 3 MHz, for 5 minutes, Enraf Nonius Sonopuls 590 [Mediotronics Physical Medicine Pty Ltd]) heat treatment application to the pathologic shoulder 5 days a week for a 3-week period was performed. Physiotherapist supervised and assisted exercise program followed the heat therapy and finally interference (4.0 kHz, 125 µsec, 100 Hz, Uniphy Guidance E [Gymna Uniphy, NY]) was used as an analgesic current. The exercise program was started with submaximal isometrics and continued with short arc isometrics, isokinetic exercises, isometrics with maximal force, progressive resistive exercises, respectively. In cases of restricted shoulders, mobilization exercises were used when necessary. Proprioception and functional exercises were started when the pain and ROM relief was achieved. An exercise program was also designed to be performed at home. Patients did not receive any specific medical treatment or shoulder injections but using simple analgesics or NSAIDs was not prohibited.

Statistical Analysis

The data were evaluated using SPSS (Statistical Package for the Social Sciences, Chicago, USA) version 15.0. Descriptive statistics of demographic data were made and the median and standard deviation values

were determined. Differences in pain (at rest, during activity and at night) and patient satisfaction among three visits were analyzed with Cochran Q Test, and the pairwise comparisons among visits were performed with Mcnemar Test. The differences in pain score and Constant score (total, rom, strength) among three visits were analyzed with Friedman two-way analysis of variance test. Post-Hoc test (33) was used to determine the differences between pairs of visits. DASH and hand grip scores were analyzed with ANOVA for repeated measures analysis, and pairwise comparison was made with Pairwise comparison test. Bonferroni correction was also applied to all binary comparisons. Spearman's rank correlation coefficient was used to make the correlation analysis.

Results

Demographic and clinical characteristics of 50 patients are given in Table 1. Pain (at rest, activity and night) was found to be lower at the 6th-month visits and it was statistically significant (p<0.001). Pain score was also lower at the 3rd and 6th months (p<0.001) (Table 2). The decrease in DASH and the increase in Constant scores were statistically significant at the 3rd and 6th months (p< 0.05 and p<0.001, respectively) (Table 3). There were statistically significant differences among subgroups of Constant score (range of motion, strength) before the treatment and at the 6th month (p< 0.001) (Table 4). But no statistically significant difference was found in the pairwise comparison of the 3rd and 6th months' data of strength, anterior flexion and lateral elevation. Hand grip strength pairwise comparisons between 0 and 3rd months, 3rd and 6th months, 0 and 6th months revealed statistically significant improvement with treatment (p< 0.05) (Table 5). Patient satisfaction rate increased to %82 at the 6th month compared to the initial evaluation, and this was statistically significant (p< 0.001) (Table 6). There was a statistically significant (p< 0.05) weak negative correlation between the pain score and the hand grip strength at the 6th month whereas the pain score was strongly correlated with the other parameters. DASH and Constant scores were also correlated with the hand grip strength weakly and with the other parameters strongly and this was statistically significant (p< 0.01) (Table 7).

Table 1. Demographic and clinical characteristics of the patients.

	Mean±SD	Min-Max	n (%)
Age	50.52±11.08	20-76	
Elapsed time after the symptoms onset (months)	14.06±18.64	1-72	
Elapsed time after the treatment started (months)	15.08±18.56	1-73	
Sex			
Man			20 (40)
Woman			30 (60)
Dominant Side			
Right			48 (96)
Left			2 (4)
Affected Side			
Right			34 (68)
Left			16 (32)
Symptom duration			
Acute (<4 weeks)			5 (10)
Subacute (1-6 months)			26 (52)
Chronic (>6 months)			19 (38)
Acromion			
Type 1			16 (32)
Type 2			27 (54)
Type 3			7 (14)
NSAID use			24 (48)

SD: *Standard deviation,* ***Min:*** *Minimum,* ***Max:*** *Maximum,* ***n:*** *Number of patients,* ***NSAID:*** *Non-steroidal anti-inflammatory drug.*

Table 2. Pain (at rest, activity and night), Pain score (VAS) and pairwise comparisons of changes at visits.

