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Randomized clinical study

The effects of Clinical Pilates exercises on patients with shoulder pain: A randomised clinical trial

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ABSTRACT

Aim: The purpose of this study was to determine the effect of Clinical Pilates exercises on patients with shoulder pain.
Material and methods: Thirty-three patients, experiencing shoulder pain continuously for at least four weeks were selected as study subjects. The patients were randomly divided into two groups, namely Clinical Pilates exercise (n = 17) group and conventional exercise (n = 16) group. The patients were treated for five days a week, the total treatment being carried out for 10 days. The assessment of pain and disability amongst the patients were done at the baseline and at the end of the treatment sessions, using Visual Analogue Scale (VAS) and Shoulder Pain and Disability Index (SPADI).
Results: The clinical Pilates exercise group showed a significant improvement in all scores used for assessment ($p < 0.05$), while the conventional exercise group demonstrated a significant improvement only in the SPADI total score ($p < 0.05$). A comparison of scores for the VAS, SPADI-Pain and SPADI-Total between the two groups, revealed a significant improvement in the Clinical Pilates exercise group ($p < 0.05$).
Conclusion: It was demonstrated by the study that Clinical Pilates exercise is an efficient technique for patients experiencing shoulder pain, as it helps reduce pain and disability among them.

1. Introduction

Shoulder pain commonly affects the working population and may result in disability to the extent of causing functional inefficiency in sports activities (Teys et al., 2008). Different exercises are employed for the treatment of shoulder pain. The conventional approach for treating shoulder pain comprised of stretching and strengthening exercises for reducing the symptoms and improving the abnormalities related to motion and muscle activity (Bang and Deyle, 2000; Wang et al., 1999).

In recent years, Clinical Pilates exercises have emerged as a popular practice, not only for rehabilitative purposes, but also in healthy individuals (Rodrigues et al., 2014). Clinical Pilates exercise is an approach that trains the mind to consciously control the movement and posture of the body. It intends to improve the compatibility between the mind and the body with an active participation of patients. The exercises focus on pain-free motion, concentration and muscle relaxation with implementation of proper breathing techniques (Ekici et al., 2008; Yakut et al., 2006). Pilates exercise allows efficient and coordinated multiple muscle

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contractions (Özdemir and İrez, 2010). These exercises can be adapted to the individual characteristics and abilities of the patient (Silva and Mannrich, 2009).

Todd pointed out that the movements of the body are mainly controlled by the lumbar and deep pelvic muscles. Therefore, in order to increase functional movements of the shoulder, it is essential to increase the stability of the lumbo-pelvic region (Todd, 1997). In addition, control over the functional movements of the shoulder may help improve the stability of the scapular region, as the stabilization of the scapula is essential for carrying out activities such as retraction and depression of the scapula, in relation to the acromion, helping the acromion to be positioned correctly. Even though Pilates exercises positively influences the strength, endurance, posture, flexibility, body composition, balance and proprioception in patients with low back pain as well as in healthy individuals (Rydeard et al., 2006; McMillan et al., 1998; Fitt et al., 1994; Segal et al., 2004), the evidence on the effect of Pilates exercises on shoulder problems is scarce.

This study was performed with the aim of determining the effect of Clinical Pilates exercise on patients experiencing pain in the shoulders.

2. Material and methods

2.1. Subjects

The study comprised of 33 patients (subjects) with persistent shoulder pain for at least four weeks. The patients were selected on the basis of the results of the diagnosis obtained using Magnetic Resonance Imaging by a physician. The exclusion criteria for the patients comprised of the presence of cervical symptoms (neck pain, numbness or tingling in the upper extremity), a history of traumatic injury resulting in the onset of symptoms, and a history of shoulder surgery.

This randomised controlled clinical study was conducted at the Physical Therapy and Rehabilitation Outpatient Department, Baskent University, Turkey. All the patients were volunteers from a local hospital in Ankara, Turkey. The study was approved by the Baskent University Institutional Review Board and Ethics Committee (Project number: KA13/203) and was supported by the University Research Fund. All the patients were informed about the study and written informed consent was taken from all of them at the time of initial assessment.

For power analysis, SPADI total scores were used to measure the outcome. The patients were randomised into two groups: Clinical Pilates exercise group (n = 17) and conventional exercises group (n = 16), using an online random allocation software program (Graphpad Software, 2013) before the study was initiated.

