

## ORIGINAL ARTICLE

# The association between kinesiophobia and proprioception, postural stability, activity level, knee function, and quality of life following anterior cruciate ligament reconstruction

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**Purpose:** The purpose of the present study was to determine the relationship between kinesiophobia and proprioception, postural stability, activity level, knee function, and quality of life after anterior cruciate ligament reconstruction.

**Methods:** Thirty-five sedentary men who underwent unilateral arthroscopic anterior cruciate ligament reconstruction with hamstring tendon graft participated in the present study. Medical history, age, gender, height, weight, and body mass index were recorded. Kinesiophobia, proprioception, postural stability, activity level, knee function, and quality of life were measured using with Tampa Scale of Kinesiophobia, Biodex System 4 Pro dynamometer, Pedalo® Sensamove Balance System, Tegner Activity Score, Lysholm Knee Scoring Scale, Anterior Cruciate Ligament Quality of Life, respectively.

**Results:** There was a significant correlation between kinesiophobia degree and activity level ( $p=0.027$ ). No significant correlation was found between kinesiophobia degree and proprioception ( $p=0.095$ ) and postural stability ( $p=0.518$ ). In addition, it was found that kinesiophobia degree was not correlated with knee function ( $p=0.364$ ), and quality of life scores ( $p=0.058$ ).

**Conclusion:** According to our results, kinesiophobia degree was correlated with activity level after anterior cruciate ligament reconstruction. It is recommended that targeting to treat kinesiophobia may be beneficial for the patients those who are physically inactive.

**Keywords:** Anterior cruciate ligament reconstruction, Activity, Outcomes.

## Ön çapraz bağ rekonstrüksiyonu sonrası kinezyofobi ile propriosepsiyon, postürel stabilite, aktivite düzeyi, diz fonksiyonu ve yaşam kalitesi arasındaki ilişki

**Amaç:** Bu çalışmanın amacı, ön çapraz bağ rekonstrüksiyonu sonrasında kinezyofobi ve propriosepsiyon, postürel stabilite, aktivite düzeyi, diz fonksiyonu ve yaşam kalitesi arasındaki ilişkiyi belirlemektir.

**Yöntem:** Bu çalışmaya hamstring tendon grefti ile tek taraflı artroskopik ön çapraz bağ rekonstrüksiyonu yapılan otuz beş sedanter erkek katıldı. Hastaların tıbbi öykü, yaş, cinsiyet, boy, kilo ve vücut kitle indeksi değerleri kaydedildi. Hastaların kinezyofobi, propriosepsiyon, postürel stabilite, aktivite düzeyi, diz fonksiyonu ve yaşam kalitesi değerleri, sırasıyla; Tampa Kinezyofobi Skalası, Biodex Sistem 4 Pro dinamometre, Pedalo® Sensamove Denge Sistemi, Tegner Aktivite Skoru, Lysholm Diz Skorlama Ölçeği ve Ön Çapraz Bağ Yaşam Kalitesi Ölçeği kullanılarak ölçüldü.

**Bulgular:** Hastaların kinezyofobi düzeyi ile aktivite seviyesi arasında kayda değer düzeyde bir korelasyon vardı ( $p=0,027$ ). Kinezyofobi derecesi ve propriosepsiyon ( $p=0,095$ ) ve postürel stabilite ( $p=0,518$ ) arasında anlamlı bir ilişki bulunmadı. Ek olarak, kinezyofobi derecesinin diz fonksiyonu ( $p=0,364$ ) ve yaşam kalitesi skorları ile ilişkili olmadığı bulundu ( $p=0,058$ ).

**Sonuç:** Sonuçlarımızla göre kinezyofobi derecesinin ön çapraz bağ rekonstrüksiyonu sonrası aktivite seviyesi ile ilişkili olduğunu raporlandırabiliriz. Kinezyofobisi yüksek olan hastaların aktivite limitasyonlarını önlemede; kinezyofobinin tedavisini hedeflemenin faydalı olabileceği önerilmektedir.