	Rest	Night	Activity	Mean pain score
n (%) of patients time				
Initial	33 (66)	44 (88)	40 (80)	6.56
3rd month	12 (24)	35 (70)	25 (50)	3.66
6th month	4 (8)	30 (60)	21 (42)	2.92
p value of difference				
Initial-3rd month	<0.001	=0.012	<0.001	<0.001
Initial-6th month	<0.001	=0.001	<0.001	<0.001
3rd-6th month	=0.008	=0.063	=0.125	<0.01

n: *Number of patients,* ***(%):*** *Percentage of patients,* ***VAS:*** *Visual analog scale.*

Table 3. Total score changes at DASH and Constant and pairwise comparisons of changes at visits.

	DASH score	Constant score
Time		
Initial	42.76	31.14
3rd month	24.37	48.02
6th month	16.94	53.76
p value of difference		
Initial-3rd month	<0.05	<0.001
Initial-6th month	<0.05	<0.001
3rd-6th month	<0.05	<0.001

DASH: *Disabilities of the Arm, Shoulder and Hand*

Table 4. Score changes in Constant subgroups and pairwise comparisons of changes at visits.

	Forward flexion	Lateral elevation	External rotation	Internal rotation	Strength
Time					
Initial	6.32	5.16	2.36	1.32	1.54
3rd month	7.72	6.84	5.08	3.40	3.28
6th month	8.32	7.32	6.20	4.16	3.92
p value of difference					
Initial-3rd month	<0.01	<0.01	<0.001	<0.001	<0.05
Initial-6th month	<0.001	<0.001	<0.001	<0.001	<0.001
3rd-6th month	>0.05	>0.05	<0.01	<0.05	>0.05

Table 5. Hand grip strength score changes and pairwise comparisons of changes at visits.

	Hand grip strength (kg)
Time	
Initial	26.68
3rd month	31
6th month	31.8
p value of difference	
Initial-3rd month	<0.05
Initial-6th month	<0.05
3rd-6th month	<0.05

kg: *Kilogram.*

Table 6. Patient satisfaction changes and pairwise comparisons of changes at visits.

	Patient satisfaction
n (%) of patients with time	
Initial	12 (24)
3rd month	33 (66)
6th month	41 (82)
p value of difference	
Initial-3rd month	<0.001
Initial-6th month	<0.001
3rd-6th month	<0.05

n: *Number of patients;* ***(%):*** *Percentage of patients*

Table 7. Correlation matrix at 6th month.

	VAS	DASH	Constant	Forward flexion	Lateral elevation	External rotation	Internal rotation	Abduction Strength	Hand grip strength
VAS	1	.836**	-.925**	-.727**	-.767**	-.810**	-.830**	-.818**	-.321*
DASH		1	-.867**	-.714**	-.764**	-.749**	-.773**	-.840**	-.419**
Constant			1	.805**	.878**	.877**	.914**	.927**	.379**
Forward flexion				1	.745**	.662**	.722**	.740**	.214
Lateral elevation					1	.725**	.763**	.824**	.359*
External rotation						1	.819**	.773**	.255
Internal rotation							1	.826**	.394**
Abduction Strength								1	.522**
Hand grip strength									1

VAS: *Visual analog scale;* ***DASH:*** *Disabilities of Shoulder, Arm and Hand. **. p<0.01, *. p<0.05*

Discussion

Factors affecting the severity of subacromial pathology are age, gender and acromial morphology (34). As Gill's et al. reported, our study revealed that the pathology is more severe in those with a hook shaped acromion, in males and in older people (34).

The natural survey of the subacromial impingement is generally various, and the long term studies suggest that this is not only a self-limited pathology but also

persistent and generally progressive if not treated (35). Twenty two-Forty six % of the patients that consult a physician with a shoulder pain declare that they have had a shoulder pain previously, and in the literature, the average number of retroactive pain attacks has been reported to be 6 (2,36). Six months after the initial examination and treatment, 34-79% of the patients reported persistent shoulder symptoms, and 61% of them had still pain after 6-18 months (37-39). More than half of the patients with positive symptoms also reported that they had received no additional treatment (37). Similarly, most of the patients in our study were included in the treatment program at subacute-chronic stage, and only 14% of them had received a conservative treatment for their shoulders previously.

