



Comparison of the effects of two different exercise programs on pain in subacromial impingement syndrome

Subakromiyal sıkışma sendromunda iki farklı egzersiz programının ağrı üzerine etkilerinin karşılaştırılması

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Amaç: Akut veya subakut subakromiyal sıkışma sendromunda (SSS) 90° altında ve üstünde yapılan iki farklı egzersiz programının ağrı üzerine etkinliği karşılaştırıldı.

Çalışma planı: Çalışmada, akut veya subakut SSS tanısı konan 30 hasta (23 kadın, 7 erkek; ort. yaş 52; dağılım 34-70) rastlantısal yöntemle eşit sayıda iki gruba ayrıldı. Grup 1'e 90 derecenin altında, grup 2'ye ise 90° ve üstünde egzersiz programı uygulandı. Standard egzersiz programına ek olarak, iki gruba da transkutanöz elektrik sinir uyarımı, kesikli ultrason ve buz uygulandı; steroid olmayan antiinflamatuvar ilaç verildi. Tedavi süresi iki hafta (10 seans) idi. Ağrının değerlendirilmesinde Constant ağrı skoru, görsel analog skala (GAS) ve yüz skalası kullanıldı. Hastaların psikolojik durumları Beck Depresyon Ölçeği ile değerlendirildi. Hasta/terapist memnuniyeti ölçüldü. Değerlendirmeler başlangıç, 2. ve 16. haftalarda yapıldı.

Sonuçlar: Constant ağrı skoru, GAS skoru ve yüz skalasında 2. hafta ve 16. hafta sonunda iki grupta da anlamlı iyileşme görüldü. Yüz skalasında grup 2'de 2-16. haftalar arasındaki değişim anlamlı bulunmadı. Beck Depresyon Ölçeği'ndeki düzelme iki grupta da anlamlıydı. Hasta memnuniyetindeki değişimler iki grupta da anlamlıyken, fizyoterapist memnuniyetinde 2-16. haftalar arasındaki artış sadece grup 1'de anlamlıydı. Gruplararası karşılaştırmalarda, Constant ağrı skorundaki değişimler anlamlı fark göstermedi. Grup 1'de 2. haftada GAS skoru, 16. haftada yüz skalası skoru anlamlı olarak daha iyi bulundu. Beck depresyon değerlendirmesi ve hasta/fizyoterapist memnuniyeti iki grupta benzer bulundu.

Çıkarımlar: Subakromiyal sıkışma sendromunda egzersizlerin 90 derecenin altında uygulanması (ağrısız hareket açıklığı) GAS ve yüz skorlarında ek düşümlere yol açmıştır.

Anahtar sözcükler: Egzersiz tedavisi/yöntem; fizik tedavi yöntemleri; omuz sıkışma sendromu/rehabilitasyon; omuz ağrısı/rehabilitasyon.

Objectives: We compared the effects of two different exercise programs below or above 90 degrees on pain in subacromial impingement syndrome (SIS).

Methods: Thirty patients (23 females, 7 males; mean age 52 years; range 34-70) with acute or subacute SIS were randomly assigned to two groups, equal in number, to receive an exercise program below (group 1) or above (group 2) 90°, respectively. In addition to the standard exercise program, transcutaneous electrical nerve stimulation, intermittent ultrasound, and cold pack were applied, and a nonsteroidal anti-inflammatory drug was given. Treatment lasted two weeks (10 sessions). Pain was assessed using the Constant score, a visual analog scale (VAS), and face score, and psychologic state was assessed with the Beck Depression Inventory. Satisfaction levels of the patients and the therapist were measured. Assessments were made before, and 2 and 16 weeks after treatment.

Results: Both groups had significant improvements in the Constant score, VAS score, and face score at 2 and 16 weeks. Change in the face score between 2 and 16 weeks was not significant in group 2. Improvements in the Beck Depression Inventory were significant in both groups. While patient satisfaction significantly increased in both groups, increase in the therapist's satisfaction between 2 and 16 weeks was significant only in group 1. The two groups did not differ with respect to changes in the Constant score, whereas VAS score at 2 weeks and face score at 16 weeks were significantly better in group 1. The two groups were similar with respect to improvements in the Beck Depression Inventory and patient/therapist satisfaction.

