ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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Comparison of the Effects of Mulligan Mobilization with Movement Method and Conventional Rehabilitation Protocol on Shoulder Pain and Functions in Subacromial Pain Syndrome: A Prospective Randomized Single Blind Trial

Subakromiyal Ağrı Sendromunda Mulligan Hareketle Mobilizasyon Yöntemi ve Konvansiyonel Rehabilitasyon Protokolünün Omuz Ağrı ve Fonksiyonları Üzerine Olan Etkilerinin Karşılaştırılması: Prospektif Randomize Tek Kör Çalışma

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ABSTRACT Objective: To determine and compare the periodic effects of conventional rehabilitation protocol (CRP) and Mulligan mobilization with movement (MWM) in subacromial pain syndrome (SAPS) patients. **Material and Methods:** This was a prospective randomized single-blind clinical trial. Fourty two patients with unilateral SAPS were randomized to two groups; CRP or MWM. Participants received CRP and MWM treatments for six weeks. Shoulder pain and function of the patients were evaluated with Shoulder Pain and Disability Index, Subacromial Interval Measurement, Goniometric Range of motion measurement and Visual Analogue Scale were assessed. Assessments at baseline, at the end of the first session, at the end of the second, fourth and sixth weeks were performed. **Results:** The two treatment groups showed significant improvements in pain and physical functions after six weeks ($p<0.01$). There was a significant improvement in active shoulder range of motions ($p<0.05$) and pain during activity ($p=0.004$) in the initial period compared to CRP in MWM and there were no differences in other periods between groups ($p>0.05$). **Conclusion:** MWM and CRP are effective in improving shoulder pain and functions in SAPS. Furthermore, while MWM is more effective in initial phase of rehabilitation than CRP, there is no difference between the two methods in other periods.

Keywords: : Shoulder pain; musculoskeletal manipulations; exercise; shoulder impingement syndrome

ÖZET Amaç: Subakromiyal ağrı sendromu (SAS) olan hastalarda Mulligan Hareketle Mobilizasyon Yöntemi (MHM) ve Konvansiyonel Rehabilitasyon Protokolü'nün (KRP) periyodik etkilerini belirlemek ve karşılaştırmaktı. **Gereç ve Yöntemler:** Çalışma prospektif randomize ve tek kör olarak yapıldı. Unilateral SAS tanısı alan 42 hasta KRP ve MWM gruplarına randomize edildi. Hastalara KRP ve MHM tedavi yöntemleri altı hafta boyunca uygulandı. Hastaların omuz ağrısı ve fonksiyonları; Omuz Ağrı ve Özürlülük İndeksi, Subakromiyal Aralık Ölçümü, Gonyometrik Eklem Hareket Açıklığı Ölçümü ve Görsel Analog Skala ile değerlendirildi. Değerlendirme; tedavi öncesinde, birinci seansın, ikinci, dördüncü ve altıncı haftanın sonunda yapıldı. **Bulgular:** Tedavi sonunda her iki grupta yer alan hastaların omuz ağrı ve fonksiyonlarında iyileşme görüldü ($p<0,05$). İlk seansın sonunda yapılan değerlendirmede, omuz eklem hareket açıklığında ($p<0,05$) ve aktivite ağrısında ($p=0,004$) MWM grubunda KRP grubuna göre anlamlı iyileşme olduğu görüldü. Yapılan diğer ölçümlerde ise gruplar arası anlamlı bir fark belirlenmedi ($p>0,05$). **Sonuç:** SAS hastalarında, MWM ve KRP omuz ağrısının ve fonksiyonlarının iyileştirilmesinde kullanılabilecek etkili yöntemlerdir. Bununla birlikte tedavinin ilk döneminde MWM, KRP' ye göre daha etkiliyken diğer periyotlarda iki yöntem arasında fark yoktur.

