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Original Investigation

The Effect of Breathing and Posture Exercise on the Clinical, Functional Status and Disease Related Quality of Life in Patients with Ankylosing Spondylitis

Meryem Özbaş Günay[1], Serpil Bal[1], Korhan Barış Bayram[1], Ece Harman[2], Elif Ebru Dalgıç[3], Hikmet Koçyiğit[1], Alev Gürgan[1]

[1] Atatürk Eğitim ve Araştırma Hastanesi, 2. FTR Kliniği, İzmir, Turkey

[2] Atatürk Eğitim ve Araştırma Hastanesi, Endokrinoloji Kliniği, İzmir, Turkey

[3] Atatürk Eğitim ve Araştırma Hastanesi, Göğüs Hastalıkları Kliniği, İzmir, Turkey

Abstract

Objectives: *The aim of this study was to investigate the effects of breathing and posture exercises on pain, functional status as well as respiratory function and health related quality of life in patients with Ankylosing Spondylitis (AS).*

Materials and Methods: *Forty patients with AS were included in the study. Pain levels were recorded by Visual Analog Scale (VAS). Disease activity levels were determined by Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), functional status was determined by Bath Ankylosing Spondylitis Functional Index (BASFI) and spinal measurements were determined by the Bath Ankylosing Spondylitis Metrology Index (BASMI) criteria. Ankylosing Spondylitis Quality of Life (ASQol) was used as the disease-related quality of life scale. Pulmonary functions were tested with the Zan spirometry device. The first group was given a home exercise program including breathing and posture exercises and the second group was given a program with only posture exercises. However, the control group was not given a home exercise program. Patients in all groups were evaluated again after three months.*

Results: *The VAS, BASDAI, BASFI, BASMI, chest expansion, pulmonary function test results and ASQol values showed a significant improvement in the group with breathing and posture exercises. There was no significant change in the control group. Chest expansion, forced vital capacity (FVC), forced expiratory volume in the first second (FEV1)/FVC ratio in the first group had improved more significantly than group 2 and the control group. Also, BASFI, BASMI, BASDAI, ASQol, VAS scores in group 1 had improved more significantly when compared to group 2 and the control group.*

Conclusion: *Breathing exercises show a positive effect on the pain level, clinical status and respiratory function and provides improved functional status and quality of life in patients with AS.*

Key Words: Ankylosing Spondylitis, Exercise, Respiratory Function.

Corresponding Address: Ece Harman, MD, İzmir Atatürk Eğitim ve Araştırma Hastanesi, Department of Endocrinology, İzmir, Turkey.
E-mail: ecarmu@gmail.com

Introduction

Ankylosing spondylitis (AS) is a chronic, systemic, inflammatory disease primarily affecting the skeletal system mainly in the sacroiliac joints, axial skeleton and large peripheral joints. The disease usually begins in the 2nd and 3rd decades of life and is more frequent in men. Other than the skeletal system, it can cause systemic symptoms such as acute anterior uveitis, gastrointestinal and genitourinary systems and lung and aorta involvement [1].

Respiratory system involvement of patients with AS can be summarized as the fixation of chest wall, restriction in chest expansion, and parenchymal diseases of the lungs. Fundamental changes are apical fibrobullous changes, interstitial lung disease, pleural thickening, and effusion [2,3]. The thoracal movements may be restricted due to the involvement of the thoracic, costovertebral, manubriosternal and costosternal vertebrae, and the effect of postural factors along with the sacroiliac joint involvement, sometimes lead to restrictive respiratory distress [4].

In clinical applications, the chest expansion measurement, costochondral joint tenderness, chest X-ray, carbon monoxide diffusion capacity, lung function tests, bronchoalveolar lavage, high-resolution tomography of the lung and transbronchial biopsy all can be used to assess the respiratory system involvement in patients [3].

