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Determining the relationship of kinesiophobia with respiratory functions and functional capacity in ankylosing spondylitis

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Abstract

Ankylosing spondylitis (AS) is a common inflammatory rheumatic disease that affects the axial skeleton, causes inflammatory lower back pain, and structural and functional disorders, which affect quality of life negatively.

The purpose of this study is to investigate the effects of kinesiophobia in AS on pulmonary function tests (PFTs) and functional performance.

Thirty-one individuals with AS (n = 19 male, n = 12 female) who were suitable on the basis of the Modified New York (MNY) criteria were included in the study. The participants were given the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), the Bath Ankylosing Spondylitis Functional Index (BASFI), the Bath Ankylosing Spondylitis Metrology Index (BASMI), in addition to the Tampa Scale for Kinesiophobia (TKS), PFTs, respiratory muscle strength, pain evaluation, and 6-minute walking test (6MWT).

The mean values were found as the following: TKS, 41.65 ± 7.59; pain visual analog scale (VAS) score, 6.23 ± 2.86; forced vital capacity (%) (FVC), 75.35% ± 17.92%; forced expiratory volume in first second (%) (FEV1), 73.45% ± 17.20%; FEV1/FVC (%), 75.58% ± 15.99%; peak expiratory flow (%) (PEF), 54,90% ± 20.21%; forced expiratory flow at 25% to 75% (FEF25–75), 77.71% ± 27.05%; maximal inspiratory pressure (MIP), 62.06 ± 31.68; maximal expiratory pressure (MEP), 95.94 ± 36.60; 6MWT, 445.88 ± 99.48. The scores obtained in TKS were found related to the values of FVC (%), FEV1 (%), chest expansion, BASFI, modified Schober test, lumbar lateral flexion, cervical rotation, and total BASMI score ($r = -0.43$, -0.36, -0.41, 0.42, -0.49, -0.56, -0.52, 0.56, respectively; $P < .05$).

Kinesiophobia is a condition that may arise in individuals with AS, which has negative effects. Physiotherapists have a responsibility to eliminate kinesiophobia beliefs and prefer therapy method in line with this responsibility.

Abbreviations: 6MWT = 6-Minute Walking Test, AS = ankylosing spondylitis, BASDAI = Bath Ankylosing Spondylitis Disease Activity Index, BASFI = Bath Ankylosing Spondylitis Functional Index, BASMI = Bath Ankylosing Spondylitis Metrology Index, BMI = body mass index, FEF25–75 = Forced Expiratory Flow at 25–75%, FEV1 = forced expiratory volume in first second, FVC = forced vital capacity, MEP = maximal expiratory pressure, MIP = maximal inspiratory pressure, MNY = Modified New York Criteria, PEF = peak expiratory flow, PFT = pulmonary function test, TKS = Tampa Scale for Kinesiophobia, TRNC = Turkish Republic of Northern Cyprus, VAS = visual analog scale.

Keywords: ankylosing spondylitis, functional capacity, kinesiophobia, pulmonary function test

1. Introduction

Ankylosing spondylitis (AS), which is the most frequently seen disease among the spondyloarthropathy group, is a common inflammatory rheumatic disease that affects the axial skeleton, causes inflammatory low back pain, structural and functional disorders that affect quality of life negatively.[1] The spinal inflammation caused by the disease gradually leads to fusion and ossification in thoracic vertebrae and costovertebral joints, and in some individuals, causes an increase in dorsal kyphosis, thorax rigidity, permanent immobility in rib cage and occurrence of syndesmophyte, as well as reducing spinal mobility.[2–4]

Progressive inflammation in the vertebral column also affects thorax and bone ankylosis in thoracic joints causes a mechanical limitation, decrease of lung volume by aching, rigidity, and reduction of thorax's capacity to expand, and thus, the work load of diaphragm in respiration increases.[5] Pulmonary function tests (PFTs) are primary methods to analyze influences on respiration in individuals with AS, and the effects of the disease on respiration are revealed as a result of measurements.[3]

Studies on the biopsychosocial approach have shown the relationship between disability and chronic pain. Pain and pain-related disability will affect individuals biologically, psychologically, and socially. Fordyce et al showed that pain-related behavior causes learning of avoidance. Individuals are not able to sustain the activities that they believe will increase their pain for a long time. Avoidance of long-duration movements leads to reduction in motor activities due to physical (incapacity syndrome as a result of loss of mobility and muscle strength) and psychological (depression and loss of self-esteem) factors. In addition, fear of movement and physical activity will develop and

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kinesiophobia will be seen. This situation, which arises especially in individuals with chronic lower back pain, negatively affects the functions of the patients. Reduction of physical performance is seen in individuals with chronic low back pain due to the decrease in physical activity with kinesiophobia.[6] Although there are a number of studies examining the negative effects of kinesophobia on individuals with chronic low back pain, there are not enough studies to study the effects of kinesophobia in AS.