Conclusion: The exercise program below 90 degrees (pain-free range of motion) resulted in additional improvements in VAS and face scores in SIS.

Key words: Exercise therapy/methods; physical therapy modalities; shoulder impingement syndrome/rehabilitation; shoulder pain/rehabilitation.

Subacromial impingement syndrome (SAIS) is one of the most common pathology found in the shoulder region. This condition, starts from supraspinatus tendon, into infraspinatus and teres minor and subacromial bursa and biceps tendon combined, compressing between humerus and coracoacromial arc, and as a result a painful shoulder pathology emerges.^[1] This pathology causes edema, inflammation and pain while reducing shoulder functions, pain and limitations significantly affect the patient's quality of life. The treatment of subacromial impingement syndrome is % 90 -95 conservative; and along with the traditionally implemented methods, affectivities of the new methods are being tested as well. These conservative methods are, rotator cuff and scapular muscles strengthening exercises,^[2-4] immobilization,^[5] manipulative treatment, passive, active and active assistive range of motion exercises (ROM), various mobilization techniques,^[6] home exercise programs and various physical therapy methods. Physical therapy methods such as transcutaneous electrical nerve stimulation (TENS) and intermittent ultrasound (US) are conservative methods to provide pain control.^[7] In a conservative approach, exercise therapy is often being used and has an important role. In portions of exercise programs, muscle strengthening programs are essential.^[2-6] The aim of the program is emphasized in two: Reducing compression while strengthening rotator cuff during shoulder elevation and depressing humeral head^[2-4], providing scapular muscle control to keep correct posture and preventing protracted shoulder.^[5,6] In other programs there are ROM exercises which are aimed towards defending and improving restricted ROM.^[6]

In some parts of the exercise programs compared; reduction in pain and improvement in functional limitations were achieved, and the advantages of these programs could not be statistically shown. In literature, we did not find a study of ROM being restricted in painful arc in SAIS. In this study, leading with the hypothesis that exercises being restricted in painful arc may have positive results on pain, two different exercise programs, one below 90° and one above 90°, were compared in patients with acute or sub-acute SAIS.

Patients and methods

In this study 33 patients diagnosed with sub-acute SAIS from the Marmara University Faculty of Me-

dicine Physical Medicine and Rehabilitation Department were included. The study criteria was taken as follows: The pain lasts for six months or longer; impingement symptoms during medical exam (Neer impingement test, Hawkins signs, Jobe supraspinatus test; %30 less limitation in passive movement compared to that of the other party; no degenerative arthritis or mezoacromion in direct radiographie; no pathologic symptoms except the edema in subacromial bursa during examination of magnetic resonance; no sports activities in progress. Patients undergoing shoulder surgery or physical therapy and rehabilitation patients and those who have received psychiatric treatment were not included in the study. After giving oral information about the study, patients who agreed to participate were divided into two groups randomly. First group had 17 patients, while the second group consisted of 16 patients. In the first group, one patient had difficulty in transportation to the hospital, and another patient had indication of surgery while attending exercise program. For these reasons, two patients were left out of the study. In the second group, one patient left the exercise program due to pain. Patients in 2 groups of 15 people (23 females, 7 males; Age 52; range 34-70) completed the treatment.

In the first group, shoulder flexion below 90 degrees, abduction, T-bar (wand) exercises containing internal-external rotation and extension, posterior capsule stretching and internal rotation exercises and rotator cuff strengthening exercises were performed (Figure 1).The second group was given exercises over 90 degrees, posterior and inferior capsule stretching exercises, rotator cuff strengthening and internal rotation exercises were given (Figure 2). Both groups performed these exercises once a day with 30 repetitions in supervision of a physiotherapist, for two weeks, at the hospital. Patients' were then asked to repeat the exercises two more times on the same day with 30 repetitions. After home exercise program, the importance of 15 minutes ice application was highlighted. In order to reduce the pain, both groups of patients in the hospital were applied TENS for 20 minutes, edema and inflammation milding effect for 4 minutes, 1 watt/cm² intermittent US and after exercise program 15 minutes ice was applied. In conjunction with the applied exercise programs, oral tenoxicam (20 mg) tablet was given once a day. Patients were evaluated on weeks 0, 2 and 16 with Constant score (pain),^[8] visual analog scale (VAS),^[9] face scale,^[10]