Anahtar Kelimeler: Omuz ağrısı; kas-iskelet manipülasyonları; egzersiz; omuz sıkışma sendromu

Pain in shoulder girdle is ranked fourth in terms of reporting to clinicians by patients.[1] Subacromial pain syndrome (SAPS) is a considerable cause of shoulder pain. SAPS is defined as a clinical syndrome that is nontraumatic, progressing usually unilaterally and characterized by localized pain around the

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acromion increasing with arm elevation. SAPS is an extended term that includes shoulder pain and dysfunction which was previously classified as subacromial impingement syndrome and bursitis, tendinosis calcarea, supraspinatus tendinopathy, partial tear of the rotator cuff, biceps tendinitis.[2,3] Disorders of scapular movement patterns and muscle activities have been detected in individuals diagnosed with SAPS.[4] These deficits cause to remain the acromion in low position in the anterolateral direction, so the subacromial interval decreases. This results in compression of the textures passing through the subacromial space during arm elevation.[5] Particularly, if the subacromial distance in the resting position of the arm is less than 6 mm, it is denominated as pathological.[6] Nonoperative methods are used in the treatment of SAPS. These are usually conventional therapies such as therapeutic exercises, joint mobilizations, massage, extracorporeal shock wave therapy, corticosteroid injections and oral NSAIDs.[2]

Conventional rehabilitation usually includes 'hands off' approaches that can be applied from the early period of treatment of SAPS.[2] Conventional rehabilitation aim to relieve pain, increase strength, promote healing, reverse abnormal muscle imbalances, and restore pain-free joint range of motion in SAPS.[2] Conventional rehabilitation protocols (CRP) are applied in SAPS rehabilitation usually based on passive methods in the initial and early periods and they are based on active techniques in the further periods.[2,7,8] According to Diercks et al., positive results are obtained at the end of treatment in SAPS with conventional rehabilitation.[2] However, it has been reported that the applications performed in the early period of conventional rehabilitation are insufficient in reducing pain and improving joint functions in various diseases.[8,9] Mulligan mobilization with movement (MWM) is a 'hands on' method based on analysis and correction of positional fault at a particular joint. According to Mulligan, positional fault occurs as a result of soft tissue problems or bone dysfunctions around the joint.[10] Positional fault in the joint causes pain, decrease in joint range of motion and muscle strength and results in joint dysfunction.[10,11] In order to achieve painless joint motion at MWM, a specific gliding is performed with belt or hands.[10] MWM is based on the patient's active movements and appropriate mobilization during all periods (early, mid-term and late) of treatment. Thanks to specific mobilization and active movements, positive results are obtained from the initial period of treatment with MWM.[12] There are some studies demonstrating that MWM is effective in various shoulder pathologies.[12-14] However, Gong et al. stated that MWM was insufficient for improving of shoulder abduction.[15]

Both CRP and MWM have aimed to improve static or dynamic dysfunctions in scapulothoracic and glenohumeral joints.[7,12] According to our knowledge there was no study in the literature that investigates and compares the periodic effect of these two techniques on SAPS. The purpose of the present study is to investigate and compare the effects of CRP (hands off approach) and MWM (hands on method) on shoulder pain and functions in acute, early, mid-term and at the end of the treatment of SAPS.

The following hypotheses were investigated: (i) Both CRP and MWM might improve shoulder pain and functions in SAPS patients. (ii) MWM would more effective than CRP in improving shoulder pain and functions in the initial period of treatment of SAPS.

MATERIAL AND METHODS

Study Design: A prospective randomized single blind study design.

This trial was conducted with the concealed randomization and blind assessment method. The study was approved by Cukurova University Faculty of Medicine Ethics Committee (No: 60/50, Date: 13.01.2017) and all procedures were conducted according to the Declaration of Helsinki. The study protocol was recorded in clinicaltrials.gov (NCT04057170).

RANDOMIZATION

Participants were randomly allocated to CRP and MWM groups using a computer-aided program by a researcher physiotherapist who did not participate in the evaluation and statistical analysis. Firstly, the number of participants to be included in the study was

entered into the computer program. Subsequently, the program set a random intervention for each number. Participants were numbered according to the order of participation in the study and included in the intervention groups corresponding to this number. The assessor physician was the blind member to the randomization and allocation.