The negative effects of AS on patients and kinesiophobia seen in individuals with chronic low back pain shaped the objectives of our study. In this regard, our aim is to associate respiratory functions and functional capacity with kinesiophobia in AS individuals.

2. Methods

Our study received the approval of Eastern Mediterranean University Ethics Board for Scientific Research and Publication (dated June 20, 2016 and numbered 2016/29-01).

2.1. Patients

The study included individuals living in the Turkish Republic of Northern Cyprus (TRNC) diagnosed with AS by a rheumatologist based on the Modified New York (MNY) criteria who volunteered for the study and signed the informed consent form. To include individuals in the study, they had to be between the ages of 20 and 70 years, not have received physiotherapy and rehabilitation in the last 6 months, not have a diagnosed or experienced respiratory system disease, and not have a cardiovascular disease where implementation of a 6-minute walking test would create contraindications. Patients with a history of musculoskeletal disease along with AS and patients with unstable angina and an old case of myocardial infarction in the last month were excluded from the study.

2.2. Outcomes

Patients were asked about their demographic characteristics, level of education, term of the disease, and their status on smoking. Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) was used to determine the levels of disease activities. Research on BASDAI validity in Turkish was conducted by Akkoc et al.[7,8] Bath Ankylosing Spondylitis Functional Index (BASFI) was used on individuals with AS in order to determine the functional capacity. Research on BASFI validity in Turkey was conducted by Yanık et al.[7,9] Bath Ankylosing Spondylitis Metrology Index (BASMI) was used to analyze the axial mobility of patients with AS. In this index, tragus-wall distance, lumber lateral flexion, modified Schober test, cervical rotation, intermalleolar distance measurements were made.[7]

Ten-centimeter visual analog scale (VAS) was used to determine the intensity of the general pain in individuals' vertebral column and hips. In VAS, 0 means "no pain," while 10 means "unbearable pain."

The Tampa Scale for Kinesiophobia (TKS) developed by Kori et al, which consists of 17 questions, was used in order to analyze kinesiophobia. High score in this scale in an indicator of increased kinesiophobia.[6,10] Research on TKS validity in Turkish was conducted by Tunca Yılmaz et al.[11]

In order to measure the capacity of thorax to contract and expand during ventilation, the circumference of individuals' chests was measured in units of centimeters on the fourth intercostal space in normal ventilation, deep inspiration, and deep expiration while they were standing and their hands were fixed on the cervical region.

A spirometer branded Futuremed Discovery 2 was used to measure the volume and capacity of lungs. While the patients were sitting on a chair with back support, forced vital capacity (FVC), forced expiration volume on the first second (FEV1), FEV1/FVC, peak expiratory flow (PEF), and average forced expiratory flow (FEF25–75) measurements were made on the basis of the criteria indicated by American Thoracic Society/ American Thoracic Society (ATS/ERS).[12]

In order to measure the strength of respiratory muscles, we measured the in-mouth pressure by a device during forced expiration and inspiration. We used the device branded Carefusion Micro RPM (BD Corporation, San Diego, CA) to measure the values of maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP). Measurements were made on the basis of ATS/ERS criteria. MIP measurement was made at the residual volume. In this method, although individuals are sitting on a chair, a clamp is fixed to the nose to prevent respiration. After removing all breath to reach the residual volume, individuals put the device in the mouth and make an inspiration as strongly as possible.[13]

MEP measurement is made in a similar way to MIP. The measurement is made when the individual reaches total lung capacity, that is, the individual exhales as strongly as possible after taking a deep breath. All measurements are repeated at least 3 times so that the difference between measurements is lower than 20%. The unit of measurement is cm/H_2O and the highest value of measurement is used as the test results.[13]

6-Minute walking test (6MWT) was used to analyze functional capacity. 6MWT is a practical test that can be implemented easily on submaximal effort level. The test is implemented in a straight enclosed environment designated by cones on a track of 30 m of length, which is not slippery and not containing material that would obstruct the individual. With the command "start," the individual walks on the track on a self-adjusted fast speed for 6 minutes. At the end of the 6 minutes, they stop with the command "stop," and they are given a chair in the stopping point to rest. The distance covered by the individual in 6 minutes is calculated in units of meters and recorded.[14]

2.3. Statistical analysis

The data obtained by tests and scales in our study were transferred to the digital environment and analyzed using the SPSS statistical software for Windows, version 21.0 (IBM Corporation, INC. Somers, NY).

