Bosphorus Medical Journal
Boğaziçi Tıp Dergisi

Original Article

DOI: 10.14744/bmj.2023.43660

Bosphorus Med J 2023;10(4):209–215

Investigation of the Relationship Between Foot Pain, Functionality, and Kinesiophobia in Patients with Calcaneal Spurs

Kalkaneal Spur (Topuk Dikeni) Hastalarında Ayak Ağrısı ve Fonksiyonelliği ile Kinezyofobi Arasındaki İlişkinin İncelenmesi

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Cite this article as: Yıldız Aydın F, Üstün I. Investigation of the Relationship Between Foot Pain, Functionality, and Kinesiophobia in Patients with Calcaneal Spurs. Bosphorus Med J 2023;10(4):209–215.

Received: 21.08.2023
Revision: 25.08.2023
Accepted: 31.08.2023

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ABSTRACT

Objectives: The purpose of this study was to analyze the relationship between foot pain, functional capability, and kinesiophobia among individuals diagnosed with calcaneal spurs.

Methods: Patients with heel pain were evaluated clinically and radiologically at Bakırköy Dr Sadi Konuk Training and Research Hospital Physical Medicine and Rehabilitation Clinic. Fifty patients diagnosed with calcaneal spurs and 50 healthy individuals were included. Demographic data were collected. The severity of pain was evaluated using the Visual Analog Scale (VAS), and foot functions were assessed with the Foot Function Index (FFI). Both groups were evaluated using the Tampa Scale for Kinesiophobia (TSK) and the Kinesiophobia Causes Scale (KCS) for kinesiophobia.

Results: Total participants in the patient and healthy individual groups 90% were females (n = 45) and 10% were males (n=5). One of the demographic characteristics, body mass index, was found to be higher in the calcaneal spur group ($p<0.05$). However, there was no significant difference in TSK scores between the groups ($p>0.05$). There was a significant increase in the calcaneal spur patients compared to the healthy controls in the biological, psychological, and total scale scores, which are among the subscales of KCS ($p=0.004$, $p=0.024$, and $p=0.003$, respectively). In patients with calcaneal spurs, a strong positive relationship was found between VAS-activity and FFI-pain score ($r=0.577$, $p\leq0.001$), VAS-activity and FFI-disability score ($r=0.411$, $p=0.003$), and a moderately positive correlation was found between activity limitation score ($r=0.361$, $p=0.010$) and FFI total score ($r=0.512$, $p<0.001$). Furthermore, a moderate and significant correlation was found between FFI-activity limitation scores and KCS-biological score ($r=0.431$, $p=0.002$) and KCS-total score ($r=0.325$, $p=0.021$).

Conclusion: There were no significant differences in kinesiophobia levels between the TSK scores of patients and controls. A distinction was observed in the KCS scores. This highlights the need to address kinesiophobia in these patients. A comprehensive approach that includes biological, psychological, and rehabilitative techniques is essential for effectively treating calcaneal spur disease.

Keywords: Calcaneal spur; foot function; heel pain; kinesiophobia.

ÖZET

Amaç: Bu çalışmada, kalkaneal spur (topuk dikeni) hastalarında ayak ağrısı ve fonksiyonel durumun kinezyofobi ile ilişkisi araştırıldı.

Yöntem: Bakırköy Dr. Sadi Konuk Eğitim ve Araştırma Hastanesi Fiziksel Tıp ve Rehabilitasyon Kliniğine topuk ağrısı ile başvuran hastalar klinik ve radyolojik olarak değerlendirilerek kalkaneal spur tanısı alan 50 hasta ve 50 sağlıklı

kontrol çalışmaya dahil edildi. Katılımcıların demografik verilerinin yanı sıra hasta grupta ağrı şiddeti Vizüel Analog Skala (VAS) ile, ayak fonksiyonları ise Ayak Fonksiyon İndeksi (AFİ) ile ve her iki grupta kinezyofobi Tampa Kinezyofobi Ölçeği (TKÖ) ve Hareket Korkusu Nedenleri Ölçeği (HKNÖ) ile değerlendirildi.

