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Original Article

Kinesiophobia and associated factors in patients with traumatic lower extremity amputation

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ABSTRACT

Objectives: The study aimed to demonstrate the level of kinesiophobia in patients with traumatic lower limb amputation (LLA) and to investigate the correlation between kinesiophobia and associated factors.

Patients and methods: This cross-sectional study included 52 male patients (mean age: 37.8±8.7 years; range, 18 to 65 years) with traumatic LLA between March 2021 and July 2021. Kinesiophobia level was measured with the Tampa Scale for Kinesiophobia. Pain intensity and prosthesis satisfaction were evaluated with the Visual Analog Scale. The Falls Efficacy Scale-International was used for the assessment of fear of falling. The Nottingham Health Profile was used to evaluate the quality of life.

Results: The percentage of the patients with a high level of kinesiophobia was 40.4%. Kinesiophobia was significantly correlated with residual limp pain intensity (r=0.317, p=0.022), the number of falls (r=0.284, p=0.041), fear of falling (r=0.495, p=0.001), and quality of life (r=0.512, p=0.001). No significant correlations between kinesiophobia and intact limb pain intensity, low back pain intensity, or prosthesis satisfaction were detected. Regression analysis showed that the physical activity subscale score of the Nottingham Health Profile was a statistically significant predictor of high kinesiophobia scores.

Conclusion: The findings suggest that limitations in physical activity were independently associated with kinesiophobia in patients with traumatic LLA. Fear and avoidance behaviors, which may limit physical activity, should be considered in the evaluation of individuals with LLA.

Keywords: Amputation, fear of falling, kinesiophobia, pain intensity, quality of life.

Limb amputation is one of the oldest known surgical methods for various clinical indications, including trauma, tumor, peripheral vascular disease, congenital anomalies, and infection.[1,2] Every year, around 185,000 people living in the United States of America (USA) undergo the amputation of a limb. It has been considered that 1.6 million people with limb amputations are living in the USA, and the prevalence of extremity loss has been estimated to reach 3.6 million by 2050.[3]

Studies declare that patients have high pain levels in the manner of residual limb pain (RLP), chronic low back pain (LBP), and phantom limb pain (PLP) after lower limb amputation (LLA), resulting in restrictions in functional activity.[4,5] Patients with high disability and pain levels are at risk of establishing avoidance behaviors.[6] Kinesiophobia, caused by a feeling of susceptibility to painful injury or reinjury, can be described as an illogical, excessive, and unbearable fear of physical activity and movement.[7] It was shown

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that there was a relation between kinesiophobia and lower physical activity levels in people with chronic pain.[8] Consequently, the risk of sedentary lifestyle rises. Inactivity leads to an increase in the risk of not only chronic pain but also other health problems, such as cardiovascular diseases. Furthermore, kinesiophobia is associated with poor treatment results.[9] Kinesiophobia negatively affects rehabilitation processes and exercise programs. The previous studies on several diseases illustrated the importance of kinesiophobia in the clinical course.[10,11]

There is limited research investigating kinesiophobia and the factors related to kinesiophobia in patients with LLA. Therefore, the study aimed to demonstrate the kinesiophobia level in patients with traumatic LLA and investigate the correlation between kinesiophobia and related factors. We hypothesized that pain intensity, prosthesis satisfaction, fear of falling, and quality of life (QoL) were associated with kinesiophobia in these patients.

PATIENTS AND METHODS

The cross-sectional study was conducted at the amputee rehabilitation unit of the Ankara Gaziler Physical Medicine and Rehabilitation Training and Research Hospital between March 2021 and July 2021. Fifty-two male patients (mean age: 37.8±8.7 years; range, 18 to 65 years) with traumatic LLA were included in the study. Inclusion criteria were as follows: *(i)* a period at least six months after amputation, *(ii)* the presence of a prosthesis, *(iii)* and bilateral or unilateral amputation above the ankle level. Exclusion criteria were as follows: *(i)* the presence of a neurological deficit, *(ii)* amputation of an upper limb, *(iii)* and the presence of neurological or musculoskeletal disease that may lead to functional impairment other than amputation. Demographic and clinical features of the participants consisting of age, sex, education, occupation, body mass index, types of prosthesis, duration of amputation, duration of walking with prosthesis per day and use of an assistive device were noted.