Shoulder pain is a true cause for disability and handicap and should be treated. Aktaş et al. (40) used pulse electromagnetic field therapy, exercise, cold and NSAID; Taşçıoğlu et al. (41) used hotpack, ultrasound, TENS and laser; Öken et al. (42) used hotpack, ultrasound, TENS and periarticular NSAID injections; Walther et al. (43) used subacromial steroid injections and oral NSAID in their studies. In our study, we used conservative therapeutic agents hotpack, ultrasound and TENS. The pain relief treatment was similar to the other conservative treatment studies in the literature. Thus, it can be concluded that subacromial impingement pain (at rest, activity and night) should be treated conservatively.

In the literature, there are also studies that compare the conservative and surgical interventions. Brox et al. (44) compared the subacromial decompression and conservative treatment including exercise and placebo laser for stage 2 impingement syndrome in their prospective, randomized and placebo controlled study. They found out that pain complaints decreased in the surgery and exercise groups compared with the placebo group, but no difference was found between these two groups. Haahr et al. (45) also reported similar results in their study comparing subacromial decompression and conservative treatment. On the basis of these data, conservative treatment can be said to be more preferable than surgical treatment since it is a less or noninvasive method of pain treatment in subacromial impingement pain.

The average decrease in DASH scores was found to be 25.8 points in our study. It can be concluded that conservative treatment provides significant improvement for upper extremity disabilities, because a decrease of 15 points is a clinically significant change for DASH scores. Depending on the significant changes in Constant score, it can also be concluded that functional capacity of the shoulder improves with conservative treatment.

Another finding supporting our conclusion was the strong correlation between the DASH and Constant scores of all follow-up visits. The literature also supports the opinion that conservative treatment improves the functional capacity and reduces the shoulder disability (40,41,43,46-49).

Another point of discussion is which questionnaire should be selected for the evaluation and follow-up of the patients with shoulder disorder. DASH is specific for upper extremities and mainly detects and differentiates small and big changes in the disability of upper arm musculoskeletal disorders (28). It is mostly used in cross-sectional studies rather than prospective studies. For the widespread use of DASH in prospective studies, further studies should be carried out to increase its ability to interpret score changes and to detect changes that may help to determine the sample size. In shoulder disorders, Constant score is cheaper, easier and can be applied in a short time. This method records individual parameters in which objective parameters receive more points than subjective parameters, and so provides an overall clinical functional assessment. It is accurately reproducible by different researchers, and it is sensitive enough to detect small changes in function (23). On the other hand, it has been proven that this method is not sufficient enough for the patients with shoulder instability. Other weak points in the application of the method are: 1) it is inadequate in the objective assessment of ROM and strength 2) it does not take radiological assessments into account (50,51).

Similar to other studies in the literature, our study revealed that the range of motion was improved significantly at all planes (40,42,43,52-55). However, forward flexion and lateral elevation reached to a stable point at the 3rd month, which can be explained with the higher initial scores. In subacromial impingement syndrome, active and passive joint movements are expected to be normal (56), and a restriction in passive movements of the shoulder suggests an adhesive capsulitis. However, particularly in older patients, a rotator cuff problem with pain may lead to decreased motion due to capsular retraction. In order to avoid pain, patients with impingement syndrome initiate shoulder abduction with scapular abduction and only at the latter phase of the movement they use the active glenohumeral abduction. Presence of a wide full-thickness rotator cuff tear should be considered if the patient is able to make abduction passively but not actively. Nevertheless, most of the patients with intact rotator cuff may exhibit this finding, because the pain caused by tendinopathy can inhibit it (57). In conclusion, if the impingement syndrome remains untreated and becomes chronic, the range of motion may be restricted not only due to pain but also due to concomitant/comorbid cuff pathology and capsular retraction.