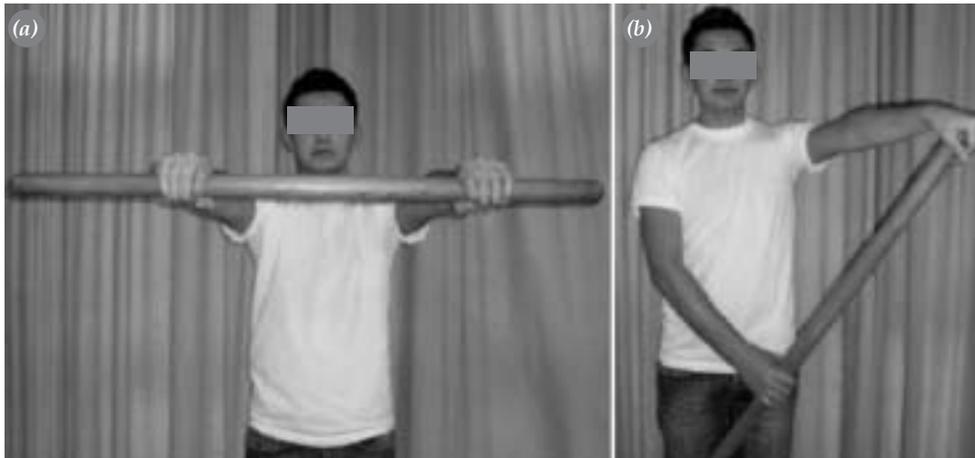


Figure 1. Shoulder (a) flexion (b) abduction exercises below 90° in the first group

Beck depression score^[11] and patient / therapist satisfaction.^[12] For Constant score, patients were asked to identify the degree pain based on none, mild, medium and serious according to the answers the scores were calculated as 15, 10, 5 and 0 points. Via visual analog scale, pain was questioned between 0 (no pain) to 10 points (extremely severe pain). Beck depression score is an assessment which examines the level of depression and intensity in patients and consists of 21 questions. The answers to each question are calculated as 0, 1, 2, 3 points. According to the total score, 0-9 points normal, 0-15 points mild depressive, 16-23 points moderate-depressive, and > 24 points express severe depression. In the patient-therapist satisfaction, the patient's mood and the therapist's observation on the patient was assessed by giving 0-4 points

(0 to elevation, 1 no change, 2 mild improvement, 3 good, 4 excellent). After treatment and at the end of 16th week, the chi-square test was used for in group analysis t-test and Mann-Whitney U test, and in comparison of the differences between two groups, based on parameter's initial assessment. The statistical significance level was accepted as $p < 0.05$.

Results

The right arm was the dominant side in 14 patients in group 1, and in all patients in group 2. Involvement in 9 patients in group 1 was on the right, in 6 patients on the left and in group 2 in 8 patients on the right and in 7 patients on the left hand-side.

In both groups Constant pain score, VAS score and face scale by the end of 2nd and 16th weeks were