Kinesiophobia level was evaluated with the Tampa Scale for Kinesiophobia (TSK).[12] The questionnaire includes 17 items using a 4-point Likert-type scale (1: strongly disagree; 4: strongly agree). Scores more than or equal to 39 are defined as a high kinesiophobia level.[13] The Turkish version of TKS is considered a valid and reliable tool.[14]

The intensity of LBP, intact limb pain, and RLP in the last month were assessed using the Visual Analog Scale (VAS; 0: no pain; 10: most severe pain). The satisfaction of prosthesis (overall), prosthetic foot, and socket system were assessed with VAS (0: dissatisfied; 10: satisfied).

The Falls Efficacy Scale (FES)-International, a self-report questionnaire including 16 items scored on a 4-point scale (1: no fear whatsoever; 4: highest possible fear), was applied to evaluate the falls efficacy under various conditions. It delivers information about the concern level related to falls during 16 activities of daily life. The Turkish validity and reliability of FES-International have been demonstrated. Patients were questioned how many times they had fallen in the last year to identify the number of falls.

The QoL was evaluated with the Nottingham Health Profile (NHP), which contains 38 questions on six different subscales, including pain, fatigue, physical activity, emotional reactions, sleep, and social isolation. Scores varying from 0 to 100 are given to each subscale of NHP, and higher scores demonstrate declines in QoL.[15] To assess health-related QoL in patients with amputation, NHP is considered a reliable scale.[16]

Statistical analysis

The sample size estimation was performed using the G*Power version 3.1 software (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). The sample size to provide 95% power with a 5% probability of type 1 error for an effect size of 0.43 was 52.[17] Data were analyzed using IBM SPSS version 23.0 software (IBM Corp., Armonk, NY, USA). The normality of data distribution was demonstrated by a nonsignificant Kolmogorov-Smirnov test. Categorical variables were presented as percentages (%); continuous variables were stated as means ± standard deviation. The Mann-Whitney U test or independent samples t-test were used to compare groups with low and high kinesiophobia levels. Spearman or Pearson correlation coefficients were used to quantify the relationship between kinesiophobia and associated factors. Logistic regression analysis was performed to identify predictors of low and high kinesiophobia scores. Bivariate analysis was carried out between all possible risk factors (age, education, body mass index, types of prosthesis, duration of amputation, duration of walking with prosthesis per day, VAS score, number of falls, FES score, and NHP score) and low and high kinesiophobia scores. Variables with $p<0.25$ in bivariate analysis were included in the regression analysis. A p value of <0.05 was considered statistically significant with a 95% confidence interval.

RESULTS

The TKS scores were non-normally distributed and ranged from 17 to 52. The percentage of the patients with a high level of kinesiophobia was 40.4%.

TABLE 1
Demographic features of the subjects

Variables	n	%	Mean±SD
Age (year)			37.8±8.7
BMI (kg/m²)			26.2±3.6
Education			
≤High school	12	23.1	
>High school	40	76.9	
Time since amputation (month)			150.5±115.1
Amputation etiology			
Mine	23	44.2	
Explosives	13	25	
Gunshot	13	25	
Rocket	1	1.9	
Car accident	2	3.8	
Amputation side			
Right	25	48.1	
Left	18	34.6	
Bilateral	9	17.3	
Amputation level			
Right	35		
Transfemoral	14	40	
Knee disarticulation	6	17.1	
Transtibial	15	42.8	
Left	26		
Transfemoral	9	34.6	
Knee disarticulation	2	7.6	
Transtibial	15	57.6	
Prosthetic knees	28		
Rheo-3	3	10.7	
Nabco	1	3.5	
Allux	1	3.5	
Plie-2	1	3.5	
Orion-2	1	3.5	
Orion-3	2	7.1	
C-leg-3	2	7.1	
C-leg-4	4	14.2	
Rheo-XC	3	10.7	
Genium	7	25	
Genium-X3	3	10.7	
Prosthetic feet			
Non-articulated dynamic foot	26	50	
Dynamic foot with hydraulic ankle	25	48.1	
Microprocessor	1	1.9	
Duration of walking with prosthesis per day (hour)			13.3±3.2
Walking aid usage			
None	45	86.5	
Single forearm crutch	3	5.8	
Double forearm crutches	4	7.7	

SD: Standard deviation; BMI: body mass index.