The survey and test results of the individuals with AS in the study were analyzed by calculating frequencies, lowest and highest values, and 95% confidence intervals. In addition, Pearson correlation analysis was used to determine the correlations between 2 quantitative variables.

3. Results

A total of 31 individuals between the ages of 20 and 70 years with AS living in TRNC were included in the study. About 61.29% were male and 38.71% were female in the study. About 22.58% were elementary school graduates, 41.94% were high school graduates, and 35.48% had undergraduate/graduate degrees. While 58.06% individuals were nonsmokers, 41.94% were smokers (Table 1). The mean age of the individuals was 47.42 ±

Table 1

Characteristic features of patients.

	N	%
Sex		
Male	19	61.29
Female	12	38.71
Education		
Elementary school	7	22.58
High school	13	41.94
Undergraduate/Graduate	11	35.48
Smoking		
Nonsmokers	18	58.06
Smokers	13	41.94
Total	31	100.00

14.03 years, the mean height was 1.66 ± 0.09 m, the mean weight was 69.47 ± 15.28 kg, and the mean body mass index (BMI) was 25.36 ± 5.79 kg/m^2 (Table 2).

The participants' mean term of disease was 21.35 ± 13.20 years, mean BASDAI score was 4.34 ± 1.91, and mean BASFI score was 3.70 ± 2.73. Considering the tests included in BASMI, the mean modified Schober test score was 2.76 ± 1.75 cm, the mean intermalleolar distance was 81.27 ± 32.32 cm, the mean lumbar lateral flexion was 9.56 ± 5.59 cm, the mean tragus-wall distance was 19.38 ± 4.97 cm, and the mean cervical rotation was 52.03° ± 17.51°. The mean score obtained from BASMI was 4.67 ± 1.89 (Table 2).

The mean pain score obtained by VAS used to analyze pain in individuals was 6.23 ± 2.86, and the mean score in TKS used to determine kinesiophobia was 41.65 ± 7.59. The mean value of chest expansion was found as 4.66 ± 1.71 cm. The mean FVC (%), the mean FEV1/FVC (%) was 75.58% ± 15.99, the mean PEF (%) was 54.90% ± 20.21, and the mean FEF25–75 (%) was 77.71% ± 27.05. The mean MIP value of the participants was found as 62.06 ± 31.68 cm/H_2O, while the mean MEP value was found as 95.94 ± 36.60 cm/H_2O. The 6MWT results of the participants with AS had a mean of 445.88 ± 99.48 m (Table 3).

Table 2

Demographic data of patients.

	$\bar{x} \pm s$ (95 CI)
Age, y	47.42 ± 14.03 42.27–52.57
Height, m	1.66 ± 0.09 1.62–1.69
Body weight, kg	69.47 ± 15.28 63.86–75.07
BMI, kg/m^2	25.36 ± 5.79 23.23–27.48
Disease duration, y	21.35 ± 13.20 16.51–26.20
BASDAI	4.34 ± 1.91 3.63–5.04
BASFI	3.70 ± 2.73 2.69–4.70
BASMI	
Modified Schober test, cm	2.76 ± 1.75 2.12–3.40
Intermalleolar distance, cm	81.27 ± 32.32 69.42–93.13
Lumbar lateral flexion, cm	9.56 ± 5.59 7.51–11.61
Tragus–Wall distance, cm	19.38 ± 4.97 17.56–21.20
Cervical rotation, °	52.03 ± 17.51 23.58
Total score	4.67 ± 1.89 3.98–5.37

BASDAI = Bath Ankylosing Spondylitis Disease Index, BASFI = Bath Ankylosing Spondylitis Functional Index, BASMI = Bath Ankylosing Spondylitis Metrology Index, BMI = body mass index, CI = confidence interval.

Table 3

Outcome measures results.