Bulgular: Her iki grubun %90'ı kadın (n=45), %10'u erkekti (n=5). Demografik özelliklerden beden kitle indeksi kalkaneal spurlu hasta grubunda yüksekti (p<0,05). Hastalar ve sağlıklı kontroller arasında TKÖ skorları arasında istatistiksel anlamlı fark saptanmadı (p>0,05). HKNÖ alt ölçeklerinden olan biyolojik alt ölçek, psikolojik alt ölçek ve total ölçek skorlarında hasta grupta kontrol grubuna göre istatistiksel olarak anlamlı yükseklik saptandı (sırasıyla p=0,004, p=0,024, p=0,003). Kalkaneal spur hastalarında VAS-aktivite ile AFİ-ağrı skoru arasında güçlü bir pozitif yönlü istatistiksel anlamlı ilişki (r=0,577, p=<0,001), VAS-aktivite ile AFİ-yetersizlik skoru (r=0,411, p=0,003), AFİ-aktivite kısıtlılığı skoru (r=0,361, p=0,010) ve AFİ toplam skoru (r=0,512, p<0,001) arasında orta derecede pozitif yönlü istatistiksel anlamlı ilişki bulundu. AFİ-aktivite kısıtlılığı skorları ile HKNÖ-biyolojik skoru (r=0,431, p=0,002) ve HKNÖ-toplam skoru (r=0,325, p=0,021) ile arasında orta derece pozitif yönlü istatistiksel anlamlı ilişki bulunmuşken, HKNÖ-psikolojik skoru (r=0,151, p=0,294) arasında bir ilişki saptanmadı.

Sonuç: Kalkaneal spur hastaları kinezyofobi açısından TKÖ ile değerlendirildiğinde sağlıklı grupla fark saptanmazken, HKNÖ'de fark gözlendi. Kinezyofobi bu hastalar için dikkate alınması gereken bir sorundur. Kalkaneal spur hastalığında biyolojik, psikolojik ve rehabilitasyon yöntemleriyle bütüncül yaklaşım esastır.

Anahtar sözcükler: Topuk ağrısı; kinezyofobi; ayak fonksiyonu; kalkaneal spur.

Heel pain is one of the essential causes of discomfort and disability in the community; a calcaneal spur is also one of the critical causes of heel pain. The calcaneal spur (plantar calcaneal spur) is defined as a bony protrusion growing from the calcaneal tuberosity on the posterior plantar surface of the calcaneus. It mainly originates from the medial part of the calcaneal tuberosity but can also occur in the lateral part of the calcaneal tuberosity and sulcus.[1] Although there is no consensus on the pathophysiology of calcaneal spurs, different hypotheses have been described. According to the most widely accepted hypothesis, repetitive traction of the plantar fascia causes inflammation and reactive ossification, resulting in calcaneal spurs.[2,3] Some authors define it as protrusions larger than 1 or 2 mm, while others use microscopy or subjective assessment. A simple calcaneal spur is a triangular structure tapering from a broad base to a sharp point.

Calcaneal spur formation is influenced by age, with higher prevalence rates observed in older populations.[4,5] In young- and middle-aged individuals, the prevalence ranges from 11 to 21%, while those over the age of 62 have a rate of 55%.[4] One of the crucial factors closely associated with calcaneal spurs is weight.[6,7] There are contradictions in the literature regarding the relationship between calcaneal spur incidence and gender. This finding may be due to traditional habits and differences in footwear between societies.[4-6]

Although 10% of patients with calcaneal spurs do not have any symptoms, the main symptoms are pain and tightness in the heel area. Pain in this region occurs predominantly in the morning while getting out of bed or standing up after sitting for a long time and during prolonged standing.[8] Kinesiophobia is the fear or avoidance of activity and physical movement caused by a painful injury and sensitivity to repeated injury.[9,10] According to cognitive-behavioral models of fear or avoidance, painful experiences can cause fear of movement and injury in some people, often leading to behavioral agitation and, in the long term, depression and increased levels of functional disability. In addition, fear avoidance attitudes and kinesiophobia are related to chronic pain complaints in the general population.[11,12] Kinesiophobia is an intense fear of pain caused by movement or the possibility of re-injury.[13] It should not be considered solely as a fear of pain but more generally as a fear of the consequences of physical activity and a feeling of physical or psychological discomfort. In the long term, kinesiophobia leads to physical disability, avoidance of physical activity, functional disability, and increased depressive symptoms.[14]