The shoulder abduction strength, which was measured as a subgroup of Constant score, and hand grip strength were found to be improved in the end of the study while both parameters were found to be moderately correlated with each other during the study. Aktaş et al. (40), Walther et al. (43), Levendoğlu et al. (47) and Ginn et al. (52,53) have also reported in their studies that conservative treatment improved the parameters of strength. Numerous studies conducted on patients with impingement syndrome have emphasized a change in scapular kinematics, which presents itself with a decrease in posterior scapular tilt, and scapular upward rotation during shoulder abduction (58-60). Additionally, development of dysfunction in the muscles controlling scapular movement and stability contributes to subacromial narrowing. Previous studies on patients with subacromial impingement syndrome have also reported decreased maximal shoulder force (49), decreased cross-sectional area of deltoid muscle for all fiber types (61) and disrupted proprioception (62). Things mentioned above are neuromuscular adaptations considered to develop as a response to shoulder inactivity and inadequate submaximal muscle contraction due to chronic pain. Based on the hypothesis that the patients with subacromial impingement may have impaired sensory and motor control, Bandholm et al. (63) measured the isometric and isokinetic submaximal force sustainability of shoulder abduction at targeted forces, hand grip strength and maximal shoulder muscle force, and accordingly, he performed electromyography recordings from eight shoulder muscles during the activities. They concluded that there was only a minor deficiency in sensory and motor control, which emphasizes sustainability of the shoulder abduction force. Furthermore there was no decrease in maximal shoulder muscle force and maximal muscle activities. In a stereophotogrammetric analysis study on cadaver shoulders, Flatow et al. (64) demonstrated that maximal approaching between the rotator cuff tendons and inferior surface of the acromion occurs at the 60° of shoulder elevation. Wuelker et al. (65) reported that the peak forces under the coracoacromial arc occur between the 51°- 82° of elevation. Since the classical range of impingement is between 70°-120°, the maximal decrease of the muscle activity is supposed to occur at that point. However, Reddy et al. (66) found out in their study that maximal decrease of the muscle activity occurs in an arc of 30-60°, and they electromyographically analyzed the deltoid and rotator cuff muscles of the patients with subacromial impingement. Based on this data, we believe that it is controversial to make a proper assessment for shoulder strength just at an angle of 90°, isometrically as described in Constant Score. Also it is impossible with this technique to assess the sustainability of the isometric and isokinetic contraction forces against increasing submaximal target forces with this technique as Bandholm et al. (63) emphasized in their study.

The change in patient satisfaction in the end of the study was statistically significant. The patient satisfaction was determined with the decrease in pain and disability and with the improvement in function, but it was independent of the presence of 'normal' shoulder. Another finding that supports this opinion is the fact that 24% of the patients having shoulder pain and impaired function at the initial examination were satisfied.

The weak points of our study can be listed as; 1) absence of a control group to compare the effectiveness of conservative treatment, 2) employment of an insufficient technique to measure the strength instead of an isokinetic dynamometer, and 3) the natural tendency of the impingement syndrome for chronicity, which masks the response to the conservative treatment. On the other hand, the favorable aspect of this study is the observational assessment of the conservative treatment of impingement syndrome.

Conclusion

In the study, it was found out that shoulder pain due to subacromial disorder is more frequent and tends to be chronic in elder patients. Involvement of the dominant shoulder was found to be more frequent, which resulted in serious disability of daily activities. It was concluded that hook-shaped morphology of the acromion might play role in the etiopathogenesis of the impingement syndrome. A strong correlation was observed between the Constant and DASH scores. We believe that it is appropriate to use Constant score in evaluating the shoulder functionally and DASH in evaluating the disability. The study also revealed that the patient satisfaction was not determined by 'normal' shoulder but by the decrease in pain and disability and the improvement in function. It was also observed that conservative treatment, including supervised exercise and home program with passive physiotherapy, had beneficial effects on final functional situation and disability.

In conclusion, we suggest that conservative treatment should be the first choice in subacromial pain disorders independent of the duration and the stage of the disease. Because it has positive impact on function and disability, and there is no absolute indication for surgery. The conservative treatment programs should be tailored individually and the exercise stages should be supervised and evaluated with follow-ups.