	$\bar{x} \pm s$ 95% CI
Pain (VAS) score	6.23 ± 2.86 5.18–7.21
TKS score	41.65 ± 7.59 38.86–44.43
6MWT, m	445.88 ± 99.48 409.39–482.37
Chest expansion, cm	4.66 ± 1.71 4.03–5.29
FVC (%)	75.35 ± 17.92 68.78–81.93
FEV1 (%)	73.45 ± 17.20 67.14–79.76
FEV1/FVC (%)	75.58 ± 15.99 69.72–81.45
PEF (%)	54.90 ± 20.21 47.49–62.32
FEF25–75 (%)	77.71 ± 27.05 67.79–87.63
MIP, cm/H_2O	62.06 ± 31.68 50.45–73.68
MEP, cm/H_2O	95.94 ± 36.60 82.51–109.36

6MWT = 6-minute walk test, FEF25–75 = forced expirator flow in 25–75, FEV1 = forced expiratory volume in 1 second, FVC = forced vital scale, MEP = maximal expiratory pressure, MIP = maximal inspiratory pressure, PEF = peak expiratory capacity, PEF = peak expiratory flow 25–75, TKS = Tampa Kinesiophobia Scale, VAS = visual analog scale.

A negative low-level relationship was found between the TKS scores of participants and their FVC (%), FEV1 (%), and chest expansion values ($r = -0.43$, $r = -0.36$, $r = -0.41$, respectively; $P < .05$). No significant relationship was found between the TKS sores of participants and their FEV1/FVC (%), PEF (%), FEF25–75 (%), MIP, MEP, and 6MWT values ($P > .05$). No significant relationship was found between BASDAI and TKS ($P > .05$). A positive low-level relationship was found between BASFI and TKS scores ($r = 0.42$; $P < .05$). Considering the relationship between BASMI and TKS, TKS had a low-level relationship with modified Schober test, and mid-level relationship with lumbar lateral flexion and cervical rotation values ($r = -0.49$, $r = -0.56$, $r = -0.52$; $P < .05$, respectively). There was a mid-level positive relationship between the BASMI score and TKS ($r = 0.56$; $P < .05$), while no relationship was found between TKS and intermalleolar distance, tragus to wall distance ($P > .05$) (Table 4, Fig. 1).

4. Discussion

AS is a progressive rheumatic disease with a course of spinal, peripheral, and systemic signs in addition to chronic inflammation and pain. The disease may develop negative effects on individuals' functions and quality of life.[15] Kinesiophobia is a condition that started to be understood in the last 2 decades

Table 4

Correlation analyses of TKS.

	TKS (r)
FVC (%)	−0.43*
FEV1 (%)	−0.36*
FEV1/FVC (%)	−0.22
PEF (%)	−0.26
FEF25–75 (%)	−0.20
Chest expansion, cm	−0.41*
MIP, cm/H_2O	−0.02
MEP, cm/H_2O	0.12
6MWT, m	−0.24
BASDAI	0.09
BASFI	0.42*
BASMI	
Modified Schober test, cm	−0.49*
Intermalleolar distance, cm	−0.09
Lumbar lateral flexion, cm	−0.56*
Tragus–Wall distance, cm	0.21
Cervical rotation, °	−0.52*
Total score	0.56*

6MWT = 6-minute walk test, FEF25–75 = forced expiratory flow in 25–75, FEV1 = forced expiratory volume in 1 second, FVC = forced vital scale, MEP = maximal expiratory pressure, MIP = maximal inspiratory pressure, PEF = peak expiratory capacity, TKS = Tampa Kinesiophobia scale.
* $P < 05$, Pearson correlation test.

whose effect mechanisms on individuals are explained by biopsychosocial structures. Avoidance of physical movement developing due to pain and kinesiophobia with fear of repeated injury lead individuals to an inactive life.[16] Kinesiophobia, which may arise in AS, is a factor that will increase the negative influence of the disease.

BASDAI, which is a scale based on self-reporting, investigates the pain in hips and spinal region, and pain, swelling, and sensitivity in peripheral joints.[17,18] The mean BASDAI score of the participants in our study was 4.34, and if we generalize, it is understood that their disease levels were active. As a result of BASFI, which we used to understand how difficult or easy the activities individuals meet or will meet during their daily lives are, it was found that the individuals did not experience restrictions in daily activities.[18] Although the disease activities of our participants were on a high level, it was seen that they were not experiencing restrictions of functionality yet. As the mean age of the participants was not high and most of them were working, BASFI values were not affected despite high levels of disease activity. In our study, we aimed to learn about axial movement levels in individuals with AS using BASMI. Considering the mean score obtained, we found that the participants with AS has a mid-level loss of axial rotation.