Conservative approaches (smoking cessation and avoiding exposure to smoking, occupational asbestos, silica, coal particles, close contact with active tuberculosis patients), physical medicine and rehabilitation practices (breathing, posture, mobilization, and strengthening exercises specific to the shortened muscle groups, heat application, analgesic current treatment) and medical or surgical treatments are applied in treatment of the respiratory system involvement [5-8].

The purpose of this study is to investigate the effects of respiratory and postural exercises within the physical medicine and rehabilitation applications on the patients' clinical symptoms, pain levels, clinical assessment scales, pulmonary function, and quality of life.

Materials and Methods

40 patients, diagnosed with ankylosing spondylitis (according to 1984 modified NewYork clinical evaluation criteria) followed by our clinic, were included in the study. After the demographic data was verified and after a simple physical examination, all patients were randomized with their outpatient clinic registration numbers into 3 groups: The first group that was assigned respiratory and postural exercises (group 1), the second group that was assigned to just postural exercises (group 2) and the control group who continued medical treatment and normal daily life activities.

The study patients were provided with the written and verbal information about the aim, duration, mode of application of the study and the problems that might be encountered. Patients signed an 'Informed Consent" form. Approval was obtained from the Local Ethics Board for the research.

Detailed history of age, gender, height, weight, occupation, level of education, duration of disease, smoking, drug use (such as NSAID, DMARD), and symptoms as the presence of lung disease, fatigue, shortness of breath, cough, sputum production were taken for each patient.

Physical examination for all patients was performed. Posteroanterior chest x-rays and thorax high resolution computed tomography (HRCT) were done. Complete blood count, routine biochemistry, erythrocyte sedimentation rate (ESR) and serum C-reactive protein (CRP) values were ordered for each study patient. Evaluation of lung function was done by respiratory function test (PFT). These tests were performed by the Zan Spirometer in our Chest Diseases Outpatient Clinic Lab of our hospital. The calibration of the equipment was repeated prior to each test. It was considered a valid calibration only when the condition of <3% error rate according to the American Thoracic Society recommendations [9] wa s met. The temperature of the exercise test room was about 22-23 degrees and humidity was below 60%. Tests were performed after the patients were explained about the respiratory maneuvers they were required to do during PFT tests. The measurements were repeated to have less then %10 in three tests and the 'best value' that the computer automatically determined was recorded. The forced vital capacity (FVC), forced expiratory volume in the first second (FEV1) and FEV1/FVC ratio values were recorded in the PFT [10]. All patients received the PFT before and also in the 12th week of treatment.

Visual Analog Scale (VAS) was used to assess the level of pain. Pain during rest, nighttime and during activity were assessed. Chest expansion was evaluated by placing the hands behind the head while the arms were in flexion in the frontal plane, the difference between the maximum inspiration and expiration in the fourth intercostal interval level was measured and recorded in centimeters. Costochondral sensitivity was evaluated by manually applying pressure to the costochondral joints and recording whether the patient had sensitivity or not precisely as 'YES' or 'NO'. Disease activity was assessed by the BASDAI (Bath Ankylosing Spondylitis Disease Activity Index) scale. Spinal mobility was assessed by the BASMI (Bath Ankylosing Spondylitis Metrology Index) scale. Functional status was assessed by the BASFI (Bath Ankylosing Spondylitis Functional Index) scale. Quality of life was evaluated by the ASQoL (Ankylosing Spondylitis *Quality of Life*) criteria.

The patients were randomized into 3 different groups according to their file numbers in the outpatient clinic:

Group 1 (Breathing and Posture Exercises Group): Patients in this group used a home exercise program with breathing and posture exercises for 12 weeks 30 minutes a day, 5 days a week after having been trained by a physician.

Group 2 (Posture Exercises Group): Patients in this group used another home exercise program only with posture exercises for 12 weeks 30 minutes/day, 5 days/week, again, after having been trained by a physician.

Control Group: Patients in this group were told to continue their medical treatment and daily life activities.

