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Research Article / Araştırma Makalesi

Outcomes with Additional Mirror Therapy to Rehabilitation Protocol in Patients with Shoulder Impingement Syndrome: A Prospective Randomized Controlled Study

Omuz İmpingment Sendromlu Hastalarda Rehabilitasyon Protokolüne Eklenen Ayna Terapisi ile İlgili Sonuçlar: Prospektif Randomize Kontrollü Çalışma

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Abstract

Mirror therapy is a method that increases the functionality of the affected extremity and is effective in the treatment of chronic pain. In this study, we aimed to investigate the effect of mirror therapy on shoulder impingement syndrome. The study included 62 participants, including 31 in the intervention group (IG) and 31 in the control group (CG) who met the inclusion criteria. IG received mirror therapy with conventional physiotherapy while CG received only conventional physiotherapy. The patients were evaluated before treatment and immediately after treatment with Visual Analog Scale (VAS) score for pain, goniometric measurement for shoulder range of motion, modified Constant-Murley score for functionality, and Tampa Kinesiophobia Scale (TSK) for kinesiophobia. After treatment, the change in the VAS score was 5.51 ± 1.89 for IG, 2.80 ± 2.61 for CG, and the significance was p<0.01. The change in the TSK score was 10.83 ± 9.53 for IG and 1.66 ± 4.85 for CG (p<0.01). The change in the total Constant-Murley score was 23.77 ± 11.41 for IG and 9.60 ± 9.70 for CG, and the significance was calculated as p<0.01. This study showed that the addition of mirror therapy to conventional treatment can improve pain severity, functionality, and levels of kinesiophobia in patients with unilateral shoulder impingement syndrome. The decrease in fear of movement along with pain in impingement syndrome has shown that mirror theraphy can be used in the treatment of different diseases for which it has not been used before.
Keywords:Should impingement syndrome; Mirrortherapy; Pain; Kinesiophobia

Özet

Ayna tedavisi, etkilenen ekstremitenin fonksiyonelliğini artıran ve kronik ağrıların tedavisinde etkili olan bir yöntemdir. Bu çalışmada ayna tedavisinin omuz impingment sendromu üzerine etkisini araştırmayı amaçladık. Çalışma grubunda 31, kontrol grubunda 31 olmak üzere dahil edilme kriterlerine uygun 62 hasta çalışmaya dahil edildi. Çalışma grubu geleneksel fizyoterapi ve ayna tedavisi alırken, kontrol grubu yalnızca geleneksel fizyoterapi aldı. Hastalar tedaviden önce ve tedaviden hemen sonra ağrı için Vizuel Analog Skala (VAS) skoru, omuz eklem hareket açıklığı için goniometrik ölçüm, fonksiyonellik için modifiye Constant-Murley skorlaması ve kinezyofobi için Tampa Kinezyofobi Skalası (TSK) ile değerlendirildi. Tedavi sonrası VAS skorundaki değişiklik çalışma grubu için 5.51 ± 1.89, kontrol grubu için 2.80 ± 2.61 ve anlamlılık p<0.01 idi. TSK skorundaki değişim çalışma grubu için 10.83 ± 9.53 ve kontrol grubu için 1.66 ± 4.85 idi (p<0.01). Toplam Constant-Murley skorundaki değişim çalışma grubu için 23.77 ± 11.41 ve kontrol grubu için 9.60 ± 9.70 idi ve anlamlılık p<0.01 olarak hesaplandı. Bu çalışma, tek taraflı omuz impingment sendromu olan hastalarda geleneksel tedaviye ayna tedavisinin eklenmesinin ağrı şiddetini, fonksiyonelliğini ve kinezyofobi düzeylerini iyileştirebileceğini göstermiştir. İmpingment sendromunda ağrı ile birlikte hareket korkusunun azalması ayna terapinin daha önce uygulanmadığı farklı hastalıkların tedavisinde de kullanılabileceğini göstermiştir.
Anahtar Kelimeler: Omuz impingment sendromu; Ayna tedavisi; Ağrı; Kinezyofobi