**Anahtar Kelimeler:** Ön çapraz bağ rekonstrüksiyonu, Aktivite, Çıktılar.



After back complaints, knee injuries are the most frequent problems of the musculoskeletal system reported in primary care. Anterior cruciate ligament (ACL) is the most commonly injured ligament of the knee joint during sport activities.<sup>1</sup>

Anterior cruciate ligament is essential for knee kinematics, especially in rotation, and functions as an anterior/posterior stabilizer.<sup>2</sup> It plays an important role in controlling knee joint stability, not only by limiting tibia anterior translation but also by controlling knee axial rotation and varus movement.<sup>3</sup>

More than 120.000 ACL injuries occur every year in the United States, mostly during the high school and college years.<sup>4</sup> ACL injuries are common in young and active individuals with estimates of injury.<sup>5</sup>

ACL injury may lead to unsatisfactory knee function, swollen knee, decreased activity, and poor knee related quality of life.<sup>6</sup> One of the most common problems following ACL reconstruction is kinesiophobia (fear of movement).

Conservative or surgical treatment is indicated for this instability.<sup>1</sup> The treatment method often includes ACL reconstruction with the aim of restoring the mechanical stability of the knee joint and re-establishing knee function.<sup>7</sup> Reconstructive surgery of ACL is typically recommended to restore the knee joint stability and function after ACL injury.<sup>3</sup>

Despite physical improvements with physiotherapy and rehabilitation program after ACL reconstruction, there are still many individuals who do not return to preinjury level. This may be due to continued knee swelling, weakness on quadriceps, pain. In addition to them, kinesiophobia is one of the significant reasons to prevent patients to return their preinjury levels.<sup>8</sup>

While there is growing evidence to support that kinesiophobia may negatively affect the knee function<sup>8</sup>, there remains a need to further explore this relationship investigating following ACL reconstruction. Furthermore, the association between kinesiophobia and proprioception, postural stability and quality of life remains poorly understood. Thus, the relationships between kinesiophobia and clinical outcomes should be examined.

The purpose of the present study was to determine the relationship between kinesiophobia and proprioception, postural

stability, activity level, knee function, and quality of life after ACL reconstruction. It was hypothesized that greater kinesiophobia is associated with poor level of proprioception, postural stability, activity, knee function, and quality of life.

## METHODS

### Participants

This study was performed in Biomechanics, Performance Analysis and Virtual Rehabilitation Laboratory at Marmara University in May 2015 – October 2017. Thirty-five sedentary men who underwent only unilateral arthroscopic ACL reconstruction with hamstring tendon graft participated in the present study.

The patients with the following conditions were excluded from the study: patients who underwent previous knee surgery or multiple knee surgeries, patients who have mental problems preventing them from assessment, and patients diagnosed with malignancy.

### *Ethics Statement:*

All subjects were informed about the study before the participation in this study and written informed consent was obtained. The ethical approval was obtained from Marmara University Faculty of Medicine Ethics Committee for Clinical Research (Protocol Number: 09.2016.150).

### **Outcome measures**

Medical history, age, gender, height, weight, and body mass index were recorded. The following parameters were measured: kinesiophobia, proprioception, postural stability, activity level, knee function, and quality of life during the first evaluation.

### *Kinesiophobia:*

Kinesiophobia (fear of movement) was determined by using Tampa Scale of Kinesiophobia. According to this scale, total score can be ranged from 17 to 68 points. Higher score represents greater perceived levels of kinesiophobia while lower score shows low fear of movement.<sup>9</sup>

### *Proprioception:*

Proprioception level was recorded by using a Biodex System 4 Pro dynamometer (Biodex Medical Systems 4 Pro, Shirley, New York, USA). Proprioception was tested at 50° degrees of knee flexion as active joint position sense. The

mean and standard deviation of the three trials was reported (Figure 1).<sup>10</sup> All subjects performed the test procedures by covering their eyes with an eye-band in the laboratory with a quiet environment.