Tables 1 and 2 demonstrate the demographic and clinical characteristics of the patients. The comparison of demographic and clinical variables between the groups with low kinesiophobia levels and high kinesiophobia levels is provided in Table 3.

Greater kinesiophobia was significantly correlated with RLP intensity (r=0.317, p=0.022), number of falls (r=0.284, p=0.041), fear of falling (r=0.495, p=0.001), physical activity (r=0.539, p=0.001), pain (r=0.530, p=0.001), fatigue (r=0.372, p=0.007), social isolation (r=0.282, p=0.043), emotional reactions subscale scores of NHP (r=0.438, p=0.001), and total NHP score (r=0.512, p=0.001). There were no significant correlations between kinesiophobia and intact limb pain intensity, LBP intensity, or prosthesis satisfaction (p>0.05; Table 4). Logistic regression analysis revealed that a one-unit increase in physical activity subscale score of NHP creates 1,186 times greater risk of a high kinesiophobia score (Table 5).

TABLE 2
Clinical characteristics of the subjects

Variables	n	%	Mean±SD
Location of pain			
Residual limb	32	61.5	
Intact limb	14	26.9	
Low back	21	40.4	
VAS: LBP (cm)			1.6±2.5
VAS: Intact limb pain (cm)			1.2±2.1
VAS: RLP (cm)			2.7±2.9
VAS: Satisfaction of prosthesis (cm)			6.9±3.0
VAS: Satisfaction of prosthetic foot (cm)			7.1±3.4
VAS: Satisfaction of socket system (cm)			7.6±2.4
Number of falls			1.5±2.1
FES-I			22.7±5.4
TSK			35.1±8.7
Kinesiophobia			
Low	31	59.6	
High	21	40.4	
NHP: Physical activity			15.3±18.7
NHP: Pain			17.5±21.5
NHP: Sleep			10.9±21.1
NHP: Fatigue			23.9±29.5
NHP: Social isolation			8.4±19.2
NHP: Emotional reactions			7.0±14.7
NHP: Total score			82.8±76.3

SD: Standard deviation; VAS: Visual Analog Scale; LPB: Low back pain; RLP: Residual limp pain: FES-I: Falls Efficacy Scale-International; TSK: Tampa Scale for Kinesiophobia; NHP: Nottingham Health Profile;

TABLE 3
Comparison of demographic and clinical variables between the groups with low kinesiophobia level and high kinesiophobia level

	Low-level kinesiophobia (n=31)	High-level kinesiophobia (n=21)	
	Mean±SD	Mean±SD	*p*
Time since amputation (month)	160.9±113.9	135.2±118.0	0.366
Duration of walking with prosthesis per day (hour)	14.1±3.0	12.2±3.2	0.019
VAS: RLP (cm)	2.0±2.7	3.8±3.0	0.017
VAS: Intact limb pain (cm)	1.4±2.4	1.0±1.5	0.976
VAS: LBP (cm)	1.6±2.6	1.7±2.4	0.741
VAS: Satisfaction of socket system (cm)	7.7±2.6	7.5±2.1	0.413
VAS: Satisfaction of prosthetic foot (cm)	7.2±3.4	7.0±3.5	0.736
VAS: Satisfaction of prosthesis (cm)	7.1±3.2	6.6±2.7	0.271
Number of falls	1.3±1.8	1.9±2.4	0.352
FES-I	20.8±4.2	25.6±5.8	0.003
NHP: Physical activity	6.1±8.9	28.9±21.1	0.001
NHP: Pain	11.5±20.0	26.4±20.9	0.001
NHP: Sleep	13.5±25.7	7.1±11.0	0.823
NHP: Fatigue	14.0±19.7	38.5±35.5	0.010
NHP: Social isolation	6.1±15.6	11.7±23.5	0.193
NHP: Emotional reactions	4.6±15.0	10.4±13.7	0.006
NHP: Total score	56.0±62.5	122.2±79.0	0.002

SD: Standard deviation; VAS: Visual Analog Scale; RLP: Residual limb pain; LBP: Low back pain; FES-I: Falls Efficacy Scale-International; NHP: Nottingham Health Profile.