PARTICIPANTS

Out of 127 patients diagnosed with SAPS in the clinic, 44 patients who met the inclusion and exclusion criteria were informed about the study and their written consents were obtained. One participant from the MWM group was withdrawn from the study at the end of the first week because of being unable to commute to hospital and two participants from CRP group were withdrawn from the study at the second week of intervention because of worsening of symptoms. Data were collected from 42 patients who completed the treatment program (Figure 1). The diagnosis criteria were having experienced pain on at least three of five (Hawkins-Kennedy test, Neer test, the painful arc test, the supraspinatus muscle strength test and external rotation resistance test) clinical tests.[2] Clinical tests were performed by a physician who has had eight years of experience and patients diagnosed with SAPS were included in the study. Inclusion criteria in the study were; to be diagnosed as SAPS by physician, to be in the 40-60 age range, to be cooperative during evaluation and treatment and to accept to participate in the study. Whereas exclusion criteria were; surgical indication or shoulder surgery, cervicothoracic problems (such as stenosis and disc herniation) diagnosed as neurological or inflammatory joint diseases. Furthermore, all patients who were diagnosed with SAPS and met the inclusion and exclusion criteria of the study were recorded by the researchers.

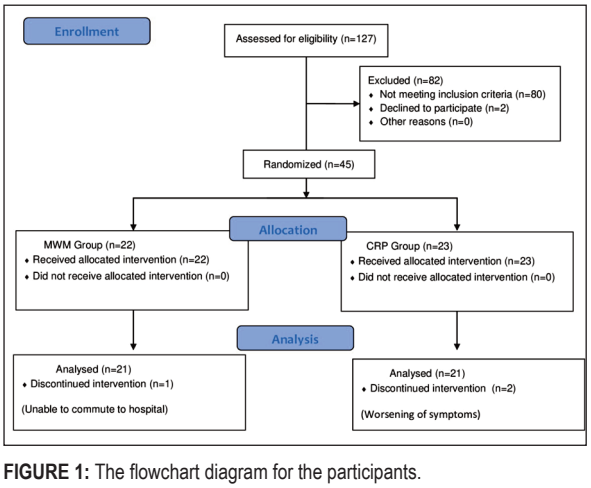

FIGURE 1: The flowchart diagram for the participants.

OUTCOME MEASURES

The participants included in the study were assessed by a researcher who was blind to the treatment groups; at baseline, at the end of the first session (to determine initial effect), at the end of the second (to determine early period effect), fourth and sixth weeks (to determine mid-term and last periods effects respectively) of intervention. Firstly, in the clinic, an assessment questionnaire including sociodemographic and symptomatic questions were applied to the patients. Subsequently, clinical data were obtained by using outcome scales. The primary outcome treatment effect measures were; Shoulder Pain and Disability Index (SPADI) and Visual Analogue Scale (VAS). Secondary effect treatment outcomes were; Active Range of Motion (AROM) and Subacromial Interval Measurement (SIM).

SPADI was used to assess the shoulder pain and functions. SPADI is a self-administered specific questionnaire which is designed to measure the pain and disability of the shoulder.[16] Turkish version is proven to have validity and reliability in shoulder pathologies (Cronbach's alpha: 0.83).[17] It consists of 13 questions in two sections as 5 pain questions and 8 disability questions. Both sections are scored with VAS. The total score range is between 0-130 and it is calculated with the percentage score. Pain and disability are inversely proportional with the percentage score.[18] VAS was used to record pain intensity during rest and active shoulder movements. VAS is a valid method that can be used to evaluate shoulder pain intensity at rest and during activity.[19] The patient was asked to mark the point corresponding to the pain (0 no pain and 10 maximal pain) on 10 cm horizontal line. The distance between the marked point and the beginning was recorded as a pain score.[20] Conventional goniometer with 1° increments was used to determine shoulder limitations due to pain in patients. The goniometric measurement that is used to measure the range of motion in shoulder problems has

high intraclass correlation (ICC) (ICC flexion: 0.95, abduction: 0.97, rotation: 0.96).[21,22] Active shoulder abduction and flexion were measured at sitting position, internal and external rotation measured at the supine position. The measurement of each movement was repeated twice with five-second intervals and the two measurements were averaged.[23] SIM was performed via anterior-posterior shoulder radiography. X-ray image was taken in standing position, arm attached to the body via shoulder extension, external rotation and palms facing ahead. The shortest distance between the cortical bone surface on the lower face of the acromion and the articular surface in the proximal of the humeral head was measured in millimeters.[24-26] Radiographic measurement was applied at baseline and at post-treatment.