Breathing exercises:

1. Inhaling through the nose and exhaling through the mouth in normal speed, twice.
2. Breathing normally, exhaling through nose and mouth.
3. Chest and abdominal breathing.
4. Deep inhalation followed by slowly exhaling through the mouth.
5. Inhaling strongly while applying pressure by hands on chest wall for the resistance exercise of the inspiratory muscles.

Posture Exercises:

1. For cervical spine flexibility:
   a. Cervical rotation in both directions while sitting
   b. Lateral flexion in both directions while sitting
   c. Cervical flexion and extension while sitting
2. For thoracic spine flexibility:
   a. Thoracic lateral flexion
   b. Thoracic rotation
   c. Thoracic flexion-extension
3. Stretching exercises for the thoracolumbar extensor muscles.
4. Stretching exercises for the shoulder and thorax.
5. Flexibility exercises for the lumbar spine.

All of the patients were evaluated before the treatment and during the 12th week of treatment. Data were analyzed by SPSS 15.0 software package (SPSS, Chicago, IL, USA). Descriptive statistics were used to determine patient characteristics, Kruskal-Wallis variance analysis was used for comparisons between groups, post-hoc analysis Marginal homogeneity test and chi-square tests were used for post-hoc analysis and Wilcoxon Signed Ranks test was used for intra-group comparisons. $p < 0.05$ level was considered statistically significant.

Results

Some demographic and clinical characteristics of patients participating in the study are shown in Table 1. Patients in all three groups were similar in terms of age ($p = 0.402$), gender ($p = 0.639$), body mass index (BMI) ($p = 0.583$), smoking ($p = 0.313$) and medical treatment ($p = 0.338$). In addition, when compared in terms of lung disease before treatment, the presence of symptoms such as chest expansion measurements, lung disease and cough, phlegm, shortness of breath and fatigue were found to be similar in all three groups (Table 2).

Table 1: Results-Distribution of the groups' demographic and clinical features

		Group 1 (n = 14)	Group 2 (n = 13)	Control Group (n = 13)	p
Age±SD (years)		40.8 ± 9.3	44.3 ± 9.8	36.4 ± 12.8	0.402
Gender (F / M) n (%)		3/11 (21.4/78.6)	4/9 (30.8/69.2)	2/11 (15.4/84.6)	0.639
BMI ± SD		25.4 ± 4.5	24.3 ± 3.4	23.8 ± 4.5	0.583
Smoking n (%)	Nonusers	9 (64.3)	5 (38.5)	8 (61.5)	0.313
	Users	5 (38.5)	7 (53.8)	3 (23.1)	
	Moves	0 (0)	1 (7.7)	2 (15.4)	
Medication n (%)	NSAIDs	9 (64.3)	8 (61.5)	3 (23.1)	0.338
	SLZ	0 (0)	0 (0)	1 (7.7)	
	NSAIDs + SLZ	4 (28.6)	4 (30.8)	7 (53.8)	
	Without medication	1 (7.1)	1 (7.7)	2 (15.4)	

BMI: Body Mass Index, NSAID: non-steroidal anti-inflammatory drugs, SLZ: Salazopyrin
Group 1: Breathing and posture exercises group
Group 2: Posture exercises group

Table 2: Results-Distribution of the groups' according to clinical features before treatment

		Group 1 (n = 14)	Group 2 (n = 13)	Control Group (N = 13)	p
Chest expansion (mean± SD)		2.5 ± 1.2	2.8 ± 1.3	3.6 ± 1.4	0.111
Costochondral Sensitivity n (%)	Yes	10 (71.4)	4 (30.8)	2 (15.4)	0.009 *
	No	4 (28.6)	9 (69.2)	11 (84.6)	
Lung disease n (%)	Yes	1 (7.1)	2 (15.4)	1 (7.7)	0.732
	No	13 (92.9)	11 (84.6)	12 (92.3)	
Cough n (%)	Yes	4 (28.6)	4 (30.8)	2 (15.4)	0.617
	No	10 (71.4)	9 (69.2)	11 (84.6)	
Sputum/Phlegm production n (%)	Yes	0 (0)	1 (7.7)	0 (0)	0.345
	No	14 (100)	12 (92.3)	13 (100)	
Shortness of breath n (%)	Yes	4 (28.6)	3 (23.1)	0 (0)	0.123
	No	10 (71.4)	10 (76.9)	13 (100)	
Fatigue n (%)	Yes	2 (14.3)	4 (30.8)	1 (7.7)	0.279
	No	12 (85.7)	9 (69.2)	12 (92.3)	