Pain, which has an important place in rheumatic diseases, arises from inflammation and continues chronically. The pain in AS affects peripheral joints, and on the basis of the localization of inflammation, it mostly influences the sacroiliac joint and the entire spinal column. The place of pain in AS is also included in MNY criteria, while it affects the lives of patients directly. As this pain is caused completely by the inflammatory process, patients always have this pain.[5,19–21] Because of the nature of inflammatory pain, it increases in a resting position and tends to decrease with exercise or physical activity. The high pain values found for participants with AS was found similar to those in other studies in this field.[19–21] Although organizing physiotherapy and rehabilitation programs for individuals with AS, their pain levels should also be considered.

Although there are many studies on kinesiophobia with especially individuals with low back pain, no study was found regarding AS, where pain is among the general symptoms. Therefore, our study is significant in terms of investigating

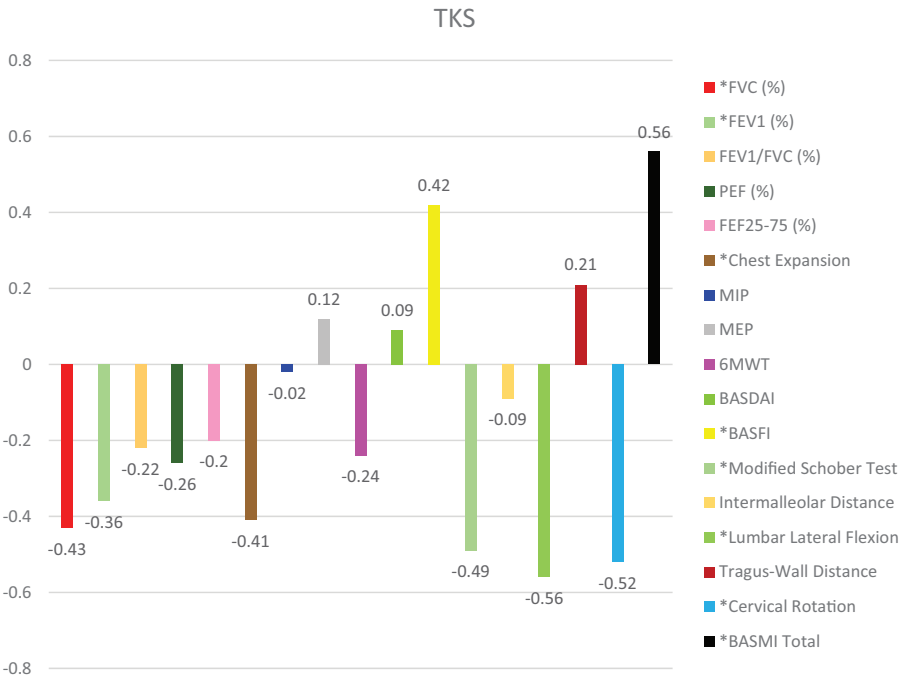

Figure 1. Figure indicates the Pearson correlation test result between TKS and pulmonary function test, respiratory muscle strength, functional capacity, and BATH indices. * indicates statistical significance; negative results shows negative correlations and positive results show positive correlations. 6MWT = 6-minute walk test, BASDAI = Bath Ankylosing Spondylitis Disease Index, BASFI = Bath Ankylosing Spondylitis Functional Index, BASMI = Bath Ankylosing Spondylitis Metrology Index, FEF25–75 = forced expiratory flow in 25–75, FEV1 = forced expiratory volume in 1 second, FVC = forced vital scale, MEP = Maximal Expiratory Pressure, MIP = maximal inspiratory pressure, PEF = peak expiratory capacity, TKS = Tampa Kinesiophobia Scale.

kinesiophobia in AS and its effects on functions. The TKS scores used to analyze existence of kinesiophobia in our participants, with a mean of 41.65 ± 7.59, showed that there was a high belief of kinesiophobia. In kinesiophobia, individuals tend to avoid physical movement because of pain. Our think, kinesiophobia is seen in individuals with AS due to the high magnitude, chronic, and inflammatory nature of pain.

Thorax mobility of individuals should be above a certain level for healthy respiration. The progressive inflammation in the vertebral column also affects thorax and leads to reduction of forwards-backwards mobility. Due to this effect, a restrictive-type respiratory deformity arises in AS and reductions in respiratory parameters are seen in comparison to healthy individuals.[5] A very important method for analyzing effects on respiration in patients with AS is PFT, and it was reported that analyzed patients were given PFT analyses in ratios changing between 20% and 57%.[3] The studies on AS in the literature found that there is a reduction in chest expansion in comparison to healthy individuals, FVC and FEV1 values decrease, and FEV1/FVC does not change. A negative relationship was found between chest expansion, which is a factor related to respiration, and FVC and FEV1 values.[22–27] In addition to the indicator of obstruction FEV1, PEF and FEF25–75 values are also valuable to reveal obstruction in early stages.[12] In addition to FEV1, reductions in PEF, which is an indicator of air flow in large airways, and FEF25–75, which is used to analyze air flow in medium and small airways, also show that obstruction has developed in individuals with AS.