Kinesiophobia was investigated in various disease groups, such as musculoskeletal diseases and chronic fatigue syndrome, and it was found to be associated with increased pain, decreased physical activity level, and deterioration of psychological status.[15] In the literature, only a few studies have evaluated kinesiophobia in patients with foot and ankle problems. Our study aimed to investigate the relationship between kinesiophobia, foot pain, and functionality in patients with calcaneal spurs.

Methods

This study included 50 patients who had painful calcaneal spurs and 50 healthy volunteers. They were all treated at the Physical Medicine and Rehabilitation Clinic of Bakırköy Dr. Sadi Konuk Training and Research Hospital between May

and July 2023. The patients with calcaneal spurs were diagnosed using clinical history, physical examination, and radiography. The study received approval from the Bakırköy Dr Sadi Konuk Training and Research Hospital Ethical Review Committee for Non-interventional Studies on May 22, 2023 (May 22, 2023/10-18).

The calcaneal spur diagnosis was determined by the patient's medical history, physical examination findings, and the detection of a bony protrusion from the calcaneal tuberosity on lateral standing radiographs. Anamnesis revealed pain in the heel region in these patients, especially in the morning and after prolonged standing. Palpation of the heel region resulted in pain and tenderness.

Inclusion criteria for the patients were unilateral or bilateral foot pain for at least 2 months, diagnosis of a calcaneal spur, age between 18 and 65 years, presence of foot pain, and being literate. Individuals with a history of fracture, spinal or lower extremity surgery, neurological/psychiatric/rheumatological disease, treatment for calcaneal spur in the past year, or illiteracy were excluded from the study.

All participants signed an informed consent form and completed the study forms themselves.

Each scale had instructions at the top of the page. The researcher only provided further explanation if the participant asked for clarification; the researcher tried to obtain an unbiased response. After completion, the filled-out forms were examined for missing items, and the participant was asked to review them. The study form included demographic information (age, gender, body mass index [BMI]), characteristics of pain, the Visual Analog Scale (VAS) to assess pain intensity, the Foot Function Index (FFI), the Kinesiophobia Causes Scale (KCS), and the Tampa Scale for Kinesiophobia (TSK). The validated and reliability-tested Turkish versions were used for all scales.[10,16,17] Pain intensity was assessed using the VAS, a numeric pain scale ranging from 0 to 10, where 0 is defined as "no pain" and 10 as "worst possible pain".[18] The TSK and the KCS were used to assess the participants' fear and avoidance of movement.

The TSK is a 17-item self-report questionnaire. The scale includes parameters regarding injury or re-injury and fear or avoidance of work-related activities. Each question has 4 response options (strongly disagree, disagree, agree, or strongly agree) ranging from 1 to 4 points, respectively.

The individual scores for items 4, 8, 12, and 16 are reversed, and a total score is calculated. The total score ranges from 17 to 68, with high scores reflecting a high fear of movement.[18]

The KCS is a 20-question survey specifically designed for use in the adult population to investigate the causes of motor inactivity. The scale is divided into two domains: biological and psychological. The biological domain of kinesiophobia examines morphological features, individual needs for movement, energy sources, and the strength of biological impulses. The psychological domain of kinesiophobia covers self-acceptance, self-assessment of motor predisposition, mental state, and sensitivity to social influences. The scale can diagnose the specific causes of fear of movement and their intensity in both domains individually. It also enables the calculation of the total score. It uses a 5-point Likert scale (1=strongly disagree, 5=strongly agree). Higher scores indicate that the individual has more fear of movement.[10,19] The FFI consists of 23 items with 3 subgroups: pain, disability, and activity restriction. Patients score all items with VAS, considering their foot condition 1 week ago. The score of each item is summed, divided by the sum of the maximum scores of the items, and multiplied by 100 to calculate the subscales and total scores. Higher scores indicate more pain, disability, and activity restriction.[16]

Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS v28, Chicago, IL, US) software. Numerical variables were given as means and standard deviations, ranges including minimums and maximums, and median values. On the other hand, qualitative data were given as numbers and percentages. To determine if the distribution of numerical variables is normal or not, various methods were employed, including histograms, box plots, Q-Q graphs, and Shapiro–Wilk and Kolmogorov–Smirnov tests. For comparing the patient and the control groups regarding continuous variables, the Student's t-test was used for normally distributed data. However, the Mann–Whitney U test was performed to compare the non-normally distributed variables. For correlation analysis in the patient group, the Pearson correlation analysis test was used if the variables had a normal distribution.

In contrast, the Spearman correlation analysis test was used for the variables with a non-normal distribution. Pearson Chi-Square, Fisher's exact test, or Fisher-Freeman-Halton exact tests were used to compare nominal variables. In all analyses, the significance threshold was set at $p<0.05$.

Table 1. Demographic data of the patients

Variables	Calcaneal spur group (n=50) mean±SD	Control group (n=50) mean±SD	p
Age (year)	47.4±8.4	48.2±7.4	>0.005[a]
BMI (kg/m^2)	32.25±6.88	28.8±6.35	0.002[b]
Educational status	**number (%)**	**number (%)**	
Literate	20 (40.0%)	20 (40.0%)	
Primary school	10 (20.0%)	7 (14%)	>0.005[c]
High school	16 (32.0%)	20 (40%)	
University	4 (8.0%)	3 (6%)	

Continuous data are presented as means±standard deviations and categorical data are presented as numbers (%). mean±SD: mean±standard deviation; n: number of patients; [a]: Student's t-test; [b]: Mann–Whitney U test; [c]: Pearson Chi-Square test; BMI: Body mass index.

Results

The study included 100 participants: 50 patients and 50 healthy volunteers. In both groups, 90% (n=45) were female, and 10% (n=5) were male. While the groups showed similar demographic characteristics regarding gender distribution, age, and education level, the BMI was significantly higher in the calcaneal spur group than in the control group (Table 1).

Analysis of the calcaneal spur patient data revealed that 19 (38%) patients had pain in the right foot, 10 (20%) in the left foot, and 21 (42%) in both feet. Twenty-three (46%) patients did not receive any treatment for the disease. The mean duration of pain, time of diagnosis, VAS at rest, VAS during activity, VAS nocturnal, and FFI scores of the patients in the calcaneal spur group are shown in Table 2.

Table 2. The pain and functional status parameters of the calcaneal spur patients

	Mean±SD
Duration of pain (months)	25.28±35.45
Time for diagnosis (months)	22.0±30.8
VAS rest	5.62±3.48
VAS activity	8.24±2.24
VAS nocturnal	5.10±3.43
FFI scores	
Pain scores	52.84±14.63
Disability scores	52.78±21.78
Activity restriction scores	20.92±10.88
Total scores	45.83±14.92

Mean±SD: mean±standard deviation; VAS: Visual Analog Scale; FFI: Foot Function Index.

Table 3 shows the TSK and KCS scores of the calcaneal spur patients and control groups. The TSK score was 41.5±8.1 and 40.2±6.1 in the calcaneal spur and healthy volunteers, respectively (p=0.09). The biological subscale, psychological subscale, and total scale scores, which are the subscales of the KCS, were significantly higher in the calcaneal spur group than in the healthy controls (p=0.004, p=0.024, p=0.003).