TABLE 4
Correlations between kinesiophobia and demographic and clinical variables

	r	*p*
Time since amputation (month)	0.005	0.973
Duration of walking with prosthesis per day (hour)	-0.249	0.075
VAS: RLP (cm)	0.317*	0.022
VAS: Intact limb pain (cm)	0.089	0.570
VAS: LBP (cm)	0.015	0.918
VAS: Satisfaction of socket system (cm)	-0.121	0.392
VAS: Satisfaction of prosthetic foot (cm)	-0.110	0.437
VAS: Satisfaction of prosthesis (cm)	-0.163	0.247
Number of falls	0.284*	0.041
FES-I	0.495*	0.001
NHP: Physical activity	0.539*	0.001
NHP: Pain	0.530*	0.001
NHP: Sleep	0.061	0.665
NHP: Fatigue	0.372*	0.007
NHP: Social isolation	0.282*	0.043
NHP: Emotional reactions	0.438*	0.001
NHP: Total score	0.512*	0.001

VAS: Visual Analog Scale; RLP: Residual limb pain; LBP: Low back pain; FES-I: Falls Efficacy Scale-International; NHP: Nottingham Health Profile.

TABLE 5
Regression analysis of low and high kinesiophobia scores

					95.0% CI for Exp (B)	
	B	S.E.	*p*	Exp B	Lower	Upper
Duration of prosthesis use	0.093	0.195	0.635	1.097	0.748	1.608
VAS: RLP (cm)	0.392	0.225	0.081	1.481	0.953	2.301
VAS: Satisfaction of prosthesis (cm)	-0.061	0.197	0.759	0.941	0.640	1.384
FES-I	0.135	0.159	0.396	1.144	0.838	1.562
NHP: Pain	0.132	0.089	0.139	1.141	0.958	1.360
NHP: Emotional reactions	0.151	0.116	0.194	1.163	0.926	1.461
NHP: Social isolation	0.086	0.061	0.159	1.090	0.967	1.229
NHP: Physical activity	0.170	0.078	0.030	1.186	1.017	1.383
NHP: Energy	0.091	0.059	0.126	1.095	0.975	1.230
NHP: Total	-0.086	0.060	0.154	0.918	0.816	1.033

CI: Confidence interval; VAS: Visual Analog Scale; RLP: Residual limb pain; FES-I: Falls Efficacy Scale-International; NHP: Nottingham Health Profile.

DISCUSSION

Our study was planned to evaluate the relationship between kinesiophobia and pain intensity, prosthesis satisfaction, number of falls, fear of falling, and QoL in patients with traumatic LLA. The findings demonstrate that the percentage of the patients with a high level of kinesiophobia (TSK ≥39) was 40.4%, and greater kinesiophobia was correlated with higher RLP intensity, a higher number of falls, increased fear of falling, and poorer QoL in these patients.

Altered painful sensations such as RLP and PLP may occur after the amputation of a limb. Postamputation pain is frequent (60-80%) and remains a major clinical challenge in terms of its incidence/prevalence and management.[18] Kinesiophobia may be related to pain and the associated outcomes (QoL and disability) in various ways.[19] First, kinesiophobia changes how people act, likely as the initial target for the avoidance of pain. It leads to modifications in motor behavior, affecting the performance of actions associated with the control and management of pain and pain-associated disability.[20] Second, pain-associated information and pain processing in people with chronic musculoskeletal pain may be related to how kinesiophobia is perceived.[21] Indeed, a higher degree of kinesiophobia predicts higher pain levels.[22] Fear leading to avoidance of activity can lead to physiological impairments, such as decreased strength, mobility, and aerobic capacity.[17]

The prevalence of kinesiophobia has been reported as 53% in acute and chronic musculoskeletal pain conditions.[23,24] Mathis[13] found that 20% of patients with LLA reported high levels of kinesiophobia. The demographic profile of our participants is different from this study. Our study population was younger (mean age of 37.8±8.7 years compared to 48.3±14.8 years), consisted of only male participants (100% compared to 32%), and the etiology was always traumatic (100% compared to 44.2%). The higher rate of kinesiophobia (40.4%) in our study compared to the other study may be due to the demographic profile difference and the higher rate of patients with RLP (61.5% compared to 41.2%) in our study.