Reduction in respiration muscle strength shows symptoms such as dyspnea and quick exhaustion. Respiratory muscle strength is another parameter affected in individuals with AS. The MIP and MEP values found in the study were lower than those in the studies conducted with the aim of developing reference values for these variables.[28–30]

Determining functional capacity has the purpose of deciding on the intensity and capacity of the exercise to be organized for individuals.[11] 6MWT was used in our study to determine the functional capacity of the participants. Casanova et al[31] found the distance covered in 6MWT by healthy individuals as 571 ± 90 m. The mean 6MWT result found in our study is well below this value.[31] The reason for lowered functional capacity in AS is the loss of mobility due to deformities in the musculoskeletal system.

The fear that physical activity may cause pain as a result of kinesiophobia in individuals will cause a decrease in muscular strength and functional activities in the ability to move in long term.[6,10,16,32] In our study, we found a significant relationship of TKS with BASFI, modified Schober test, lumbar lateral flexion, cervical rotation, and BASMI scores ($P < .05$). This relationship shows that increase in kinesiophobia decreased the functionality and movement capacity of individuals. We are presuming that kinesiophobia leads to negative outcomes such as avoidance of movement and reduction of physical mobility. We did not find a relationship between TKS and BASDAI ($P > .05$). We think that lack of correlation between these 2 scales was caused by the content of BASDAI. Although there are 5 different types of questions in BASDAI, there is no question that investigates physical activity. Lack of a significant relationship between the 2 scales may have been caused by the fact that TKS contains questions regarding physical activity. As a result of literature review, we found 1 study on the relationship between respiratory functions and kinesiophobia. While the study analyzed the changes in respiratory functions in individuals with chronic neck pain, it showed that VC, ERV, FVC, and maximal voluntary ventilation parameters were lower in individuals with neck pain, and considering the relationship between TKS and the decrease in the parameters, they found that it was negatively related to VC and maximal voluntary ventilation, and not related to the PEF value.[33] No study was found to be investigating the relationship between kinesiophobia and respiratory functions in individuals with AS.

In our study, we found a negative relationship between TKS and FVC in individuals with AS, and no relationship between TKS and PEF. Although respiratory functions have a continuous trend of decrease in individuals with AS, we think that the reduction in respiratory functions will continue even further as a result of avoidance of physical movement caused by kinesiophobia, and it will be effective in the emergence of restriction by increase in the TKS score as a result of this relationship and the FVC estimated percentage falling below 80%. As in the case of FVC, the relationship between FEV1 and TKS is in the negative direction, and by increase of TKS and decrease of FEV1, which is a sign of obstruction, we think the reduction of the air given in the first second of expiration causes obstruction. As the respiratory functions start to be affected in individuals with AS with the first stages of the disease, patients should be directed to physiotherapy and rehabilitation programs in early stages and all signs should be kept in mind for organizing the physiotherapy program. In addition, there is a necessity of long-term studies investigating the effects of various exercise trainings on kinesiophobia and respiratory functions. It was reported in various studies on exercise intolerance developing in AS that reduction of respiratory functions and respiratory muscle strength is an important factor in development of intolerance.[3,25,34–36]

Our study did not find a significant relationship between TKS values and values of MIP, MEP, and 6MWT ($P > .05$). In a study on individuals with chronic neck pain, MIP and MEP values were found related to TKS.[37] While the reduction of respiratory function in individuals with AS was found related to TKS in our study, we do not think that the reduction of respiratory muscle strength will have enough effect on development of kinesiophobia. In the study by Doury-Panchout et al[38] on the effects of kinesiophobia on patients with osteoarthritis who had total knee arthroplasty surgery, it was shown that 6MWT and TKS were correlated and kinesiophobia has effects on functional capacity. The participants in our study and those in the study by Doury-Panchout et al[38] had different diseases. In addition, due to the difficulty we had in finding individuals with AS to participate in our study, we were not able to group the participants in any way. We think the lack of a significant relationship between TKS and 6MWT was caused by our participants' different stages of progress of the disease. Measuring maximal oxygen consumption by running more complicated tests such as Bruce, modified Bruce, and similar tests to investigate the effects of kinesiophobia on exercise capacity and exercise intolerance may create more accurate results in this matter.