* P <0.05

Group 1: Breathing and posture exercises group
Group 2: Posture exercises group

The only significant difference between groups was the costochondral sensitivity value (p = 0.009). In binary comparisons between group 1 and group 2 (p = 0.076) and between group 1 and control group (p = 0.012) there were significant differences. There were no significant differences between group 2 and the control group (p = 0.511). The values of respiratory function test reviews and pulmonary function test parameters were found to be similar in all three groups (Table 3). All three groups were similar in terms of pain levels (VAS) during rest, nighttime and activity as mentioned in Table 4, their clinical rating scales (BASMI, BASDAI, BASFI, ASQol) and laboratory values (ESR, CRP).

Table 3: Results-Distribution of the groups according to respiratory functions before treatment

		Group 1 (n = 14)	**Group 2** (n = 13)	**Control Group** (n = 13)	**P**
PFT comment n (%)	**Normal**	3 (21.4)	6 (46.2)	7 (53.8)	
	Restrictive	9 (64.3)	4 (30.2)	6 (46.2)	
	Obstructive	2 (14.3)	3 (23.1)	0 (0)	0.173
FVC(mean± SD)		2.9 ± 0.9	2.7 ± 0.7	3.2 ± 0.9	0.286
FEV 1(mean± SD)		2.4 ± 0.8	3.3 ± 0.4	2.6 ± 0.7	0.266
FEV1/FVC (%) (mean± SD)		82.2 ± 9.9	83.3 ± 7.5	84.0 ± 3.9	0.948

Group 1: Breathing and posture exercises group
Group 2: Posture exercises group

Table 4: Results - Distribution of groups according to clinical and laboratory evaluations

	Group 1 (n = 14)	**Group 2** (n = 13)	**Control Group** (n = 13)	p
	mean ± SD			
Resting VAS	6.8 ± 1.7	5.7 ± 2.2	5.4 ± 1.9	0.200
VAS Night	6.5 ± 2.1	5.9 ± 2.3	5.3 ± 2.5	0.490
ActivityVAS	7.5±2.1	7.2±2.0	6.7±2.0	0.520
BASMI	4.7±1.6	4.4±2.0	3.8±2.3	0.595
BASDAI	4.6±1.0	4.6±2.1	3.5±1.0	0.077
BASFI	4.4±1.8	4.1±1.2	3.4±1.4	0.356
AsQoL	7.9±3.3	9.3±3.8	7.6±3.5	0.455
ESR	23.1±22.7	23.7±21.7	22.6±19.3	0.984
CRP	1.4±1.4	1.6±2.5	1.4±1.2	0.970

Group 1: Breathing and posture exercises group,
Group 2: Posture exercises group

When patients were evaluated after treatment, significant improvement was seen in chest expansion, FVC, FEV 1, FEV 1/FVC value averages, compared to baseline in group 1. However, there was no improvement in group 2 and the control group (Table 5). Again, when all three groups were evaluated in terms of pulmonary function tests comments, before and after treatment, only group 1 showed significant improvement ($p = 0.005$). In this group, while the obstructive disorder rates remained unchanged, 8 of 9 patients with restrictive disorder moved to the normal pulmonary function group (Table 6).