In calcaneal spur patients, there was a strong positive significant relationship between VAS activity and FFI pain score (r=0.577, p<0.001), VAS activity and FFI disability score (r=0.411, p=0.003), FFI activity restriction score (r=0.361, p=0.010), and FFI total score (r=0.512, p<0.001). A strong positive significant relationship was found between VAS rest and FFI pain score (r=0.664, p<0.001), FFI disability score (r=0.548, p<0.001), and FFI total score (r=0.629, p<0.001), and a moderate positive significant relationship was found between VAS rest and FFI activity restriction score (r=0.409, p=0.003). There was also a moderately positive significant

Table 3. Comparison of the groups based on kinesiophobia scale scores

	Calcaneal spur group Mean±SD	Control group Mean±SD	p
TSK	41.5±8.1	40.2±6.1	p=0.09[a]
KCS			
Biological	2.931±0.896	2.437±0.762	p=0.004[b]
Psychological	2.630±0.930	2.271±0.591	p=0.024[b]
Total	2.759±0.783	2.331±0.628	p=0.003[b]

mean±SD: mean±standard deviation; TSK: Tampa Scale of Kinesiophobia; KCS: Kinesiophobia Causes Scale; [a]: Mann–Whitney U test; [b]: Student's t test.

relationship between VAS nocturnal and the FFI pain scores (r=0.440, p=0.001), FFI disability score (r=0.398, p=0.004), and FFI total score (r=0.434, p=0.002). In contrast, no significant relationship was found between VAS nocturnal and FFI activity restriction score (r=0.26, p=0.068) (Table 4).

A moderately positive significant correlation was found between FFI activity restriction scores and KCS-biological score (r=0.431, p=0.002) and KCS-total score (r=0.325, p=0.021). However, no correlation was found between KCS psychological scores (r=0.151, p=0.294). Also, no correlation was found between other FFI subgroups and FFI total and KCS scores (Table 5).

Discussion

Our study's goal was to assess kinesiophobia, pain, and the functional status of the foot in patients with calcaneal spurs, as well as compare the level of kinesiophobia in these patients to that of healthy volunteers.

In this study, 90% of the patients were women. Toumi et al.[20] reported that the rate of calcaneal spurs was significantly higher in women than in men. However, Beytemür et al.[5] and Menz et al.[4] found equal rates in men and women. Our findings support the findings of Toumi et al. The variation in gender distribution among the studies can be attributed to the differences in the average age of the patient groups. The study's larger proportion of female patients could be attributed to the fact that the patients were, on average, younger.

When the demographic characteristics of the calcaneal spur patients and healthy controls were compared, the gender, age, and educational status of the patients were similar. The BMI values were higher in the patient group compared to the control group. Many studies have supported the relationship between obesity and calcaneal spurs.[4,6,7] These studies indicated that the likelihood of having a calcaneal spur increased with increasing patient weight.

Analysis of the VAS at rest, activity, and nocturnal pain scores of the calcaneal spur patient group revealed that VAS activity scores were significantly higher than the control group. In these patients, pain in the heel region occurred, especially at the first step after rest and during prolonged standing.[8]

Kinesiophobia is a significant problem that negatively affects the quality of life of individuals with musculoskeletal system diseases.[21-25] There are limited studies evaluating foot and ankle diseases in the literature. To our knowledge, this is the first study in which the relationship between kinesiophobia and foot function has been analyzed, and the foot functions of the patients with this problem were compared with a healthy control group.

Table 4. Results of the correlation analysis between the VAS and FFI scores

	FFI Pain score	FFI Disability score	FFI Activity restriction score	FFI Total
VAS- activity				
r	0.577**	0.411**	0.361**	0.512**
p	<0.001*	0.003*	0.010*	<0.001*
VAS- rest				
r	0.664**	0.548**	0.409**	0.629**
p	<0.001*	<0.001*	0.003*	<0.001*
VAS- nocturnal				
r	0.440**	0.398**	0.260	0.434**
p	0.001*	0.004*	0.068	0.002*
Tampa Kinesiophobia				
r	0.023	0.077	0.089	0.064
p	0.876	0.596	0.540	0.658

VAS: Visual Analog Scale; FFI: Foot Function Index *Correlation is significant at 0.05 level (Pearson correlation test); **Correlation is significant at 0.01 level (Pearson correlation test).