INTERVENTIONS

The physiotherapy interventions for MWM and CRP groups were performed by a single physiotherapist who had 10 years of clinical experience in MWM method and the participants did not receive any treatment other than MWM and CRP. The treatment of both groups started on the day of the first evaluation of the patients. The physiotherapy interventions of the participants in both groups were applied in the same clinic. In this clinic, there are suitable treatment rooms and equipments to perform manual therapy and shoulder exercises. Prior to interventions, the participants were provided with verbal and written enlightenment about their treatment and they were asked to perform the home program. The home program follow-up of the participants in the CRP group was done by phone calling and inquiring in the clinic before routine assessments and the participants in the MWM group were inquired on the day of treatment. All patients in both groups stated that they applied the home program at the specified frequencies.

The protocol which include some techniques of conventional treatment of SAPS and that was designed by Düzgün et al., was applied to CRP group.[2,7] The intervention program is summarized in Table 1. The exercises of the participants in this group were taught in the exercise room at the clinic. Participants in the CRP group performed only two sessions in the clinic. The first session of the treatment was applied (to determine the initials effect of treatment) under the supervision of the physiotherapist. Additionally, scapular mobilization and manual posterior capsule stretching exercises were performed by the physiotherapist in the clinic. Patients were asked to perform all other applications every day at determined frequencies (frequency details are summarized in Table 1) at home. The intervention in MWM group was ap-

TABLE 1: Conventional rehabilitation protocol.[7]

Week	Application	Frequency
First week	Cryotherapy	4 times/day
	Posterior capsule stretching	1 time/hour
	Rest of the shoulder joint	
Second week	Continuation of the 1st week protocol	
	Scapular mobilization and manual posterior capsule stretching	1 time/ week, at clinic
	Scapular retraction with elbow flexion	4 times/day, 10
	Scapular retraction with elbow extension	4 times/day, 10
	Scapular retraction on the wall	4 times/day, 10
Third week	Continuation of the 2nd week protocol	
	Shoulder muscle strengthening with 0.5-kg weight	
	Flexion	4 times/day, 10
	Abduction	4 times/day, 10
	Arm elevation at scapular plane (full-can)	4 times/day, 10
Fourth-sixth weeks	Continuation of the third week protocol	
	Arm flexion, abduction, and full-can (increased weight)	4 times/day, 10
	External and internal rotation at 0°, arm abduction with Thera-band®	4 times/day, 10

plied to the participants by the physiotherapist in the manual therapy rooms at the clinic for six weeks and three days a week. The physiotherapist applied belt assisted gliding during the shoulder flexion in the sitting position of the participant. The belt was wrapped around the hips of the standing physiotherapist and around the effected shoulder in the posteriolateral direction of the patient. The physiotherapist supported the belt with one hand and asked the patient to perform shoulder flexion until the last range and he applied posterior gliding up to 90 degrees with adding inferior glide after 90 degrees. Thus, posterior-lateral-inferior gliding was performed to humeral head at shoulder flexion.[10] Participant did not feel pain at any stage of MWM practice. Three sets of 10 repetitions were applied with a rest interval of 30 s between each set.[12] Furthermore, the participant was given a home program including 'self-gliding'. In self gliding practice, patient extended its arm against the wall at 90 degrees shoulder flexion in one leg ahead standing position. While the patient was moving her/his body forward, s/he slid its hand upwards (in the flexion direction) across the range of motion of shoulder without pain.[10] The participant performed the home program; every day of the week, four sessions a day and each session with 3 sets and 10 repetitions (with 30 seconds rest between each set. The patients were asked to apply the home program from the first day of treatment.