Table 5: Results-After treatment effects on lung function of patients: Intragroup evaluation

		Pre-treatment (mean ± SD)	**post- treatment** (mean ± SD)	**P**
Group 1 (n = 14)	**Chest expansion**	2.5 ± 1.2	4.3 ± 1.2	0.01*
	FVC	2.9 ± 0.9	3.2 ± 0.8	0.01*
	FEV 1	2.4 ± 0.8	2.6 ± 0.8	0.039*
	FEV1/FVC (%)	82.3 ± 9.9	79.4 ± 8.8	0.016*
Group 2 (n = 13)	**Chest expansion**	2.8 ± 1.3	2.7 ± 1.3	0.317
	FVC	2.7 ± 0.7	2.7 ± 0.9	0.363
	FEV 1	2.2 ± 4	2.3 ± 0.6	0.447
	FEV1/FVC (%)	83.4 ± 7.5	85.5 ± 3.7	0.670
Control Group (n = 13)	**Chest expansion**	3.6 ± 1.4	3.6 ± 1.4	0.999
	FVC	3.2 ± 0.9	3.2 ± 0.9	0.437
	FEV 1	2.6 ± 0.7	2.6 ± 0.7	0.599
	FEV1/FVC (%)	84.1 ± 3.9	84.3 ± 4	0.180

* $p < 0.05$
Group 1: Breathing and posture exercises group,
Group 2: Posture exercises group

Table 6: Results - Changes in patients after treatment interpretations respiratory function testing: Intragroup evaluation

		Before Treatment n%	**After Treatment** n%	**P**
Group 1 (n = 14)	**Normal**	3 (21.4)	11 (78.6)	0.005*
	Restrictive	9 (64.3)	1 (7.1)	
	Obstructive	2 (14.3)	2 (14.3)	
Group 2 (n = 13)	**Normal**	6 (46.2)	6 (46.2)	0.414
	Restrictive	4 (30.8)	6 (46.2)	
	Obstructive	3 (21.3)	1 (7.7)	
Control Group (n = 13)	**Normal**	7 (53.8)	7 (53.8)	0.999
	Restrictive	6 (46.2)	6 (46.2)	
	Obstructive	0 (0)	0 (0)	

* $P < 0.05$

Group 1: Breathing and posture exercises group
Group 2: Posture exercises group

Table 7: Results-Clinical evaluation of patients post-treatment changes: Intragroup evaluation

		Pre-treatment (mean ± SD)	**after treatment** (mean ± SD)	**P**
Group 1 (n = 14)	**VAS at rest**	6.8 ± 1.7	3.8 ± 1.5	0.001*
	Night VAS	6.5 ± 2.1	3.7 ± 1.6	0.001*
	Activity VAS	7.5 ± 2.1	4.0 ± 1.8	0.001*
	BASMI	4.7 ± 1.6	3.3 ± 1.3	0.002*
	BASDAI	4.6±1.0	3.1±0.8	0.001*
	BASFI	4.4±1.8	2.7±1	0.001*
	ASQol	7.9±3.3	4.6±2.4	0.001*
Group 2 (n=13)	**VAS rest**	5.7±2.2	5.8±2.3	0.524
	VAS night	5.9±2.3	5.9±2.3	0.854
	VAS activity	7.2±2.0	6.9±2.2	0.039*
	BASMI	4.4±2.2	4.3±2.0	0.157
	BASDAI	4.6±2.0	4.6±2.1	0.270
	BASFI	4.1±1.2	6.6±9.2	0.478
	ASQol	9.3±3.8	9.0±3.8	0.157
Control Group (n=13)	**VAS rest**	5.4±1.9	5.3±1.9	0.206
	VAS night	5.3±2.5	5.1±2.5	0.440
	VAS activity	6.7±2.0	6.4±2.3	0.574
	BASMI	3.8±2.3	4.0±2.5	0.655
	BASDAI	3.5±1.0	3.4±0.9	0.838
	BASFI	3.4±1.4	3.4±1.5	0.581
	ASQol	7.6±3.5	8.0±3.8	0.059

* $p<0.05$
Grup 1: Breathing and Posture exercises group
Grup 2: Posture exercise group

When each of the 3 groups were evaluated within itself, only group 1 showed significant improvement in VAS, BASMI, BASDAI, BASFI and ASQol values. These values did not change significantly in group 2 and control group (Table 7). When chest expansion and lung function tests of patients were compared after treatment, the chest expansion, FVC, and FEV 1 values showed significant difference in all three groups. Paired group comparisons showed significant difference in the post-treatment parameters in group 1, as opposed to the other two groups. Patients in group 1 had improved significantly in terms of the chest expansion, FVC and FEV 1 values ($p <0.001$), compared to group 2. Group 2, compared to the control group, did not differ significantly in terms of change in these parameters after treatment (Table 8).