References

1. Rekola KE, Keinänen-Kiukaanniemi S, Takala J. Use of primary health services in sparsely populated country districts by patients with musculoskeletal symptoms: consultations with a physician. J Epidemiol Community Health 1993;47:153-7.
2. van der Windt DAWM, Koes BW, de Jong BA, Bouter LM. Shoulder disorders in general practice: incidence, patient characteristics, and management. Ann Rheum Dis 1995;54:959-64.
3. Järvholm U, Palmerud G, Herberts P. Intramuscular pressure and electromyography in the supraspinatus muscle at shoulder abduction. Clin Orthop Rel Res 1989;245:102-9.
4. Michener LA, McClure PW, Karduna AR. Anatomical and biomechanical mechanisms of subacromial impingement syndrome. Clin Biomech 2003;18:369-79.
5. Valadie III A, Jobe C, Pink M. Anatomy of provocative tests for impingement syndrome of the shoulder. J Shoulder Elbow Surg 2000;9:36-46.
6. Sigholm G, Styf J. Subacromial pressure during diagnostic shoulder tests. Clin Biomech 1988;3:187-9.
7. Nørregaard J, Jacobsen S, Kristensen JH. A narrative review on classification of pain conditions of the upper extremities. Scand J Rehabil Med 1999;31:153-64.
8. Desmeules F, Côté CH, Frémont P. Therapeutic exercise and orthopedic manual therapy for impingement syndrome: a systematic review. Clin J Sport Med 2003; 13:176-82.
9. Brox JI. Shoulder pain. Best Pract Res Clin Rheumatol 2003;17:33-56.
10. Corso G. Impingement relief test: an adjunctive procedure to traditional assessment of shoulder impingement syndrome. J Orthop Sports Phys Ther 1995;22:183-92.
11. Morrison DS, Frogameni AD, Woodworth P. Non-operative treatment of subacromial impingement syndrome. J Bone Joint Surg Am 1997;79:732-7.
12. Petri M, Dobow R, Neiman R. Randomized, double-blind, placebo-controlled study of the treatment of the painful shoulder. Arthritis Rheum 1987;30:1040-5.
13. Kibler WB. Shoulder rehabilitation: Principles and practice. Med Sci Sports Exerc 1998;30:40-50.
14. Michener LA, Walsworth MK, Doukas WC, Murphy KP. Reliability and diagnostic accuracy of 5 physical examination tests and combination of tests for subacromial impingement. Arch Phys Med Rehabil 2009;90:1898-903.
15. Neer CS. Impingement lesions. Clin OrthopRelat Res 1983;173:70-7.
16. Hawkins RJ, Kennedy JC. Impingement syndrome in athletes. Am J Sports Med 1980;8:151-8.
17. Naredo E, Aguado P, De Miguel E, Uson J, Mayordomo L, Gijon J, et al. Painful shoulder: comparison of physical examination and ultrasonographic findings. Ann Rheum Dis 2002;61:132-6.
18. Hartrick CT, Kovan JP, Shapiro S. The numeric ratin scale for clinical pain measurement: A ratio measure? Pain Pract 2003;3:310-6.
19. Downie WW, Leatham PA, Rhind VM, Wright V, Branco JA, Anderson JA. Studies with pain rating scales. Ann Rheum Dis 1978;37:378-81.
20. Tulunay M, Tulunay C. Ağrının değerlendirilmesi ve ağrı ölçümleri. In: Erdine S, editor. Ağrı. İstanbul: Nobel Tıp Kitabevleri, 2000:91-110.
21. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clin Orthop 1987;214:160-4.
22. Constant CR, Gerber C, Emery RJH, Sojbjerg JO, Gohlke F, Boileau P. The Constant score: Modifications and guidelines for its use. J Shoulder Elbow Surg 2008;17:355-61.
23. Demirhan M, Akman Ş, Akalın Y. Omuz eklemi hastalıklarında preoperatif ve postoperatif skorlama. Acta Orthop Traumatol Turc 1993;27:129-31.
24. Beaton D, Davis AM, Hudak P, McConnell S. The DASH (Disabilities of the Arm, Shoulder and Hand) Outcome Measure: What do we know about it now? J Hand Ther 2001;6:109-18.
25. Bot S, Terwee C, van der Windt DAWM, Bouter L, Dekker J, de Vet H. Clinimetric evaluation of shoulder disability questionnaires: A systematic review of the literature. Ann Rheum Dis 2004;63:335-41.
26. Davidson J. A comparison of upper limb amputees and patients with upper limb injuries using the Disability of the ARM, Shoulder and Hand (DASH). Disabil Rehabil 2004;5:917–23.
27. Greenslade J, Mehta R, Belward P, Warwick D. Dash and Boston questionnaire assessment of carpal tunnel syndrome outcome: What is the responsiveness of an outcome questionnaire? J Hand Surg [Br] 2004;29:159-64.
28. Gummesson C, Atroshi I, Ekdahl C. The disabilities of the arm, shoulder, and hand (DASH) outcome questionnaire: Longitudinal construct validity and measuring self-rated health change after surgery. BMC Musculoskelet Dis 2003;4:11.
29. Jester A, Harth A, Germann G. Measuring levels of upper extremity disability in employed adults using the DASH questionnaire. J Hand Surg [Am] 2005;30:1074–84.
30. Kirkpatrick JE. Evaluation of grip loss. Calif Med 1956;95:314-20.
31. Mathiowetz V, Weber K, Volland G, Kashman N. Reliability and validity of hand strength evaluation. J Hand Surg 1994;9A:222.