SAMPLE SIZE CALCULATION

Sample size was determined by using G Power® (Heinreich Heine Universitat Dusseldorf, Dusseldorf Germany) program. To determine the sample size, the study conducted by Granviken et al. was used. At least a sample size of 30 was required to detect in a mean difference of 17 (for 5% type I error and 90% power with d=0.81 effect size) in SPADI (primary outcome).[27]

DATA ANALYSIS

The Statistical Package for Social Sciences (version 22.0; SPSS, Chicago, IL) software was used for statistical analysis. Shapiro-Wilk test revealed that data was normally distributed (p>0.05). Descriptive statistics were calculated for all variables, and normally distributed data are shown as mean±standard deviation (sd). Gender differences were compared using the chi-square test. Comparative analysis between groups was performed by using *t* test and p<0.05 was considered statistically significant. Within the groups, the change of evaluation criteria according to time was assessed by using Paired Samples *t* test for SIM and Repeated Measures ANOVA test for SPADI, AROM and VAS. Mauchly's test was used to test the assumption of sphericity for Repeated Measures ANOVA and (p>0.05) was accepted as the assumption of sphericity is provided (VAS, SIM). In the data (AROM, SPADI) where the assumption of sphericity was not provided (p<0.05), the value of Greenhouse and Geisser corrections were preferred. Bonferroni correction was applied as post-hoc multiple comparison test and p<0.01 were considered statistically significant.

TABLE 2: Baseline characteristics of the study groups.

Characteristics	MWM n=21	CRP n=21	p value
Age, years, mean±SD	50.3±7.6	48.3±7.7	0.301
BMI ($kg*m^{-2}$)	29.2±5.1	27.4±3.9	0.323
Sex, n (%)			0.750
Female	14 (66.7)	13 (61.9)	
Male	7 (33.3	8 (38.1)	
Affected shoulder, n (%)			0.650
Right	12 (57.1)	12 (57.1)	
Left	9 (42.9)	9 (42.9)	
Symptom duration, month, mean±SD	3.1±1.7	2.2±1.4	0.060

MWM: Mulligan movement with mobilization; CRP: Conventional rehabilitation protocol; BMI: Body mass index; SD: Standard deviation.

RESULTS

Data from 42 patients were analyzed. There was no significant difference at baseline in demographic characteristics between groups (p>0.05). Demographic details are summarized in Table 2.

There was no significant difference in SPADI scores between the groups at baseline (p=0.320). SPADI scores improved significantly in both groups at the end of the treatment (p<0.01). Furthermore, there was no significant difference between the groups at the end of the second, fourth and sixth

TABLE 3: In-group and inter-group comparisons of SPADI, VAS at rest and during activity and SIM.

	MWM Mean±SD	CRP Mean±SD	p[1] value
SPADI (%)			
Baseline	60.01±16.12	55.47±12.14	0.320
Second week	39.19±14.93	34.55±13.15	0.304
Fourth week	27.28±15.61	21.08±15.94	0.116
Sixth week	22.61±16.52	16.66±15.25	0.155
p[2] value	**0.001**	**0.003**	
VAS			
Pain at rest			
Baseline	2.76±2.52	2.52±2.04	0.765
First session	1.81±2.35	2.33±2.10	0.057
Second week	1.10±1.44	1.29±1.58	0.754
Fourth week	0.71±1.45	0.71±1.27	0.928
Sixth week	0.76±1.48	0.67±1.19	0.959
p[2] value	**0.001**	**0.001**	
Pain during activity			
Baseline	7.95±2.13	7.00±1.73	0.765
First session	5.71±2.28	6.57±1.69	0.004
Second week	4.52±1.59	4.62±1.96	0.028
Fourth week	3.43±2.13	3.00±1.92	0.661
Sixth week	2.81±1.94	2.62±2.08	0.248
p[2] value	**0.004**	**0.003**	
SIM (mm)			
Before treatment	6.48±2.07	6.78±1.63	0.606
Sixth week	7.41±1.99	7.83±2.03	0.511
p[2] value	**0.004**	**0.001**	

[1]: Inter-group comparison; [2]: In-group comparison; SD: Standard deviation; SPADI: Shoulder pain and disability index; VAS: visual analogue scale; MWM: Mulligan movement with mobilization; CRP: Conventional rehabilitation protocol; SIM: Subacromial interval measurement.

weeks (p>0.05). SPADI scores are summarized in Table 3.