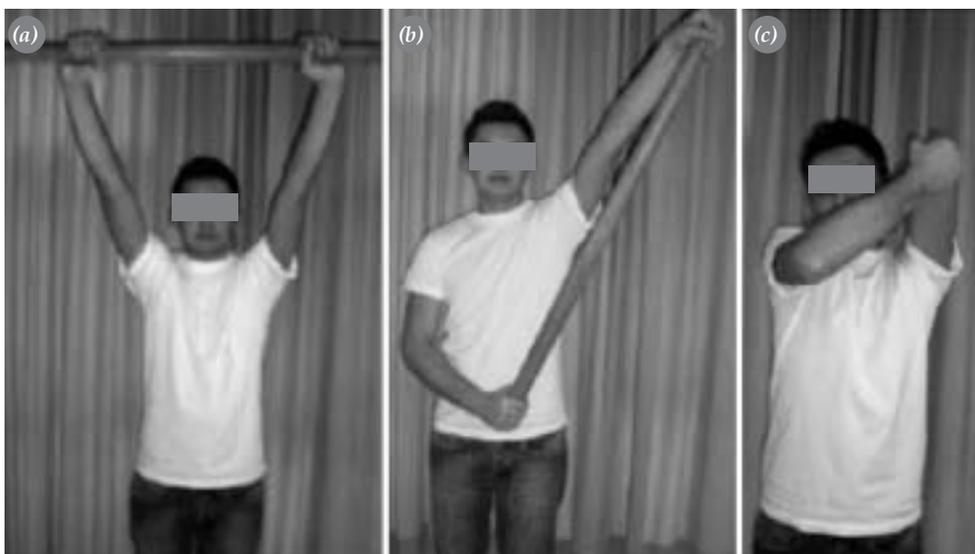


Figure 2. Shoulder (a) flexion (b) abduction and inferior capsule stretching exercises above 90° in the second group

Table 1. The results of treatment before, 2nd and 16th week in both groups

	Group 1			Group 2			p		p
	Ort.±SS	0-2 week	0-16 week	2-16 week	Ort.±SS	0-2 week	0-16 week	2-16 week	
Constant pain score									
0. week	4.7±3.5	0.003	0.001	0.007	3.0±2.5	0.002	0.001	0.003	0.181
2 nd week	9.0±3.8				7.0±3.1				0.107
16 th week	12.7±2.5				12.3±4.1				0.873
Visual analog scale									
0. week	5.4±1.9	0.001	0.000	0.000	5.7±2.2	0.010	0.001	0.003	0.50
2 nd week	2.9±1.7				4.1±1.6				0.03
16 th week	1.1±1.0				1.6±1.6				0.832
Face scale									
0. week	14.2±3.7	0.000	0.000	0.001	9.3±4.2	0.002	0.018	0.059	0.001
2 nd week	9.6±3.0				7.3±4.0				0.117
16 th week	4.0±2.9				4.3±5.1				0.010
Beck depression score									
0. week	9.5±5.2		0.003		13.6±8.0		0.019		0.128
16 th week	6.9±3.3				8.6±6.3				0.933
Patient satisfaction									
2 nd week	2.6±0.7			0.011	2.2±0.6			0.005	0.722
16 th week	3.3±0.4				3.1±0.1				0.847
Physical therapist satisfaction									
2 nd week	2.6±0.6			0.001	2.9±0.7			0.109	0.585
16 th week	3.7±0.4				3.4±0.1				0.391

found to show significant improvements (Table 1). The differences between 2nd and 16th weeks were not found significant in face scale in group 2. Via Beck depression scale by the end of 16th week in both of the 2 groups, significant improvements were obtained (Table 1). In patient satisfaction evaluation the difference between 2nd and 16th weeks were significant in both 2 groups. With physiotherapist's satisfaction on 2nd and 16th weeks only group 1 had significant improvement (Table 1). When the changes in the two groups were compared, Constant pain score on 2nd and 16th weeks between the 2 groups did not show significant difference (Table 1). Visual analog scale results was better in group 1 only on the 2nd week than that in group 2, but this difference disappeared on the 16th week. Face scale was found to be significantly better at the end of the 16th week in group 1. In Beck depression evaluation on the 16th week, in patient / physiotherapist satisfaction evaluation on the 2nd and 16th weeks there were no significant differences between groups.

Discussion

The purpose of our study was, with a different approach which did not take place in exercise programs for patients with impingement, to compare the exercise program where ROM was restricted in painful arc and the exercise program which took place on the painful arc. The difference between the exercise programs that took place in 2 groups was the degree of the exercise. Studies, where the effectiveness of exercise programs were investigated, based on muscle strengthening programs. [13] Kamkar et al. [14] indicate that rotator cuff muscles, especially strengthening of infraspinatus and teres minor muscles has a critical role in the treatment of impingement syndrome. Rotator cuff muscles stabilize the humeral head in the glenoid, preventing the superior head anterior translation and causing humerus to rotate outside while protecting the distance between large tubercle and acromion in anatomical position and preventing compression. In studies where rotator cuff muscles are strengthened separately [15] or together [2,4,16], the

effects of increasing muscle power on impingement syndrome are investigated. Ludewing et al.^[16] evaluated the home exercise program containing stretching and strengthening exercises' effects on shoulder pain and functions.