The relationship between pain and kinesiophobia was demonstrated in various studies.[25,26] We also identified a significant correlation between kinesiophobia and RLP and the pain subscale score of NHP in patients with traumatic LLA. In a study using multivariable linear regression analysis, kinesiophobia was found to be independently associated with pain catastrophizing and not pain intensity in individuals with LLA.[13] In our regression analysis, the association between kinesiophobia and RLP and the pain subscale score of NHP was also not statistically significant; however, the p value was close to 0.05. Further studies having larger sample sizes are needed to understand whether pain intensity independently affects kinesiophobia in patients with LLA. No significant correlation was detected between

kinesiophobia, the intact limb, and LBP in our study. Butowicz et al.[27] found that kinesiophobia levels of lower limb amputees with and without chronic LBP were similar, but LBP-related disability was moderately associated with kinesiophobia.

It was shown that kinesiophobia had a negative effect on QoL in various diseases and musculoskeletal pain.[28,29] Goldberg et al.[30] stated that kinesiophobia was negatively related to health-related QoL in an outpatient physical therapy setting in patients with a diagnosis associated with musculoskeletal pain. It needs to be emphasized that, to the best of our knowledge, there is no study investigating the relationship between kinesiophobia and QoL in patients with traumatic LLA. Our results demonstrate that kinesiophobia had a negative effect on QoL in patients with traumatic LLA. Moreover, the physical activity subscale score of the NHP was the only significant factor independently predicting kinesiophobia scores. In patients with traumatic LLA, limitations in physical activity may be associated with various factors that may contribute to kinesiophobia, such as fear of falling and the number of falls, as we noted in this study. The study results support that fear and avoidance behaviors, which may limit physical activity, should be considered in the evaluation of individuals with LLA.

The fear of falling is high in prosthesis users, and their social participation decreases due to this fear. Around 52% of community-residing prosthesis users state a fall in the previous year, and almost one out of five lower extremity prosthesis users experience a fall during the rehabilitation.[31] Thus, one of the causes of kinesiophobia in patients with LLA may be the high number of falls and the fear of falling. We found that kinesiophobia was correlated with the number of falls and fear of falling. To our knowledge, there is no other study investigating the relationship between fear of falling and kinesiophobia in patients with LLA.

Prosthesis satisfaction plays an important role in regaining mobility and is crucial for optimizing prosthesis use.[32] Contrary to our hypothesis, there was no association between kinesiophobia and prosthesis satisfaction. We used the VAS for the evaluation of prosthesis satisfaction. There are various questionnaires, such as the Trinity Amputation and Prosthesis Experience Scales and the Prosthesis Evaluation Questionnaire, that evaluate different aspects of satisfaction in more detail. Further studies using these questionnaires may reveal different results from our study.

It is recognized that kinesiophobia is a barrier to adherence to rehabilitation in different chronic pain situations.[19] Kinesiophobia may be an adjustable treatment target for people with complaints of musculoskeletal pain with potential effects on QoL.[30] Multimodal rehabilitation programs consisting of physical exercise and education were effective on kinesiophobia level and health-related QoL in individuals with chronic pain.[33,34] Although there are some studies for the treatment of kinesiophobia, such as education[35] and cognitive behavioral therapy,[36] in patients with LBP, we could not find any research on the treatment of kinesiophobia in patients with LLA. Further randomized controlled studies on the treatment of kinesiophobia in patients with amputation are needed.

The main limitations of this study are that the sample size is small and all of the participants were males from one center; thus, the results cannot be generalized. The sample of this study consists of patients with traumatic amputations using a prosthesis. Therefore, this study also does not represent the general amputee population. The heterogeneity of amputee patients is another limitation as the level of amputation affects the activity level of the patients. The cross-sectional design of this study limits our understanding of how kinesiophobia may affect pain intensity and QoL longitudinally. Other factors that may affect kinesiophobia (e.g., PLP intensity, comorbidities, and depression) have not been investigated.

In conclusion, our findings demonstrate that greater kinesiophobia is correlated with higher RLP intensity, a higher number of falls, increased fear of falling, and poorer QoL in patients with traumatic LLA. Patients with LLA should be evaluated in terms of kinesiophobia, and educational counseling programs should be organized not only to emphasize the importance of physical activity but also to reduce fear and anxiety.

Ethics Committee Approval: The Ankara City Hospital Ethics Committee approved the study protocol (date: 10.02.2021, no: E2-21-106), and the study was performed according to the principles of the Declaration of Helsinki.

Patient Consent for Publication: A written informed consent was obtained from each patient.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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