Table 5. Results of the correlation analysis between the FFI and KCS scores

	KCS biological	KCS psychological	KCS total
FFI Pain score			
r	−0.044	0.019	0.002
p	0.760	0.898	0.991
FFI Disability score			
r	0.182	−0.027	0.094
p	0.206	0.852	0.515
FFI Activity restriction score			
r	0.431**	0.151	0.325**
p	0.002*	0.294	0.021*
FFI Total score			
r	0.155	0.009	0.102
p	0.282	0.953	0.483

KCS: Kinesiophobia Causes Scale; FFI: Foot function ındex; *Correlation is significant at 0.05 level (Pearson correlation test); **Correlation is significant at 0.01 level (Pearson correlation test).

The comparative analysis of the calcaneal spur patients and the healthy controls regarding TSK revealed no significant difference in our study. Vlaeyen et al.[26] determined 37 as a cut-off value for TSK. In our study, high-level (i.e., TSK>37) kinesiophobia was found in 37 patients in the calcaneal spur group and 33 participants in the control group. In the study by Wikstrom et al.[27] comparing patients with chronic ankle instability and healthy copers, TSK scores did not differ between the two groups. However, both groups had high levels of kinesiophobia. On the contrary, in the study by Houstan et al.,[22] patients with chronic ankle instability had significantly higher TSK scores than healthy individuals. The number of patients and controls in both studies was lower than in our study. Studies with a larger number of patients are needed to provide more precise results.

The total and sub-scores of the KCS were statistically significantly higher in the calcaneal spur group compared to the healthy group. In the literature, the KCS was used in patients with chronic low back pain and obese patients.[28-30] However, this is the first study using the KCS score in podiatric patients. This scale was developed for the adult patient population and aims to diagnose the causes of motor passivity.[19] Using this scale in calcaneal spur patients can assist in determining the biological and psychological causes of fear of movement and aid in physical and psychological rehabilitation.

In the calcaneal spur patients, VAS activity scores were higher than rest and nocturnal pain VAS scores. Patients were also evaluated for FFI pain, disability, activity restriction, and total scores. A strong correlation was found between VAS activity and FFI pain scores. In contrast, a moderately significant positive correlation was found between VAS rest, VAS nocturnal, FFI disability, FFI activity restriction, and FFI total scores. The FFI scale scores the pain, disability, and activity restrictions of the patients in the last week using VAS. The correlation between FFI and VAS scores suggests that patients gave consistent responses and that the Turkish version of the FFI is a valid tool for evaluating patients.[16] This study found no correlation between the TSK and FFI scores. Yildiz et al.[21] evaluated the relationship between foot problems and kinesiophobia in 37 patients and found that patients with low kinesiophobia scores had better foot function. In our study, on the contrary, there was no relationship between kinesiophobia scores and foot function. Studies with larger samples are needed to reach a clear conclusion.

A moderately positive correlation was detected between the FFI activity restriction score, one of the subscales of the FFI scale, the biological subscale of the KCS, and the total score of the KCS. In contrast, no correlation was found between the KCS psychological score. No correlation was found between the other FFI subgroups and FFI total and KCS scores. These data show that while the biological problems of the patients cause activity limitations, the psychological effects do not cause limitations in the activities of daily living, and treating their biological problems can increase their productivity.

One of the limitations of this study is the unbalanced gender distribution in the patient and control groups. Another limitation is that, although the patients were evaluated in the psychological domain of KSC, no scale was used to evaluate their psychological status. In addition, there were no long-term follow-up data, and the number of patients was relatively small in this cross-sectional study.

Conclusion

The calcaneal spur is a cause of disability that causes pain in patients and leads to limitations in activities of daily living. Kinesiophobia is also a problem that needs to be combated in these patients. It is essential to approach these patients holistically with biological, psychological, and rehabilitation methods. Randomized, controlled studies with larger samples are needed to validate our findings.

Disclosures

Ethics Committee Approval: The study received approval from the Bakırköy Dr Sadi Konuk Training and Research Hospital Ethical Review Committee for Non-interventional Studies on May 22, 2023 (May 22, 2023/10-18).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – F.Y.A.; Design – F.Y.A., I.U.; Supervision – F.Y.A.; Materials – F.Y.A., I.U.; Data collection &/or processing – F.Y.A., I.U.; Literature search – F.Y.A., I.U.; Writing – F.Y.A., I.U.; Critical review – F.Y.A., I.U.

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