Table 8: Clinical results-patients pre and post treatment respiratory changes: Intragroup evaluation

	Grup 1 (n=14)	**Grup 2** (n=13)	**Control Group** (n=13)	**P**
Difference in Chest expansion (BT-AT) mean±SD	1.8±0.7	0±0.1	0±0	0.001*
FVC (BT-AT) mean±SD	0.4±0,5	0±0.5	0±0.1	0.009*
FEV1 (BT-AT) mean±SD	0.2±0.4	0.1±0.5	0±0.1	0.095
FEV1/FVC(%) (BT-AT) mean±SD	2.9±3.5	2.2±53	0.2±0.6	0.008*

* p<0.05
BT: Before treatment, AT: After treatment
Group 1: Breathing and Posture exercises group
Group 2: Posture exercises group

When all three groups were compared in terms of changes in some clinical parameters; pain levels (VAS at rest, night and activity), BASFI, BASMI, BASDAI and ASQol values had significant differences (p <0.001). In paired comparisons, group 1 showed significant difference in the parametrical changes against group 2 and control group. Compared to group 2, group 1 patients had improved significantly in terms of the post-treatment changes in VAS, BASDAI, BASMI, BASFI, ASqol values (p <0.001). Again, compared to the control group, group 1 patients (p <0.001). There was no significant difference between Group 2 and the control group in terms of change in these parameters. (Table 9).

Table 9: Clinical Results-Patients' pre and post treatment clinical assessment changes: Intragroup evaluation

	Grup 1 mean±SD	**Grup 2** mean±SD	**Control Group** mean±SD	**P**
VAS rest (BT-AT)	-3±1.4	0±0.3	-0.1±0.4	<0.001*
VAS night	-2.8±1.5	0±0.4	0±0.4	<0.001*
VAS activity	-3.5±2.1	-0.3±0.4	-0.3±0.8	<0.001*
BASMI	-1.4±0.8	-0.2±0.4	0.2±0.9	<0.001*
BASDAI	-1.5±1.1	0±0.1	0±0.4	<0.001*
BASFI	-1.7±1.3	2.5±9.2	0±0.2	<0.001*
ASQol	-3.3±2.3	0.4±1	0.4±0.7	<0.001*

* p<0.05
BT: Before treatment, AT: After treatment
Group 1: Breathing and Posture exercises group
Group 2: Posture exercises group

Discussion

AS is a chronic disease that has a negative effect on patients' lives because of the skeletal and non-skeletal symptoms leading to disabilities. The deterioration of lung function as well as the spinal and peripheral joint pain, stiffness, deformity and movement restrictions disrupt the quality of life, contributing to the reduction in the patients' exercise capacity and qol [11-14].

In the follow-up of these changes, tests such as ESR, CRP, clinical measures, disease activity, radiological and functional assessment scales, quality of life and PFT are widely used. Home exercise programs have been shown to have a positive impact on pain, fatigue, mobility, function, mood, behavior, quality of life and well-being in patients with AS [15]. However, we did not come across any studies in the literature evaluating the changes in respiratory function tests before and after exercise therapy. In our study, we found significant improvement in the chest expansion, FVC, FEV 1/FVC values in the group that was assigned breathing and posture exercises post-treatment. These values did not show any improvement in the group assigned only posture exercises and the control group. Likewise, when the pulmonary function test results were evaluated, the group with breathing and posture exercises showed significant transition from restrictive pattern to normal pattern, while neither the group with posture exercises nor control group showed change. This demonstrates the importance of breathing exercises on pulmonary functions.