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1. Introduction

Subacromial impingement syndrome is the most common disorder of the shoulder, resulting in functional loss and disability (1,2). It represents a spectrum of pathology ranging from subacromial bursitis to rotator cuff tendinopathy and full-thickness rotator cuff tears (3). The main purpose of shoulder impingement treatment is to reduce pain and improve shoulder function. The most common conservative treatment methods are corticosteroid injections, nonsteroidal anti-inflammatory drugs, and physiotherapy (4,5).

Mirror therapy is an easy-to-apply, inexpensive and most importantly patient-centered treatment method used to improve upper extremity function (6). It creates a normal perception of the painful and restricted area by making use of the healthy side movements with the help of a mirror. It is a method that creates a visual illusion by placing the movements of the patient's healthy extremity parallel to the patient's midline so that the affected extremity is not visible, and observing in the mirror.The mechanism of action;activation of mirror neurons and enhanced self-awareness and spatial attention through observation of movements performed and mental practice of motor tasks. It increases functionality in the affected extremity and is effective in the treatment of chronic pain. This method is especially useful in the treatment of phantom pain, peripheral nerve injuries after rehabilitation of sensory and motor losses, stroke, complex regional pain syndrome and upper limb amputation. With mirror therapy, it is aimed to increase the range of motion of the affected extremity and reduce learned pain and immobilization by creating a visual illusion on the affected side by seeing a healthy extremity (7).

There are limited studies in the literature on the efficacy of mirror therapy as adjuvant therapy. However, to the best of our knowledge, there is no study found in the literature investigating the functional effectiveness of mirror therapy in impingement syndrome, which is the most common cause of chronic shoulder pain. There fore, in the current study, our aim was to investigate the efficacy of mirror therapy added to conventional physiotherapy in performance and functional independence in patients with shoulder impingement syndrome.

2. Materials and Methods

This was a prospective, single-blinded, randomized controlled trial. The study was conducted between January 2022-March 2022 and approval was received from the ethics committee of the university (date/number: September 15, 2021/2021-05/04). The methods used in this study were reported using the CONSORT statement.

2.1 Study Design

2.2 Participants

2.2.1 Recruitment and setting

Patients with shoulder impingement syndrome who visited the inpatient clinic of the Physical Medicine and Rehabilitation Department of the hospital during the study period were screened for eligibility by an independent physician and they were invited to participate in the study if found eligible. The diagnosis of shoulder impingment syndrome was determined by physical examination and clinical findings in patients presenting with shoulder pain. All the participants were informed in advance about the procedures and assessments to be performed in the study, and those who agreed to participate and signed the consent form were included in the sample.

2.2.2 Inclusion criteria

• Being aged 18-75 years

• Being diagnosed with shoulder impingement syndrome

• Having unilateral shoulder pain for at least six months

2.2.3 Exclusion criteria

• Being non-cooperative

• Having an additional systemic disease

• Having uncontrolled hypertension

• Presence of heart failure

• Having hearing or vision problems

• Having a balance disorder

•Diagnosis of heart or lung disease so advanced that exercise is contraindicate

• Having neuromusculardisorders

• Having psychiatricdisease

•History of shoulder surgery

•Having any pathology that may cause referred pain (e.g., cervical radiculopathy)

•Shoulder trauma or previous humeral fracture history

• Steroid injection into the shoulder joint or subacromial bursa within the last six months

2.3 Study procedures

After the randomization of the patients into two groups, intervention (IG) and control (CG), the initial evaluation of the participants was carried out by a blinded researcher, and then they underwent four weeks of treatment carried out by a different researcher. The participants were re-evaluated by the same blinded researcher at the end of the fourth week. The patients in IG received mirror therapy in addition to conventional physiotherapy while those in CG received only conventional physiotherapy (see the flow diagram in Figure 1).