All participants sat on the chair in a comfortable position. They were stabilized by a belt across the trunk, pelvis, chest, and hips. All procedures were done according to manufacturer's instructions in their guideline. Before the test, all participants were informed about the procedure of the measurements, and a practice trial was conducted. The referenced angles were demonstrated. The participant was held in this position to learn the reference angle for 10 second. After that, the participant brought the knee to the neutral position back. Then the participant was wanted to reproduce the targeted angle actively with eyes closed.<sup>11</sup>

#### *Postural Stability:*

Postural stability was measured using Pedalo® Sensamove Balance System. It is a wobble board which can be used in balance training, testing and assessment. The device can be used to evaluate the proprioception and reaction time, as well. Higher score presents better level of postural stability (Figure 2).<sup>12</sup>

#### *Activity Level:*

Tegner Activity Score was used to assess the activity level of subjects. The scale is graded numerically according to physical activity. While 0 point is defined as leaving the activity due to injury, 10 points are defined as the professional level of activity at the national team level.<sup>13</sup>

#### *Knee Function:*

Lysholm Knee Scoring Scale was used to assess the knee function of subjects. Lysholm knee scale is an eight-item questionnaire designed to assess knee function following knee ligament injury. This scale ranges between 0 and 100 points. Higher point describes better knee function.<sup>14</sup>

#### *Quality of Life:*

Anterior Cruciate Ligament Quality of Life (ACL-QOL) questionnaire was used to assess the quality of life. The ACL-QOL scale represents a subjective, patient-based and disease-specific questionnaire. The scale consists of five separate items. Higher scores indicate a higher quality of life.<sup>15</sup>

#### **Statistical analysis**

All statistical analyses were performed

using IBM SPSS version 11.5 software (IBM Corporation, USA), with a p value of <0.05 considered statistically significant. All numerical data were expressed as mean  $\pm$  standard deviation.

Shapiro–Wilk test for normality was used for all parameters. Parametric tests were used in the study because all parameters were normally distributed. Analysis was carried out with Pearson's correlation test, and results expressed as “strong” ( $r>0.5$ ), “medium” ( $0.5<r<0.3$ ) or “weak” ( $r<0.3$ ).<sup>16</sup>

## RESULTS

Although 41 patients were screened, 35 patients were eligible in terms of the inclusion criteria assigned to this study. Thirty-five male participants were included in the final analysis. The age of patients ranged between 18 and 41 years. Demographic characteristics, kinesiophobia, proprioception, postural stability, activity level, knee function, and quality of life scores of patients are shown in Table 1.

There was a significant but weak correlation between kinesiophobia degree and activity level ( $r=-0.374$ ,  $p=0.027$ ) (Table 2, Figure 1). No significant correlation was found between kinesiophobia degree and proprioception ( $r=0.287$ ,  $p=0.095$ ), and postural stability ( $r=0.113$ ,  $p=0.518$ ) (Table 2). In addition, it was found that kinesiophobia degree was not correlated to knee function ( $r=-0.158$ ,  $p=0.364$ ), and quality of life scores ( $r=-0.337$ ,  $p=0.058$ ) (Table 2).

## DISCUSSION

There is an increasing tendency to investigate the return to sport or preinjury activity level after ACL reconstruction. One of the most important factors that is becoming increasingly evident as a reason for lack of return to sport or preinjury activity level is kinesiophobia.<sup>17</sup> Although kinesiophobia is considered as a predictive factor of return to sport following ACL reconstruction, the literature which investigates the associations between kinesiophobia with patient outcomes is limited.



Figure 1. Assessing the proprioception level.



Figure 2. Assessing the postural stability level.

Table 1. Demographic and clinical characteristics of the patients (N=35).

	X±SD
Age (years)	28.42±5.91
Weight (kg)	81.91±14.05
Height (cm)	178.45±6.43
Body mass index (kg/m <sup>2</sup> )	25.62±3.57
Time after surgery to evaluation (week)	16.00±12.33
Kinesiophobia (score)	36.54±4.22
Proprioception (degree)	3.35±2.22
Postural stability (score)	70.16±11.21
Activity level (score)	5.89±0.77
Knee function (score)	86.29±11.36
Quality of life (score)	71.68±6.77

Table 2. Association of kinesiophobia with activity level, proprioception, postural stability, knee function, and quality of life (N=35).

	Kinesiophobia r (p)
Activity level	-0.374 (0.027)*
Proprioception	0.287 (0.095)
Postural stability	0.113 (0.518)
Knee function	-0.158 (0.364)
Quality of life	-0.337 (0.058)

\*p<0.05. r: Pearson correlation analysis.