2.2. Intervention

The demographic and clinical characteristics of the patients were recorded at the beginning of the study. All the patients were assessed before and after treatment. The subjects in both the groups received the same pain relieving therapy consisting of hot pack application and conventional transcutaneous electrical nerve stimulation (TENS) (Chattanooga Intellect®, frequency = 100 Hz, curing time = 60 μsn) for 20 min; followed by continuous ultrasound (Enraf-NoniusSonoplus 590; 1 MHz, 1 w/cm^2) for 5 min (Segal et al., 2004; Todd, 1997) on the shoulder area before the exercises. The subjects in both the groups were treated for five days a week, for a total of ten days.

2.3. Clinical Pilates exercises

Clinical Pilates exercises were performed under the supervision of a certificated physical therapist. Every exercise included scapular stabilization and glenohumeral joint mobilization in the direction of flexion, abduction and internal-external rotation and was repeated ten times.

During the Pilates exercises, different visual imagery techniques (embracing the word, creating a rainbow in the sky, picking apples from tree in different directions and adding to the chart) were used along with Pilates breathing. The patients were instructed to breathe through the nose before initiating the movements and complete the movement with breathing out through the mouth with a sigh, i.e. “breathing out through your teeth, with your lips pursed”. In addition to deep breathing, the subjects were required to ‘pull in’ the abdomen by actively contracting the transverse abdominal and pelvic floor muscles (Keays et al., 2008; Cancelliero-Gaiad et al., 2014).

2.4. Conventional program

The patients were required to perform the exercises for a set of ten repetitions under the supervision of a physical therapist. The exercises used in the study were the pendulum exercise, wall flexion and abduction stretch and active range of motion exercises in the flexion, abduction, and internal and external rotation direction.

2.5. Outcome measurements

The severity of pain was evaluated at rest and during activity, using the Visual Analogue Scale (VAS) within the two groups. The patients were asked to indicate the severity by marking on a 10-cm long horizontal line, labelled (with the anchors) as “no pain” at one end and “worst pain possible” at the other end. It was thus essential for the patients to be able to equate the length of the line (as measured from the left-hand side to the point marked) with the amount of pain experienced (Clark et al., 2003; Briggs and Closs, 1999).

Shoulder Pain and Disability Index (SPADI) were used to evaluate the shoulder pain and disability, which comprised of two subscales: pain and disability. The pain subscale consisted of five questions concerning the severity of pain experienced by the subject. The disability subscale comprised of eight questions, designed to measure the level of difficulty faced by an individual while performing various daily activities that involve the upper-extremities. Each item corresponded to a Visual Analogue Scale ranging from “no pain”/“no difficulty”, to “worst pain imaginable”/“patient assistance required”. Item scores from each section are averaged to produce separate subscale scores ranging from 0 to 100. The scores from both subscales were further averaged to derive a total score, ranging from 0 (best) to 100 (worst). Higher scores indicated greater pain and disability (Bumin et al., 2008; Roach et al., 1991).

2.6. Statistical analysis

The statistical analyses were carried out using SPSS 20.0. Normal distribution of the data was analyzed using the Kolmogorov Smirnov test. Non-normal data were analyzed using the Shapiro-Wilk test. Since the outcome measures were not normally distributed, nonparametric analyses were used.

Wilcoxon test was used to compare the scores (treatment scores) obtained before and after the treatment of the groups. The Mann Whitney-U test was used to analyse the differences between

the groups. The level of significance was set at $p = 0.05$.

The sample size was determined to be fourteen by means of statistical power analysis procedures, using PASS 2005 software (NCSS, Kaysville, UT, USA).

3. Results

Out of the 46 patients screened, only 33 fulfilled the selection criteria and were randomly assigned to one of the two groups: Clinical Pilates exercise group ($n = 17$) and the conventional group ($n = 16$). At the end of two weeks, only 33 subjects completed the study and participated in the final assessment (see Fig. 1). The diagnoses of the final subjects included subacromial impingement syndrome (SIS) ($n = 19$), partial rotator cuff rupture ($n = 6$) and adhesive capsulitis ($n = 5$) (see Table 1). Other descriptive and clinical characteristics of patients are shown in Table 1. There were no significant differences in age, BMI and gender between the groups, as determined before the initiation of the treatment ($p > 0.05$). However, there was a significant difference in the duration of pain between the two groups ($p < 0.05$) before the treatment was initiated (see Table 1).