We experienced various limitations in our study, where we investigated the effects of kinesiophobia on functions. We had to keep the age interval wide in the inclusion criteria for individuals with AS, as their population has not been determined in TRNC and they are a small group of people. We observed that the differences of the term of the disease among participants were high, as a result of keeping the age interval wide. Another limitation in our study was the high differences of BASDAI values among participants, which prevented us from categorizing the participants in certain score intervals.

Kinesiophobia is a condition that may arise in AS. We showed the effects of this negative belief on functions with tendency to

decrease in individuals such as respiratory functions, chest expansion, functions used frequently in daily life, and axial mobility. This result shows that the losses of individuals due to the disease will be even more severe with kinesiophobia, and the exercise programs organized for individuals with AS should consider kinesiophobia in terms of physiotherapy and rehabilitation, and prefer exercised where the individual will be more active.

References

[1] Martins NA, Furtado GE, Campos MJ, et al. Exercise and ankylosing spondylitis with New York modified criteria: a systematic review of controlled trials with meta-analysis. Acta Reumatol Port 2014;39: 298–308.

[2] Turan Y, Duruöz MT. Osteoporosis in patients with ankylosing spondylitis. Turk J Osteoporos 2007;13:83–7.

[3] Berdal G, Halvorsen S, Heijde D, et al. Restrictive pulmonary function is more prevalent in patients with ankylosing spondylitis than in matched population controls and is associated with impaired spinal mobility: a comparative study. Arthritis Res Ther 2012;14:R19.

[4] Hyungpil C, Taikon K, Tae-Hwan K, et al. Spinal mobility, vertebral squaring, pulmonary function, pain, fatigue, and quality of life in patients with ankylosing spondylitis. Ann Rehabil Med 2013;37: 675–82.

[5] van der Horst-Bruinsma IE. van Royen BJ, Dijkmans BAC. Clinical aspects of ankylosing spondylitis. Ankylosing Spondylitis Diagnosis and Management Taylor & Francis Group, New York:2006;45–70.

[6] Vlaeyen JW, Kole-Snijders AM, Boeren RG, et al. Fear of movement/(re) injury in chronic low back pain and its relation to behavioral performance. Pain 1995;62:363–72.

[7] Zochling J. Measures of symptoms and disease status in Ankylosing Spondylitis Ankylosing Spondylitis: Disease Activity Score (ASDAS), Ankylosing Spondylitis Quality of Life Scale (ASQoL), Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), Bath Ankylosing Spondylitis Functional Index (BASFI), Bath Ankylosing Spondylitis Global Score (BAS-G), Bath Ankylosing Spondylitis Metrology Index (BASMI), Dougados Functional Index (DFI), and Health Assessment Questionnaire for the Spondylarthropathies (HAQ-S). Arthritis Care Res 2011;63: S47–58.

[8] Akkoc Y, Karatepe AG, Akar S, et al. A Turkish version of the Bath Ankylosing Spondylitis Disease Activity Index: reliability and validity. Rheumatol Int 2005;25:280–4.

[9] Yanik B, Gürsel YK, Kutlay S, et al. Adaptation of the Bath Ankylosing Spondylitis Functional Index to the Turkish population, its reliability and validity: functional assessment in AS. Clin Rheumatol 2005;24:41–7.

[10] Vlaeyen JW, Kole-Snijders AM, Rotteveel AM, et al. The role of fear of movement/(re)injury in pain disability. J Occup Rehabil 1995;5:235–52.

[11] Tunca Yılmaz Ö, Yakut Y, Uygur F, et al. Turkish version of the Tampa scale for kinesiophobia and its test-retest reliability. Turk J Physiother Rehabil 2011;22:44–9.

[12] Miller MR, Hankinson J, Brusasco V, et al. Standardisation of spirometry. Eur Respir J 2005;26:319–38.

[13] American Thoracic Society, European Respiratory SocietyATS/ERS Statement on respiratory muscle testing. Am J Respir Crit Care Med 2002;166:518–624.

[14] ATS Board of DirectorsATS statement: guidelines for the six-minute walk test. Am J Respir Crit Care Med 2002;166:111–7.

[15] Braun J, Sieper J. Ankylosing spondylitis. Lancet 2007;369:1379–90.

[16] Crombez G, Eccleston C, Van Damme S, et al. Fear-avoidance model of chronic pain: the next generation. Clin J Pain 2012;28:475–83.