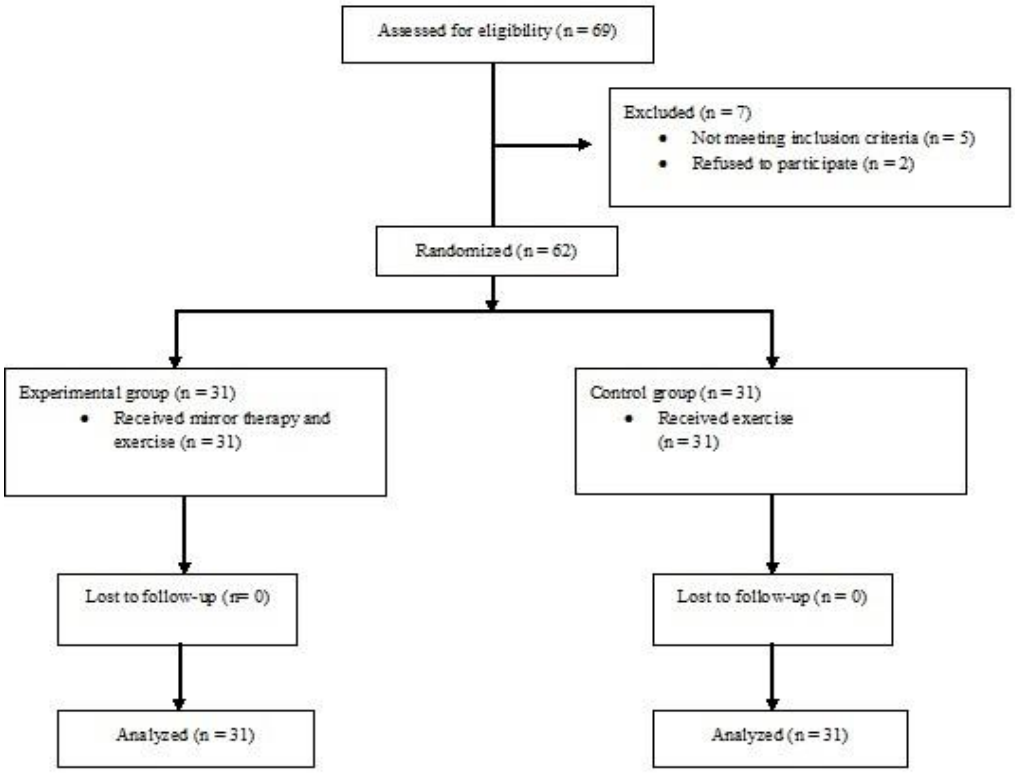

Figure 1. CONSORT flowdiagram of thestudy

2.4 Interventions

CG received only standard conventional physiotherapy. All the patients in this group underwent a total of 28 sessions of conventional physiotherapy (30 minutes per session, seven sessions per week for four weeks). IG received both conventional physiotherapy and mirror therapy. Similarly, mirror treatment was applied for four weeks, 20 minutes per session and seven sessions per week.

2.4.1 Mirror therapy

The patients in IG received an exercise program before mirror therapy. They continued to do the exercises in front of the mirror for the remaining 20 minutes of the session. In order to see the reflection of the healthy side of the patient, a 190 x 75 cm mirror was placed on the parasagittal line. The non-affected shoulder was positioned in a similar position as the affected shoulder since this facilitated the intensity of the mirror illusion. The patient looked at the reflection of his/her intact extremity in the mirror. The exercises were performed with 10 repetitions on both the intact and affected shoulders. The exercises were explained to the patients by giving voice commands. In the 20-minute session, the patient performed active flexion, abduction, and internal and external rotation movements of both shoulders in front of the mirror. While performing the exercise with the healthy side in front of the mirror, the patient tried to do the same movement with the shoulder diagnosed with impingement syndrome on the other side of the mirror. Seeing the reflection in the mirror helped the patient perform each exercise accurately.