All the parameters assessed before and after treatment showed statistically significant differences in the Pilates exercise group ($p < 0.05$). On comparing the different values of the two groups, it was found that in the Clinical Pilates exercise group, VAS, SPADI pain and SPADI total scores decreased significantly ($p < 0.05$) (see Table 2). On the other hand it was found that there was a significant difference only in SPADI total score ($p = 0.02$) in the conventional exercise group while no difference was found between the other parameters measured before and after the treatment in this group ($p > 0.05$).

4. Discussion

It was found in the study that the severity of pain and disability significantly decreased in Pilates exercise group. Also, Pilates exercises have been found to be more effective than conventional exercises in patients with shoulder pain.

Though, many studies have been carried out to investigate the effects of Pilates exercises, none of them have investigated their effect on shoulder pain (Rodrigues et al., 2014). The literature reports a single study (Keays et al., 2008) to investigate the effects of Pilates exercises on shoulder range of motion. However, this study considered only females with breast cancer.

Shoulder problems may cause pain and disability. Physiotherapy is one of the initial approaches used for treating shoulder problems (Green et al., 2003). At this point, choosing the right exercise methods plays a very important role. In the recent times, there has been a significant increase in the popularity of exercises based on Pilates methods. Yet, the literature lacks sufficient evidence about this type of exercise technique and its efficacy (Ludewig and Borstad, 2003). Pilates exercises method is based on combination of the eastern theories of body-mind-spirit interaction with western theories of biomechanics, motor learning, and core stability (Lange and Larkam, 2000; Anderson and Spector, 2000; Latey, 2001). Muscle stability is essential for optimal contraction. In case of a lack of muscle stability, both ends of the muscle will not be able to produce an efficient movement. The stabilization of one end of the muscle allows the powerful contraction to be focused on the moving lever and thus the intended movement can be performed by the recruitment of only a few motor units, thereby making the movement easier and more efficient (Fitt, 1996). The reason for choosing Clinical Pilates exercise for the study is its beneficial effects. The effects of Clinical Pilates exercises and conventional exercises were compared in patients with shoulder-pain, and it was found that Clinical Pilates exercises are more effective than conventional exercises.

Ekici et al. proved that the futile muscle recruitment in patients with fibromyalgia, which could potentially lead to early fatigue, decreased stability and impaired recovery, can be minimised by Pilates exercises. They also stated that the contraction of the diaphragm and transversus abdominis muscles activates the central column, as a result of controlled breathing which brings about isolated movement. The severity of perceived pain decreases with relaxation in expiration period of breathing in patients who focus on breathing control with Pilates exercises (Ekici et al., 2008; Yakut et al., 2006).

Several articles supported the hypothesis that functional

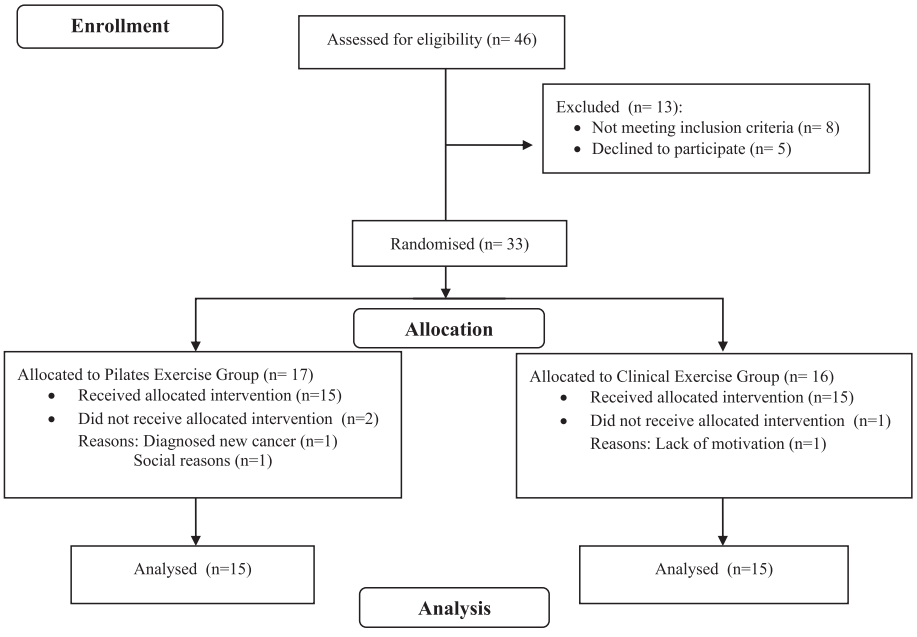

Fig. 1. Flow diagram of the study.