[17] Danve A, Reddy A, Vakil-Gilani K, et al. Routine Assessment of Patient Index Data 3 Score (RAPID3) correlates well with Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) in the assessment of disease activity and monitoring progression of axial spondyloarthritis. Clin Rheumatol 2015;34:117–24.

[18] Hsieh LF, Chuang CC, Tseng CS, et al. Combined home exercise is more effective than range-of-motion home exercise in patients with ankylosing spondylitis: a randomized controlled trial. Biomed Res Int 2014;2014: 398190.

[19] Baysal O, Durmuş B, Ersoy Y, et al. Relationship between psychological status and disease activity and quality of life in ankylosing spondylitis. Rheumatol Int 2011;31:795–800.

[20] van der Heijde D, Breban M, Halter D, et al. Maintenance of improvement in spinal mobility, physical function and quality of life in patients with ankylosing spondylitis after 5 years in a clinical trial of adalimumab. Rheumatology 2015;54:1210–9.

[21] Dagfinrud H, Vollestad NK, Loge JH, et al. Fatigue in patients with ankylosing spondylitis: a comparison with the general population and associations with clinical and self-reported measures. Arthritis Rheum 2005;53:5–11.

[22] Dinçer Ü, Çakar E, Kıralp MZ, et al. The pulmonary involvement in rheumatic diseases: pulmonary effects of ankylosing spondylitis and its impact on functionality of and quality of life. Tohoku J Exp Med 2007;212:423–30.

[23] Durmuş D, Alayli G, Uzun O, et al. Effects of two exercise interventions on pulmonary functions in the patients with ankylosing spondylitis. Joint Bone Spine 2009;76:150–5.

[24] Şahin G, Calikoğlu M, Ozge C, et al. Respiratory muscle strength but not BASFI score relates to diminished chest expansion in ankylosing spondylitis. Clin Rheumatol 2004;23:199–202.

[25] Hsieh LF, Wei JC, Lee HY, et al. Aerobic capacity and its correlates in patients with ankylosing spondylitis. Int J Rheum Dis 2014;19:490–9.

[26] Durmuş D, Altay F, Uzun O, et al. Relation between clinical parameters and pulmonary function in ankylosing spondylitis. Turk J Rheumatol 2009;24:178–82.

[27] Seçkin U, Bölükbaşı N, Gürsel G, et al. Relationship between pulmonary function and exercise tolerance in patients with ankylosing spondylitis. Clin Exp Rheumatol 2000;18:503–6.

[28] Leech JA, Ghezzo H, Stevens D, et al. Respiratory pressures and function in young adults. Am Rev Respir Dis 1983;128:17–23.

[29] Wilson SH, Cooke NT, Edwards RHT, et al. Predicted normal values for maximal respiratory pressures in Caucasian adults and children. Thorax 1984;39:535–8.

[30] Vincken W, Ghezzo H, Cosio MG. Maximal static respiratory pressure in adults: normal values and their relationship to determinants of respiratory function. Bull Eur Physiopathol Respir 1987;23:435–9.

[31] Casanova C, Celli BR, Barria P, et al. Six Minute Walk Distance Project (ALAT). The 6-min walk distance in healthy subjects: reference standards from seven countries. Eur Respir J 2011;37:150–6.

[32] Fritz JM, George SZ, Delitto A. The role of fear-avoidance beliefs in acute low back pain: relationships with current and future disability and work status. Pain 2001;94:7–15.

[33] Dimitriadis Z, Kapreli E, Strimpakos N, et al. Pulmonary function of patients with chronic neck pain: a spirometry study. Respir Care 2014;59:543–9.

[34] Ozdemir O, Inanici F, Hasçelik Z. Reduced vital capacity leads to exercise intolerance in patients with ankylosing spondylitis. Eur J Phys Rehabil Med 2011;47:391–7.

[35] van der Esch M, van 't Hul AJ, Heijmans M, et al. Respiratory muscle performance as a possible determinant of exercise capacity in patients with ankylosing spondylitis. Aust J Physiother 2004;50:41–5.

[36] Lubrano E, Spadaro A, Amato G, et al. Tumour necrosis factor alpha inhibitor therapy and rehabilitation for the treatment of ankylosing spondylitis: a systematic review. Semin Arthritis Rheum 2015;44:542–50.

[37] Dimitriadis Z, Kapreli E, Strimpakos N, et al. Respiratory weakness in patients with chronic neck pain. Man Ther 2013;18:248–53.

[38] Doury-Panchout F, Metivier JC, Fouquet B. Kinesiophobia negatively influences recovery of joint function following total knee arthroplasty. Eur J Phys Rehabil Med 2015;51:155–61.