2.4.2 Conventional physiotherapy

The conventional physiotherapy program included wand exercises for shoulder abduction, flexion, hyperextension and internal and external rotation, Codman exercises, isometric and resistive exercises of the shoulder girdle. The exercise program was performed under the supervision of an experienced physiotherapist. Codman, isometric, capsule stretching and postural control exercises were performed in the first week while wand, active-assisted isotonic and scapular muscle strengthening exercises were added to the treatment in the second week. In the third and fourth weeks, strengthening exercises with resistant elastic bands, anteroposterior capsule stretching exercises, and strengthening exercises for the shoulder and surrounding muscles were applied.

2.5 Outcome measurements

Data regarding the participants' age, gender, height, body weight, body mass index (BMI), duration of symptoms, affected side, and education level were recorded. All the assessments were repeated before treatment and four weeks after treatment (follow-up) by the same physician, who was blinded to the interventions. The Visual Analog Scale (VAS) score for shoulder pain was the primary outcome measure, and clinical examination with measurements of shoulder range of motion, the modified Constant-Murley shoulder assessment, and the Tampa Scale of Kinesiophobia were the secondary outcome measures.

2.5.1 Assessment of Pain

VAS, a scale consisting of a single line of 10 cm, was used to evaluate the pain severity. The patients were asked to mark the severity of their pain at rest and during the activity on two separate 10 cm lines. The starting point on the scale indicates no pain while the endpoint represents the most severe pain ever experienced. During the calculation, the distance between the marked point and the starting point was measured in cm. A higher score means a greater severity of pain (8).

2.5.2 Assessment of Shoulder

In the shoulder examination, measurements of shoulder range of motion were performed with a goniometer (shoulder active flexion, extension,internal-external rotation, abduction angles).

2.5.3 Assessment of Functionality

The modified Constant-Murley Score (CMS) was used to evaluate the functional level of

the patients' shoulder joint. In this scoring, shoulder joint pain, activities of daily living (ADL), range of motion, and strength parameters are evaluated. The total CMS was classified as excellent (90-100), good (80-89), moderate (70-79), and poor (<70). A higher score corresponds to a higher quality of function. Subjective findings of the participants (severity of pain, ADL, working in different positions) constitute 35 points, while objective measurements constitute 65 points. A setup was prepared using a simple hand scale for the power parameter evaluation, which is a subtest in CMS. The lower end of the hand scale was fixed to the ground with a length-adjustable band, and a band system was placed on the upper end that could be attached to the forearm. The measurement was performed with the patient in a standing upright position and with the upper extremity at 90° elevation, elbow in extension, and forearm in pronation. After the patient was positioned, the band at the upper end of the hand scale was placed on his/her forearm over the wrist, and the lower end was fixed onto the floor by the person who measured the patient's shoulder in such a way as to maintain the 90° elevation position, and the patient was asked to try to lift his/her arm up for 5 seconds. The mean score was recorded following one trial and three repetitions. The score was recorded as 0 if the patient had pain during the measurement and was unable to maintain the 90° elevation position (9,10).

2.5.4 Assessment of Kinesiophobia

The Tampa Scale of Kinesiophobia (TSK) was used to evaluate kinesiophobia. TSK is a 17-item scale developed to measure the fear of movement/re-injury. The validity and reliability studies of the Turkish version of the TSK were carried out by Yılmaz et al (11). The scale includes parameters of injury/re-injury and fear-avoidance in work-related activities. A four-point Likert scoring (1 = I strongly disagree, 4 = I strongly agree) is used in the scale. The total score varies between 17 and 68. A high score on the scale indicates a high level of kinesiophobia.

2.6 Sample Size

G × Power software v. 3.0.10 (Franz Faul, Kiel University, Germany) was used to determine the necessary sample size. The primary outcome measure was the VAS score. Based on a previous study, (12) using this effect size, 62 participants were required to show statistically significant differences at 80% power and with an α level of .05.