32. Fess EE, Moran C. Clinical assessment recommendations. Indianapolis: American Society of Hand Therapists Monograph, 1981.

33. Siegel S, Castellan NJ. The case of κ related samples. In: Siegel S, Castellan NJ, editors. Nonparametric statistics for the behavioral sciences. New York: Mc Graw-Hill Corp, 1988;169-89.

34. Gill TJ, McIrvin E, Kocher MS, Homa K, Mair SD, Hawkins RJ. The relative importance of acromial morphology and age with respect to rotator cuff pathology. J Shoulder Elbow Surg 2002;11:327-30.

35. Hyvonen P, Lohi S, Jalovaara P. Open acromioplasty does not prevent progression of an impingement syndrome to a tear. Nine-year fallow-up of 96 cases. J Bone Joint Surg Br 1998;80:813-6.

36. Croft P, Pope D, Silman A. The clinical course of shoulder pain: prospective cohort study in primary care. BMJ 1996;313:601-2.

37. Van der Windt DAWM, Koes BW, Boeke AJP. Shoulder disorders in general practice: prognostic indicators of outcome. Br J Gen Pract 1996;46:519-23.

38. Chard MD, Satelle LM, Hazleman BL. The long-term outcome of rotator cuff tendinitis - a review study. Br J Rheumatol 1988;27:385-9.

39. Bartolozzi A, Andreychik D, Ahmad S. Determinants of outcome in the treatment of rotator cuff disease. Clin Orthop 1994;308:90-7.

40. Aktas I, Akgun K, Cakmak B. Therapeutic effect of pulsed electromagnetic field in conservative treatment of subacromial impingement syndrome. Clin Rheumatol 2007;26:1234–9.

41. Taşçıoğlu F, Dalkıran İ, Öner C. Parsiyel Supraspinatus Tendon Rüptürü Olan Subakromiyal Sıkışma Sendromlu Hastalarda Düşük Doz Lazer Tedavisinin Etkinliği. Türkiye Fiziksel Tıp ve Rehabilitasyon Dergisi 2003;49:18-22.

42. Öken Ö, Ayhan F, Yorgancıoğlu R.Omuzda sıkışma sendromunda fizik tedavi ve eklem çevresi tenoksikam enjeksiyonu etkinliğinin karşılaştırılması. Fiz Tıp Reh Bil Der 2007;1:9-13.

43. Walther M, Werner A, Stahlschmidt T, Woelfel R, Gohlke F. The subacromial impingement syndrome of the shoulder treated by conventional physiotherapy, self-training, and a shoulder brace: Results of a prospective, randomized study. J Shoulder Elbow Surg 2004;13:417–23.

44. Brox JI, Gjengedal E, Upphelm G, Bohmer AS, Brevik JI, Ljunggren AE, Staff PH. Arthroscopic surgery versus supervised exersises in patients with rotator cuff disease (stage II impingement syndrome): a prosrective, randomized, controlled study in 125 patients with a 2 ½ -year follow-up. J Shoulder Elbow Surg 1999;8: 102-11.