In studies, as home exercise program pectoralis minor, upper trapezius and posterior capsule stretching exercises, as strengthening program serratus anterior, exercises containing external rotators were performed; and also they showed that the pain was decreased and the functions were increased in exercise group compared to that of control group.^[16] McClure et al.^[17] gave exercises geared towards correction and working conditions in similar treatment program; and in addition to the exercise program, they concluded that patient education has positive impact on limitations. In another study where exercise activity was investigated, to the 2 groups that were separated into 2 as control and exercise groups, for 2 months straight twice a week, exercise program, in order to strengthening shoulder muscles, was given.^[15] From the pain that was evaluated using VAS after treatment, significant improvement in favor of the exercise group was obtained, and it was shown that strengthening the affected shoulder muscles via resistance training, was effective in reducing pain both during rest and activity. Also in this study, in the exercise group compared with the control group, function and quality of life have increased.^[15]

Roy et al.^[18], in the study where they investigated the effects of strengthening exercises reported, reduction in flexion and abduction painful arc, reduction in isometric peak tork and development in scapular kinematics especially in sagittal plan, reduction in pain and increase in functional level. It was shown that impingement syndrome is responsible for scapular movement disorders.^[19,20] The situation where scapular movement disorders surface and subacromial area narrows is the shoulder elevation above 90 degrees. Although we have not investigated the impairment of scapular movement, the range of motion under 90 degrees prevented possible scapular movement impairment thus the impingement is also prevented which may result from a decrease in the external rotation, posterior tilt or upper rotation of the scapula. In shoulder impingement syndrome electrotherapy methods were used alone or with exercise programs.^[21] Michener et al.^[7] U.S., in a study where they investigated

acupuncture, laser, joint mobilization and efficiency of exercise treatment, showed that in subacromial impingement symptoms exercise and joint mobilization are more effective compared to the electrotherapy methods. In our study, from the electrotherapy methods, we used TENS and US with both groups in addition to the exercise program.

The most important clinical parameter in evaluating the effectiveness of subacromial impingement syndrome is the reduction in pain. The reduction in pain affects a person's psychology in a positive way and at the same time plays a key role in determining the patient's and physiotherapist's satisfaction after the treatment. For this reason, mainly in our study, we included Beck depression score and patient / physiotherapist satisfaction assessments, besides evaluating pain. Skolimowski et al.^[22], in a study to determine the best physiotherapy approach on patients with SAIS, reducing the pain first and then fixing the shoulder joint stability, movement and scapulathoracic rhythm and at last aiming the ROM, was thought to be a right approach. In our study we tried to reveal the degree of improvement by assessing the change in pain via three different scales. The level of pain in everyday life was questioned in the study. In our study, while the exercise program that we performed in 2 groups had similarity with the literature, we did not come across a study that showed the exercises to be performed on or under the painful arc.

In addition, the number of exercises and their frequency given in literature show so differences and this continues to be an important issue that requires discussion. Our exercise program compared to the other programs in literature, required more repetitions and sessions; but this condition did not cause any further problems with our patients. In our study we did not evaluate how well our patients do the home exercises and to what extent they comply with them. Also, other activities that increase patients' shoulder pain were not questioned and they were not given daily living activity modifications to reduce pain. In subacromial impingement syndromes conservative treatment, 10 sessions for 2 weeks with TENS and intermittent US that were given to the 2 groups, in the group that is exercising below the painful arc, compared to the group exercising above painful arc, and obtaining early significant decrease in pain, can be explained by limitation of exercises below painful

arc. This result shows us that during the conservative treatment of SAIS while exercise is being planned, pain should be taken into consideration and exercise program must be planned in order not to increase pain.

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