2.7 Randomization

Randomization was carried out by a different researcher (F.Y.), who was not involved in the application of interventions or evaluation of outcomes. Patients to be assigned to IG or CG were selected by simple randomization with a 1:1 allocation ratio according to a list generated by an online randomizer. Opaque and sealed envelopes were used to conceal the allocation before the intervention.

2.8 Blinding

The principal investigator was blinded to the group allocation during assessment and was not involved in the participants' treatment sessions or data analysis process. The participants were asked not to mention their groups to the researcher that performed the assessment.

2.9 Statistical analysis

SPSS v. 25 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.) Software package was used to analyze the data. In the study, descriptive statistics (mean, standard deviation, median, first quartile, third quartile, number, and percentage values) were presented for categorical and continuous variables. Normality assumption was checked with the Shapiro-Wilk test. Paired-samples t-test and Wilcoxon test were used to compare the pain and proprioception parameters between the pre-treatment and post-treatment measurements. Independent-samples t-test and Mann-Whitney U test were utilized to test the differences between the groups. The effect size was calculated using the equation proposed for Cohen's d (Lenhard and Lenhard

2016). $p<0.05$ was accepted as statistically significant.

3. Results

This study was completed with a total of 62 participants, including 31 patients in IG (mean age, 55.48 ± 8.74 years) and 31 in CG (mean age, 55.00 ± 11.24 years). Table 1 presents the age, gender, height, body weight, BMI, employment status, dominant extremity and painful extremity of the individuals participating in the study. In the comparison of the demographic data of the patients included in the study, no statistically significant difference was found in terms of height, body weight, BMI, employment status, dominant extremity, and painful extremity (Table 1). There was also no significant difference between the two groups in terms of symptom duration (7.22 ± 8.76 for IG and 7.16 ± 8.80 for CG, $p = 0.965$).

Primary Outcomes

There was no significant difference between the two groups in terms of the VAS scores before treatment (7.54 ± 1.76 for IG and 7.50 ± 1.59 for CG, $p = 0.907$) (Table 2). Therewas a significant improvement in the VAS scoreboth in themirror groupand in the exercise group after the treatment (2.03 ±1.11 and 4.70 ± 2.33, $p< 0.01$, Cohen's d:3.62) (Table 3). After treatment, the change in the VAS score was 5.51 ± 1.89 for IG and 2.80 ± 2.61 for CG, and the significance was $p < 0.01$ (Table 4).

Secondary Outcomes

There was no significant difference ($p > 0.05$) between IG and CG in regards to the shoulder range of motion before treatment (Table 2). There was a significant improvement in the flexion, extension, abduction, external rotation angles both in themirror ($p<0.01$, $p=0.011$,$p<0.01$,$p<0.01$; Cohen's d: 2.55, 1.02, 2.67, 1.89) and in the exercise group after the treatment($p<0.01$, $p=0.007$,$p<0.01$,$p<0.01$; Cohen's d: 1.77, 1.13, 2.53, 1.98) (Table 3). There was a significan timprovement in the internal rotation angle in the mirror group ($p=0.023$; Cohen's d: 0.89) (Table 3). While the angle of increase in flexion movement was 30.32 ± 31.96 for IG, it was 10.83 ± 13.13 for CG, which was significantly higher ($p = 0.006$). The angle of increase in abduction movement was 42.41 ± 34.71 for IG and 21.33 ± 20.75 for CG, which was significantly higher ($p = 0.029$) (Table 4).