There was no significant difference in VAS scores at rest and during activity between groups at baseline (p=0.765). In both groups, VAS scores at rest and during activity improved significantly after treatments (p<0.01). There was no difference in reducing pain score at rest in any period between the groups (p>0.05). Furthermore, in the assessment of pain during activity, at the end of the first session (p<0.01) and second week (p=0.028) MWM was found to be more effective than CRP. At the end of the fourth and sixth weeks, there was no difference in pain during activity between the groups (p>0.05). VAS scores during activity and at rest are summarized in Table 3.

There was no difference in AROM values between groups at baseline (p>0.05). In both groups, active AROM increased significantly in flexion, abduction, internal and external rotation after interventions (p<0.01). There was a significant increase in flexion, abduction and internal rotation in the MWM group compared to the CRP group at the end of the first session (p<0.05). At the end of the second, fourth and sixth weeks, there was no significant difference

TABLE 4: In-group and inter-group comparisons of goniometric AROM measurements.

AROM (°)	MWM Mean±SD	CRP Mean±SD	p[1] value
Flexion			
Baseline	134.05±25.47	139.05±19.72	0.561
First session	148.57±16.85	142.38±16.85	**0.002**
Second week	160.95±14.71	156.43±14.15	0.076
Fourth week	164.52±13.68	163.10±12.69	0.211
Sixth week	163.33±13.81	166.19±10.82	0.747
p[2] value	**0.008**	**0.006**	
Abduction			
Baseline	127.63±26.68	135.79±8.20	0.279
First session	144.74±22.51	138.42±17.56	**0.001**
Second week	156.32±21.07	153.42±15.40	0.059
Fourth week	162.89±13.87	162.11±14.46	0.108
Sixth week	162.11±14.17	164.47±13.73	0.226
p[2] value	**0.003**	**0.005**	
External rotation			
Baseline	67.14±26.20	77.38±15.38	0.296
First session	72.62±22.83	77.62±14.96	**0.051**
Second week	80.95±17.93	79.52±16.87	0.218
Fourth week	82.14±15.04	83.57±13.34	0.238
Sixth week	80.95±16.92	85.00±11.18	0.519
p[2] value	**0.003**	**0.003**	
İnternal rotation			
Baseline	47.86±31.08	51.43±21.22	0.714
First session	66.90±21.22	55.95±21.77	**0.008**
Second week	75.24±21.99	66.43±18.17	0.106
Fourth week	77.29±17.41	71.90±21.00	0.300
Sixth week	77.62±30.59	74.05±20.77	0.752
p[2] value	**0.001**	**0.001**	

[1]: Inter-group comparison; [2]: In-group comparison; SD: Standard deviation; (°): Degree; AROM: Active range of motion; MWM: Mulligan movement with mobilization; CRP: Conventional rehabilitation protocol.

between the groups (p>0.05). Goniometric AROM measurements are summarized in Table 4.

Subacromial interval was similar between the groups at baseline (p>0.05). Both methods were found to be effective in increasing the subacromial interval (p<0.01). The assessment at the end of the sixth week demonstrated that there was no significant difference between the two methods in improving of subacromial interval (p>0.05). SIM values are summarized in Table 3.

DISCUSSION

This study which compared the effects of two treatment strategies -MWM and CRP- demonstrated that: (i) Both methods were effective in reducing pain, improving active shoulder ROMs and functions at the end of the treatment in patients with SAPS. The improvement in the effected shoulder of the patients was both statistically and clinically significant. (ii) There was a significant improvement in shoulder pain and AROM in the initial phase of the treatment compared to CRP in MWM. (iii) There was no difference between treatment methods in reducing pain and improving shoulder functions in mid-term and late periods of treatment.