Table 1
Sociodemographic and clinical characteristics of patients.

Characteristics of Patients	Clinical exercise group (n = 15)	Pilates exercise group (n = 15)	p
Age (χ ±SD, years)	52.46 ± 11.21	48.26 ± 13.56	0.40¥
BMI (χ ±SD, kg/m^2)	29.01 ± 7.40	29.47 ± 5.23	0.39¥
Pain duration (χ ±SD, months)	11.96 ± 7.67	6.86 ± 10.54	0.01¥*
Gender, n (%)	9 (60)	11 (73.3)	0.06†
Male	6 (40)	4 (26.7)	
Female			
Diagnosis, n (%)	9 (60)	10 (66.7)	0.00†*
Subacromial Impingement Syndrome	5 (33.3)	1 (6.7)	
Partial tear	1 (6.7)	4 (26.7)	
Adhesive capsulitis			
Affected upper extremity, n (%)	12 (80)	12 (80)	0.00†*
Right	3 (20)	3 (20)	
Left			
Dominant upper extremity, n (%)	15 (100)	15 (100)	0.00†*
Right	0 (0)	0 (0)	
Left			
Occupation, n (%)	6 (40)	4 (26.7)	0.05†
Active	5 (33.3)	5 (33.3)	
Retired	4 (26.7)	5(33.3)	
Housewife	0 (0)	1 (6.7)	
Student			

†Chi-Square Test ¥Mann Whitney *U* test *p < 0.05.
BMI: Body Mass Index χ ±SD = Mean ± Standard Deviation.

Table 2
Changes between and within groups after the treatments.

		Conventional group (n = 15)		Clinical Pilates exercise group (n = 15)		p[b]
		X ±SD	p[a]	X ±SD	p[a]	
VAS (rest)	Baseline	1.94 ± 1.98	0.400	2.69 ± 2.30	0.006*	0.002*
	2 weeks	2.24 ± 2.39		1.06 ± 1.48		
VAS (during activity)	Baseline	2.78 ± 2.25	0.523	4.42 ± 2.52	0.002*	0.002*
	2 weeks	2.40 ± 2.06		0.98 ± 1.73		
SPADI_Pain	Baseline	53.26 ± 22.89	0.108	66.20 ± 20.20	0.001*	0.012*
	2 weeks	44.26 ± 19.82		33.90 ± 20.12		
SPADI_Disability	Baseline	47.41 ± 23.65	0.091	55.04 ± 21.30	0.001*	0.085
	2 weeks	33.50 ± 22.42		26.83 ± 18.95		
SPADI_Total	Baseline	49.12 ± 19.40	0.026*	62.55 ± 14.93	0.001*	0.026*
	2 weeks	37.37 ± 20.67		29.41 ± 18.90		

VAS: Visual Analogue Scale.
SPADI_Pain: Shoulder Pain and Disability Index Pain Score.
SPADI_Disability: Shoulder Pain and Disability Index Disability Score.
SPADI_Total: Shoulder Pain and Disability Index Total Score.
*p < 0.05.
[a] Wilcoxon Signed Rank Test: Changes within groups.
[b] Mann Whitney *U* Test: Changes between groups.

improvement is an expected outcome in pain-relieved patients (Rodrigues et al., 2014) in case of a negative correlation between decrease in pain and function (Green et al., 2003). Keays and Harris demonstrated that Pilates exercises could decrease shoulder pain and improve the functional status in women who have undergone breast cancer treatment (Keays et al., 2008). In our study it was found that a decrease in the severity of pain was related to improved SPADI-Pain, SPADI-Disability and SPADI-Total scores in Clinical Pilates group. However, there was no significant change in SPADI-Pain and SPADI-Disability scores in the conventional group, though there was an improvement in SPADI-Total score in that group.

5. Conclusion

The study demonstrated that Clinical Pilates exercises are more efficient in relieving pain and improving function than the conventional exercises. It has thus been deliberated that Clinical Pilates exercises should be taken into consideration as a valuable exercise model in clinical physiotherapy programs. However, more studies comparing the efficiency of Clinical Pilates exercises with different exercise approaches for specific shoulder pathologies must be carried out with larger sample size over longer periods of time.

5.1. Limitation

Significant differences were found between the duration of pain and diagnoses of subjects within the groups in baseline demographics. This is a potential limitation of the study.

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Conflicts of interest

The authors report no conflict of interest.

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