There was no significant difference between IG and CG in terms of the TSK scores before treatment (43.74 ± 6.85 and 42.86 ± 6.32, respectively; $p = 0.492$) (Table 2).There was a significant improvement in the TSK in the mirror group after the treatment ($p < 0.01$, Cohen's d: 2.85) (Table 3). The change in the TSK score was 10.83 ± 9.53 for IG and 1.66 ± 4.85 for CG, indicating that IG had significantly greater improvement ($p < 0.01$) than CG (Table 4). No significant difference was observed between IG and CG in regards to the total CMS before treatment (40.38 ± 14.64 and 43.93 ± 14.04, respectively; $p = 0.184$) (Table 2).There was a significant improvement in the CMS Total and CMS Objective in mirror group ($p < 0.01$, $p < 0.01$; Cohen's d: 3.58, 3.36) and exercise group after the treatment ($p < 0.01$, $p < 0.01$; Cohen's d: 2.39, 3.41) (Table 3). The change in the total CMS was 23.77 ± 11.41 for IG and 9.60 ± 9.70 for CG, and the significance was calculated as $p < 0.01$ (Table 4).

Table 1. Demographic characteristics of the groups

		Intervention Group (n = 31) (Mean ± SD) (Min-Max)	*Control Group (n = 31) (Mean ± SD)* (Min-Max)	p
Age (years)		55.48 ± 8.74 (35-75)	55.00 ± 11.24 (28-73)	0.129
Height (cm)		162.42 ± 8.86 (150-183)	160.43 ± 6.11 (150-171)	0.061
Weight (kg)		76.51 ± 9.79 (60-95)	70.46 ± 10.72 (47-94)	0.991
BMI (kg/m^2)		29.19 ± 4.75 (23.03-38.95)	27.59 ± 5.01 (19.31-40.62)	0.435
Symptom duration (months)		7.77 ± 8.40 (3-48)	7.63 ± 8.52 (3-48)	0.996
		n (%)	n (%)	
Gender	**Female**	19 (61.3)	25 (83.3)	0.052
	Male	12 (38.7)	5 (16.7)	
Education	**Primary school**	17 (54.8)	23 (76.7)	0.088
	High school	10 (32.3)	2 (6.7)	
	University	3 (9.7)	3 (10.0)	
	Illiterate	1 (3.2)	2 (6.7)	
Dominant side	**Right**	29 (93.5)	27 (90)	0.613
	Left	2 (6.5)	3 (10)	
Painful side	**Right**	15 (48.4)	15 (50)	0.090
	Left	16 (51.6)	15 (50)	

SD: standard deviation, cm: centimeter; kg: kilogram; BMI: Body mass index, t-test; p < 0.05

Table 2. Outcome measures at baseline

	Intervention Group (n=31) Mean ± SD (Min-Max)	*Control Group (n=31)* Mean ± SD (Min-Max)	p
VAS	7.54 ± 1.76 (5-10)	7.50 ± 1.59 (5-10)	0.907
Shoulder Flexion	141.45 ± 37.39 (45-180)	156.66 ± 32.43 (45-180)	0.059
Shoulder Extension	44.51 ± 4.15 (30-50)	43.16 ± 5.33 (30-50)	0.346
Shoulder Abduction	126.29 ± 40.08 (60-180)	141.16 ± 42.88 (40-180)	0.112
Shoulder Internal rotation	44.51 ± 4.35 (30-50)	43.50 ± 5.43 (25-50)	0.573
Shoulder External rotation	69.03 ± 24.67 (20-90)	73.00 ± 21.63 (20-90)	0.722
TSK	43.74 ± 6.85 (27-57)	42.86 ± 6.32 (35-58)	0.492
CMS Subjective	19.03 ± 4.71 (12-32)	18.93 ± 4.07 (10-26)	0.919
CMS Objective	21.41 ± 11.26 (2-46)	24.93 ± 11.60 (2-45)	0.236
CMS Total	40.38 ± 14.64 (20-78)	43.93 ± 14.04 (19-71)	0.184

SD: standard deviation, Min: minimum, Max: maximum; VAS: Visual Analog Scale, TSK: Tampa Scale of Kinesiophobia, CMS: Constant Murley Score, Mann-Whitney U test; p < 0.05