45. Haahr JP, Andersen JH. Exercises may be as efficient as subacromial decompression in patients with subacromial stage II impingement: 4–8-years' follow-up in a prospective, randomized study. Scand J Rheumatol 2006;35:224–8.

46. Richards RR, An K-N, Bigliani LU. A standardized method for the assessment of the shoulder function. J Shoulder and Elbow Surg 1994;3:347-52.

47. Levendoğlu F, Yılmaz H, Uğurlu H. Subakromiyal sıkışma sendromlu hastalarda fizik tedavi programı ile steroid enjeksiyonun etkinliğinin karşılaştırılması. Romatizma 2005;20:1-7.

48. Botanlıoğlu H, Kesmezacar H, Erginer R, Babacan M. Omuz sıkışma sendromunun konservatif tedavisi. Gülhane Tıp Dergisi 2006;48:208-14.

49. Akman Ş, Demirhan M, Akalın Y, Berkman M, Örenk Z. Subakromial sıkışma (impingement) sendromunda konservatif tedavi metodu ve sonuçlarımız. Acta Orthop Traumatol Turc 1993; 27:239-42.

50. Conboy VB, Morris RW, Kiss J, Carr AJ. An evaluation of the Constant–Murley shoulder assessment. J Bone Jt Surg [Br] 1996;78-B:229–32.

51. Grassi FA, Tajana MS. The normalization of data in the Constant–Murley score for the shoulder. A study conducted on 563 healthy subjects. Chir Organi Mov 2003; 88:65–73.

52. Ginn KA, Cohen ML, Conservative treatment for shoulder pain: prognostic indicators of outcome. Arch Phys Med Rehabil 2004;85:1231-5.

53. Ginn KA, Cohen ML. Exercise therapy for shoulder pain aimed at restoring neuromuscular control: a randomized comparative clinical trial. J Rehabil Med 2005;37:115–22.

54. Ginn KA, Herbert RD, Khouw W, Lee R. Randomized, controlled clinical trial of a treatment for shoulder pain. Phys Ther 1997;77:802-11.

55. Conroy DE, Hayes KW. The effect of joint mobilization as a component of comprehensive treatment for primary shoulder impingement syndrome. J Orthop Sports Phys Ther 1998;28:3-14.

56. Koester MC, George, MS, Kuhn JE. Shoulder impingement syndrome. Am J Med 2005;118:452-5.

57. Almekinders LC. Impingement syndrome. Clinics in Sport Medicine 2001;20:491-504.

58. Endo K, Ikata T, Katoh S, Takeda Y. Radiographic assessment of scapular rotational tilt in chronic shoulder impingement syndrome. J Orthop Sci 2001;6:3-10.

59. Ludewig PM, Cook TM. Alterations in shoulder kinematics and associated muscle activity in people with symptoms of shoulder impingement. Phys Ther 2000;80: 276-91.

60. Lukasiewicz AC, McClure P, Michener L, Pratt N, Sennett B. Comparison of 3-dimensional scapular position and orientation between subjects with and without shoulder impingement. J Orthop Sports Phys Ther 1999;29:574-83.

61. Bang MD, Deyle GD. Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. J Orthop Sports Phys Ther 2000;30:126-37.

62. Machner A, Merk H, Becker R, Rohkohl K, Wissel H, Pap G. Kinesthetic sense of the shoulder in patients with impingement syndrome. Acta Orthop Scand 2003;74:85-8.

63. Bandholm T, Rasmussen L, Aagaard P, Jensen BR, Diederichsen L. Force steadiness, muscle activity, and maximal muscle sttrength in subjects with subacromial impingement syndrome. Muscle Nerve 2006;34:631-9.

64. Flatow EL, Soslowsky LJ, Ticker JB. Excursion of the rotator cuff under the acromion. Patterns of subacromial contact. Am J Sports Med 1994;22:779-88.

65. Wuelker N, Roetman B, Roessig S. Coracoacromial pressure recordings in a cadaveric model. J Shoulder Elbow Surg 1995;4:462–7.

66. Reddy AS, Mohr KJ, Pink MM, Jobe FW. Electromyographic analysis of the deltoid and rotator cuff muscles in persons with subacromial impingement. J Shoulder Elbow Surg 2000;9:519-23.