VAS is the most effective method in the assessment of pain and stiffness in AS (16). Studies evaluating the effectiveness of exercise on pain report different results. Kraag and colleagues found no significant difference between treatment group and control group after 4 months of exercise [17]. A small but significant difference in favor of the treatment group was found in the Sweeney study [18]. The Lim study found a significant improvement in VAS in the treatment group [19]. Uhrin, et al. concluded that exercise without supervision work to reduce pain and stiffness, back exercises improve pain level and function and the exercises should be done at least 5 days a week for 30 minutes to maintain the health status [20]. In our study, VAS values we evaluated during activity, nighttime and rest showed significant improvement in the group that did breathing and posture exercises, while VAS values during activity only showed a significant improvement in the group that did posture exercises and there was no significant improvement in other parameters. Therefore this suggests that the breathing exercises done with posture exercises have a positive effect on the pain level.

Santos et al. looked at the effect of weekly exercise amount on disease activity and function of the disease, they divided the patients as in group 1 (2-4 hours per week), group 2 (10 hours per week), group 3 (no exercise). The majority did 2-4 hours exercise/week. The group that did intense exercise showed increase in function but no change in disease activity. Medium intensity exercise group however, showed increase in function and decrease in disease activity. They concluded that the success of the study was a result of the continuity of treatment rather than the amount of the exercise, believing in the benefit of exercise and education [21].

The randomized controlled study done by Sweeney et al., examined the effectiveness of the home exercise program, they divided the patients into a treatment group with 155 patients (n=75) and control group (n = 80) . The treatment group patients were given an exercise video, exercise monitoring card and patient education booklet. While there was no difference in the initial measures of the two groups, the BASFI, BASDAI, and BAS-G outcome measurements at the end of 6 months showed statistically significant improvement [18]. Karatepe et al. reported that the AS patients assigned a home exercise program showed significant improvement in their BASFI, BASMI, BASDAI scores and stopped using non-steroidal anti-inflammatory drugs [22]. Karapolat et al. study divided 41 patients into two groups as group therapy and home exercise group. After the six-week exercise program BASMI, BASFI, BASDAI, NHP were determined as the outcome measures. In both groups, BASMI, BASDAI, NHP subscales showed significant improvement emotionally and in pain levels. There was no statistically significant difference between the two groups. In conclusion both treatments were found effective in improving the symptoms of patients with AS, increasing mobility and quality of life; the home exercise program being less expensive and easily applicable was found as a must to take place in the treatment of AS [23].

In our study, the breathing and posture exercises group exercised for 2.5 hours per week and after 12 weeks of treatment, significant improvement was observed in BASFI, BASMI and BASDAI values. Therefore, the breathing exercises done along with posture exercises have a positive impact on disease activity and functional status of patients.

The occurence of various factors such as pain, restricted motion, loss of function and wellbeing, during the natural course of AS, suggests that the disease has negative effects the quality of life. Quality of life scales objectively reveal the effects of disease on individuals [24]. We used the more AS specific ASQoL scale [25] and observed a significant improvement in ASQoL values in the group with breathing and posture exercises. Though the posture exercise group showed improvement compared to the control group, this change was not statistically significant. In the study that they reviewed a group of 30 patients who exercised regularly and a group of 38 patients who lived a sedentary life, HJ Lim et al., reported the regular exercise group expressed significantly lower pain levels, high levels of family support and quality of life [19].

As a result, exercise programs beyond medical treatment are known to be of great importance in the treatment of AS patients. As well as the routine exercises designed towards axial skeletal involvement, breathing exercises that will improve the functions of the respiratory system need to be developed. The main target for the patient is to achieve the highest possible functional capacity, despite the impairment in respiratory function. These programs should be arranged to include breathing and posture exercises. The individualized comprehensive rehabilitation program developed after determining the status of the respiratory function of patients will result in increasing the quality of life for patients.

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