Table 3. Meandifferencesbetweenthebaselineand post-treatmentevaluationwithingroups

	InterventionGroup (n=31) Mean ± SD				*Control Group (n=31) Mean ± SD*			
	Pre-treatment	**Post- treatment**	**p**	**d**	**Pre-treatment**	**Post- treatment**	**p**	**d**
VAS	7.54±1.76	2.03± 1.11	**<0.01**	3.62	7.50 ± 1.59	4.70 ± 2.33	**<0.01**	2.37
ShoulderFlexion	141.45 ± 37.39	171.77 ± 14.40	**<0.01**	2.55	156.66 ± 32.43	167.50 ± 27.02	**<0.01**	1.77
ShoulderExtension	44.51 ± 4.15	45.96 ± 2.71	**0.011**	1.02	43.16 ± 5.33	46.00 ± 2.42	**0.007**	1.13
ShoulderAbduction	126.29 ± 40.08	168.70 ± 19.27	**<0.01**	2.67	141.16 ± 42.88	162.5 ± 33.75	**<0.01**	2.53
ShoulderInternalRotation	44.51 ± 4.35	45.80 ± 2.91	**0.023**	0.89	43.50 ± 5.43	44.16 ± 4.37	0.257	0.42
ShoulderExternalRotation	69.03 ± 24.67	87.58 ± 5.14	**<0.01**	1.89	73.00 ± 21.63	81.83 ± 15.83	**<0.01**	1.98
TSK	43.74 ± 6.85	32.90 ± 6.32	**<0.01**	2.85	42.86 ± 6.32	41.20 ± 5.28	0.128	0.57
CMS Subjective	19.03 ± 4.71	19.67 ± 2.73	0.268	0.40	18.93 ± 4.07	18.90 ± 2.66	0.882	0.05
CMS Objective	21.41 ± 11.26	44.25 ± 6.18	**<0.01**	3.58	24.93 ± 11.60	33.96 ± 11.40	**<0.01**	2.39
CMS Total	40.38 ± 14.64	64.16 ± 8.00	**<0.01**	3.36	43.93 ± 14.04	53.53 ± 12.70	**<0.01**	3.41

SD: standarddeviation, Visual Analog Scale, TSK: TampaScale of Kinesiophobia, CMS: ConstantMurleyScore, Wilcoxon Test, d: effect size, p < 0.05

Tablo 4. Comparison of differencespre- and post-treatmentevaluationparametersbetweengroups

	InterventionGroup n=31 Mean ± SD	*Control Group n=31 Mean ± SD*	**p**	**z**
VAS	5.51 ± 1.89	2.80 ± 2.61	**<0.01**	-3.725
ShoulderFlexion	30.32 ± 31.96	10.83 ± 13.13	**0.006**	-2.748
ShoulderExtension	1.45 ± 3.21	2.83 ± 5.20	0.384	-8.70
ShoulderAbduction	42.41 ± 34.71	21.33 ± 20.75	**0.029**	-2.177
ShoulderInternalRotation	1.29 ± 2.87	0.66 ± 3.14	0.218	-1.232
ShoulderExternalRotation	18.54 ± 21.41	8.83 ± 10.96	0.219	-1.288
TSK	10.83 ± 9.53	1.66 ± 4.85	**<0.01**	-4.147
CMS Subjective	0.64 ± 4.69	0.03 ± 4.35	0.426	-0.796
CMS Objective	22.83 ± 9.73	9.03 ± 9.34	**<0.01**	-4.667
CMS Total	23.77 ± 11.41	9.60 ± 9.70	**<0.01**	-4.327

SD: standarddeviation, Visual Analog Scale, TSK: TampaScale of Kinesiophobia, CMS: ConstantMurleyScore, z: Mann-Whitney U test; p < 0.05

4. Discussion

This study was designed to investigate the efficacy of mirror therapy in impingement syndrome. As a result of the study, it was shown that mirror therapy added to conventional treatment led to significant improvement in pain, shoulder joint range of motion, shoulder functionality and kinesiophobia. Mirror therapy is beneficial in the treatment of pain and treatment of functional loss due to pain. In the literature review, it was determined that mirror therapy caused a significant improvement in pain when added to conventional treatment in complex regional pain, phantom limb pain, and pain syndromes secondary to hemiplegia (13).