Posterior capsule tightness and an excessive imbalance of shoulder girdle muscles give rise to anterior-superior migration of the humerus head and decrease in the subacromial interval.[28] Hotta et al., stated that shoulder posterior capsule stretching reduce shoulder pain and improve functions in patients with SAPS.[28] Akkaya et al. reported that subacromial interval increase by dynamic exercises. Researchers attributed the improvement to exercises that mend shoulder kinematics.[29] In the current study CRP improved pain and increased subacromial interval by restoring shoulder arthrokinematic.[5-7] Participants in CRP group have started active movements by scapular exercises at the second week. Scapular exercises provide the restoration of scapulothoracic joint movements and scapular stabilization.[7] Along with active scapular exercises, significant improvement occurs in shoulder pain and functions of the participants in this group. Strengthening exercises of rotator cuff and shoulder girdle muscles in the third and fourth weeks of CRP contribute to shoulder stabilization.[30] By the application of strengthening exercises, improvement in shoulder pain and function becomes progressive. In addition, subacromial interval increases by restoration of scapulothoracic joint movements and by providing shoulder stabilization.[5] We consider that the pain intensity decreased and subacromial interval increased in the MWM group by improvement of glenohumeral kinematics and by the gliding applied to the humerus head especially in the inferior direction.[13] There is no other trial revealing that the subacromial interval has increased by MWM in literature. MWM provides hypoalgesia and normal glenohumeral arthrokinematics by mobilization applied to humerus head in the posterior-inferior direction with active movement.[10] The reduction of pain from the initial phase of intervention is explained by the induction of the mechanism of non-opioid pain inhibition. It's hypothesized that mechanical stimulus, which occurred by MWM, triggers mechanisms of pain inhibition in the central nervous system.[11] Furthermore, pain may be reduced by appropriate mobilization which decreases the sensitivity of nociceptors in the joint capsule.[31] There should be a reduction of at least 18 points in SPADI and 1.4 cm in the VAS for the acceptance of clinical recovery.[32] Considering these values, it is seen that both parameters improved clinically in both groups.

Participants in the MWM group received a fixed program including mobilization with active movements from the first session to the end of the intervention. The participants shoulder pain decreased, and AROMs were observed to increase from the initial phase of the intervention. Positive results were obtained from the initial phase of SAPS rehabilitation due to the active movements included in MWM.[31-33] Active exercises were not applied to the patients in the CRP group during the first period of treatment. CRP group received cryotherapy, rest and stretching exercises in this period. However, cryotherapy and static stretching of posterior capsule applied during the first session of CRP have not improved the initial pain and AROMs of shoulder. The acute efficiency of static posterior capsule stretching and cryotherapy are limited.[8,9] No improvement observed in the CRP group in the initial phase of inter-

vention can be explained by the absence of safe active movements.[31]

Comparison of the effectiveness of supervised physiotherapy and home based exercises in rehabilitation within the scope of socioeconomic costs and physical benefit balance were attracted the attention of the researchers.[34] Granviken et al., reported that home exercises and supervised exercises are similarly effective for people with subacromial impingement.[27] It is thought that it would be more advantageous to manage subacromial impingement with home based exercises in order not to affect badly the socioeconomic status of individuals. However, Şenbursa et al. stated that supervised methods (manual therapy techniques) are superior to home based exercises and it would be more appropriate to manage supraspinatus tendinopathy in the clinic.[35] In our study, MWM group 18 days and CRP group only 5 days (for scapular mobilization and assessments) went to the clinic. Considering the home program of the patients in the MWM group, exercise volumes were similar in both groups. It can be stated that, patients in the CRP group are socioeconomically less negatively affected than those in the MWM group since there were similar physical benefits in both groups at the end of the treatment.

It should be noted that compliance with treatment and independence in daily living activities can be increased by using appropriate treatment modalities from the initial period.[36] It was observed that the compliance of the patients in the MWM group to treatment program was better than the patients in the CRP group. This situation might occur due to positive results obtained from the initial period of MWM program.

LIMITATIONS

There were some limitations of this study. The first limitation was that the long-term follow-up of patients could not be performed. Long-term patient follow-up is necessary to determine whether the effects of treatment programs are sustained.[37] Secondly, SIM was performed on shoulder radiographs. SIM, which is performed by using this method, may give more contradictory results than other radiological (USG or MRI) methods.[6,25] A long-term follow up and controlled trial is recommended to improve the validity of these results.

CONCLUSION

The results of this study indicate that, MWM and CRP are effective in improving shoulder pain and functions in SAPS. Furthermore, while MWM is more effective in initial phase of rehabilitation than CRP, there is no difference between the two methods in other periods. More effective results can be obtained in treatment of SAPS by adding MWM to rehabilitation programs especially in the early period.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

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