This study investigated whether there is an association between kinesiophobia degree with proprioception, postural stability, activity level, knee function, and quality of life following ACL reconstruction. It was hypothesized that higher kinesiophobia is related to poor level of proprioception, postural stability, activity, knee function, and quality of life. Our findings partially support this hypothesis and suggest that higher kinesiophobia may represent poor activity levels of patients. This was an expected result. It is well established that following ACL reconstruction, a small proportion of patients can return to sport or their preinjury activity level.<sup>18</sup> Kvist et al. investigated whether kinesiophobia is a key factor to return to preinjury activity level following ACL reconstruction.<sup>19</sup> They reported that only 53% of the patients returned to their preinjury activity level. A key finding from their study was that the patients who did not return to their preinjury activity level had greater kinesiophobia and this high kinesiophobia was correlated with low knee-related quality of life.<sup>19</sup> In another study by Gunn et al. it was reported that kinesiophobia could negatively impact activity level of the patients with knee osteoarthritis.<sup>20</sup>

Contrary to our hypothesis, there was no association between kinesiophobia with proprioception, postural stability, knee function, and quality of life after ACL reconstruction. These results were unexpected. It is thought that this result may be due to low or moderate level of kinesiophobia of the patients participated in our study. Mean of kinesiophobia degree of the patients participated in this study was 36.5±4.2 points which is considered to be

low or moderate fear of movement/reinjury level. It is important to note that higher kinesiophobia may be related to patient outcomes. In addition, proprioception was measured at 50° of knee flexion in our study. We had chosen to measure the proprioception at 50° of knee flexion because of functional degree. However, there may be a correlation between kinesiophobia and proprioception at the end angles of the range, especially between 0° and 20° or 110° and 135° of the knee flexion.

Another key finding was that kinesiophobia is not related to postural stability. It is thought that this is a result of the measurement way. In our study, postural stability was measured using with a wobble board which was a measurement way of static balance. However, kinesiophobia which is fear of movement may be related to dynamic balance. Trigsted et al. reported that fear of injury is related to dynamic activity such as jump-landing activities in women after ACL reconstruction.<sup>21</sup>

Another significant result of our study is the association of kinesiophobia and quality of life and functional status. According to our findings, kinesiophobia was not correlated to knee related quality of life and knee function following ACL reconstruction. Most studies on kinesiophobia were generally carried out on chronic neck and low back pain.<sup>21, 23</sup> There is no study investigating the association between kinesiophobia with other clinical measures in patients with ACL reconstruction. In a systematic review, Luque-Suarez et al. investigated the association between kinesiophobia and quality of life in people with chronic musculoskeletal pain.<sup>24</sup> According to this study, the association between kinesiophobia and quality of life was evaluated in eight studies. While a total of three studies showed a significant association between kinesiophobia and quality of life, one study showed no significant association. Finally, four studies showed inconsistency.<sup>24</sup> In addition, the reason that there is no association between kinesiophobia with the other parameters may be the pain. Thus, the patients participated in our study had no pain in the assessment testing. As noted in the definition, kinesiophobia results and develops from the response to previously experienced significantly painful movement.<sup>25</sup>

To our knowledge, this is the first study to investigate the association between

kinesiophobia with proprioception, postural stability, activity level, knee function, and quality of life in individuals with ACL reconstruction. More studies that include more cases, especially women, are needed in order to understand the association between kinesiophobia with patient outcomes following ACL reconstruction.

#### **Limitations**

The current study has certain limitations. First, the main limitation of this study is the lack of power analysis to determine the sample size. Another study limitation of this study is the gender distribution. There are no women participated in our study. Finally, this study was designed as cross-sectional and on a large sample size. Therefore, participating in a treatment program differed between the patients included in this study.

#### **Conclusion**

Identifications of these relationships may help inform physiotherapists as they choose the modalities to target kinesiophobia. According to our findings, it is recommended that targeting to treat kinesiophobia may be beneficial for the patients those who are physically inactive.

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**Ethical Approval:** The protocol of the present study was approved by the European University of Lefke, Institute of Graduate Studies & Research, Ethical Committee (issue: ÜEK/03/02/04/-1617/8 date: 11.04.2017).

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