It is considered that mirror therapy may be effective in reducing pain through sensory-perception-motor response. At the same time, this treatment aims to make the affected side feel healthy by reducing pain with visual input. The patient seeing a healthy extremity in front of the mirror reduces pain and sensory input(14). In a randomized controlled trial evaluating the effects of mirror therapy in 30 patients with adhesive capsulitis through a conventional rehabilitation program, Baskaya et al. reported a significant improvement in joint range of motion, functionality, and quality of life in the mirror therapy group compared to the control group (12). In another study evaluating the effectiveness of mirror therapy in 69 patients with shoulder pain due to different diagnosed causes (impingement, rotator cuff tear, operated or not, frozen shoulder, bursitis, etc.), it was determined that mirror therapy resulted in significant improvement in fear of movement and active shoulder flexion. In our study, the pain was the primary outcome in response to treatment, and when pain severity was evaluated by VAS, a significant improvement was found similar to previous studies (15). The effect of mirror therapy on shoulder joint range of motion and shoulder functionality was similar to the literature. The most common cause of limitation due to shoulder pain is seen in flexion, abduction and rotation movements (16-19)and we observed a significant improvement in shoulder flexion and abduction. Also, in our study we evaluated shoulder functionality with the modified Constant-Murley shoulder scoring andsignificantimprovementwasobserved in thegroupreceivingmirrortherapy. Previous studies have reported that shoulder pain is not only nociceptive pain, but the release of inflammatory mediators and central sensitization also play a role in the mechanism of chronic pain (20-22). Mirror therapy has also been found to be effective in central sensitization in the chronic pain mechanism, and psychosocial features affecting all these factors, (15) and it is considered that the visual feedback of the normal extremity breaks the link between pain and fear of movement. Decreased pain and increased range of motion may lead to a decrease in kinesiophobia(23,24).

The difference between our study and the previous studies was that patients with impingement syndrome, the most common cause of shoulder pain, were evaluated in ourstudy. Another difference is the evaluation of patients with unilateral involvement. Thus, we were able to show the functional effectiveness of mirror therapy using the healthy side with maximum biofeedback. Unlike previous studies (12,15), we evaluated a patient group with chronic shoulder pain because it has been shown in other mirror studies conducted on chronic pain of the musculoskeletal system that this therapy shows its effects through the central sensitization mechanism in chronic pain. Therefore, it is important to demonstrate the efficacy of mirror therapy, which is an easy, inexpensive, and non-invasive method for the prevention of disability, in chronic shoulder pain.

Limitations of the study are the effect of mirror treatment was examined immediately after treatment, and we did not follow up on the long-term effects of treatment. Also the dominant extremity of the patients was questioned, but both the dominant and non-dominant extremities were evaluated in the study groups.

5. Conclusion

This study showed that the addition of mirror therapy to conventional treatment can improve pain severity, functionality and kinesiophobia in patients with unilateral shoulder impingement syndrome. Reducing pain in impingement syndrome, in which pain-induced limitation of movement is evident, directly affected kinesiophobia and increased functionality. This has shown that a known application such as mirror theraphy can be a treatment option in different diseases. There is a need for further studies which would investigate the long-term effects of this treatment option in patients with shoulder impingement syndrome.

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Ethics

Ethics Committee Approval: The study was approved by Kutahya Health Sciences University Ethical Committee (Decision no: 2021-05/04, Date:15.09.2021).

Informed Consent: The authors declared that it was not considered necessary to get consent from the patients because the study was a retrospective data analysis.

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