Factors Associated with Kinesiophobia in Patients with Knee Osteoarthritis

Kinesiophobie-assoziierte Faktoren bei Patienten mit Kniearthrose

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ABSTRACT

Purpose This study aims to determine factors affecting kinesiophobia in patients with knee osteoarthritis (OA).

Materials and Methods The fear of movement was measured using the Tampa Scale of Kinesiophobia in 60 patients with knee OA. Pain intensity was assessed with the Visual Analog Scale, quality of life with the Nottingham Health Profile (NHP), disability with the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), anxiety and depression with the Hospital Anxiety and Depression Scale (HADS), balance with the Berg Balance Scale, mobility with the Timed Up and Go Test, and the physical activity status was measured with the International Physical Activity Questionnaire.

Results Physical mobility and emotional reactions subscales of NHP, all WOMAC subscales and the HADS depression subscale were significantly related to kinesiophobia. Muscle strength, ROM, level of physical activity, balance, mobility and anxiety were not significantly related to kinesiophobia. Quality of life and disability explained 34.4 % of the variation in the Tampa Scale of Kinesiophobia.

Conclusions Kinesiophobia was associated with quality of life, disability and depression. It may be useful for clinicians to pay attention to the evaluation of psychosocial characteristics instead of physical performance parameters in order to increase treatment success in OA patients.

ZUSAMMENFASSUNG

Ziel Ziel dieser Studie ist die Ermittlung der Einflussfaktoren auf Kinesiophobie bei Patienten mit Kniearthrose.

Material und Methoden Bei 60 Patienten mit Kniearthrose wurde mithilfe der Tampa Scale of Kinesiophobia die Angst vor Bewegung gemessen. Die Schmerzintensität wurde mit der Visual Analog Scale, die Lebensqualität mit dem Nottingham Health Profile (NHP), die Behinderung mit dem Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Angst und Depression mit der Hospital Anxiety and Depression Scale (HADS), das Gleichgewicht mit der Berg Balance Scale, die Mobilität mit dem Timed Up and Go Test und der körperliche Aktivitätsstatus mit dem International Physical Activity Questionnaire bewertet.

Ergebnisse Die Subskalen für körperliche Mobilität und emotionale Reaktionen des NHP, alle WOMAC-Subskalen und die Depressions-Subskalen des HADS waren signifikant mit Kinesiophobie assoziiert. Muskelkraft, Bewegungsfreiheit, körperlicher Aktivitätsgrad, Gleichgewicht, Mobilität und Angst waren nicht signifikant mit Kinesiophobie assoziiert. Lebensqualität und Behinderung erklärten 34,4 % der Abweichungen bei den Ergebnissen der Tampa Scale of Kinesiophobia.

Schlussfolgerung Kinesiophobie war mit Lebensqualität, Behinderung und Depression assoziiert. Um den Behandlungserfolg bei Arthrosepatienten zu steigern, kann es für Klinikärzte sinnvoll sein, das Augenmerk auf die Bewertung der psychosozialen Merkmale statt der körperlichen Leistungsparameter zu richten.

Introduction

Osteoarthritis is a common chronic degenerative disease, causing disruptions in joints, muscle weakness and loss of deep joint sense, as well as limitations in daily life [1–4]. Occupying the first place in terms of the incidence of musculoskeletal diseases, OA has become a major health problem in the aging world. A radiographic study reported that the annual incidence of knee OA was 2.3 %, progression rate was 2.8 % per year and worsening rate was 3 % per year [5, 6]. For all these reasons, the burden of this disease on the health system is also quite high [7]. OA is one of the most important causes of musculoskeletal pain [8]. Moreover, it can cause disability by causing muscle strength and flexibility loss, and impairing functionality [9]. As a result of all these changes, depression and anxiety disorders can develop while the quality of life declines [10]. Due to increased pain sensation, the person may be afraid to move and may respond with avoidance or confrontation in coping with pain. Avoidance of activity increases with fear. This vicious cycle forms the basis of kinesiophobia, that is, the fear of movement [11]. According to Kori and his colleagues who studied the relationship between chronic pain and physical activity in 1990, kinesiophobia was defined as "a condition in which patients had a fear of physical activity in an excessive, unreasonable and debilitating way, or developed a feeling of a painful injury or re-injury after an activity" [11]. Vlaeyen and his colleagues describe kinesiophobia as a special fear of believing in injury, such as "fear of movement/(re)injury" [12]. Although there are numerous studies in knee-osteoarthritic individuals with regard to parameters such as joint degeneration, pain, muscular strength and functionality [13]. There are a limited number of studies examining the factors associated with kinesiophobia [8, 14, 15]. However there can be potential connection between kinesiophobia and functional outcomes of OA such as pain intensity, quadriceps, hamstring strength, balance, mobility, physical activity level, disability, quality of life, depression and anxiety. Severe chronic pain, fear and anxiety associated with pain lead to evading activity and depression, all of which contribute to even more impairment of functional status and quality of life [16, 17]. Previous studies demonstrated cognitive and behavioural aspects associated with knee OA [18–20]. Individuals with knee OA may prefer to avoid daily life activities that can cause their pain to start, such as sitting up and down, going up and down stairs, and doing things that require bending the knee. It has been repeatedly stated that pain is a biopsychosocial concept and may affect both psychological and social conditions and functionalities of patients [21, 22]. Especially in patients with chronic pain, kinesophobia due to the effects of both physical and psychosocial components is thought to be able to worsen the quality of life and mood of the patient and may have effects on disease progression. As a result of the studies, although it is thought that it will contribute to the development of kinesophobia in psychosocial components such as anxiety, depression and quality of life as well as physical components such as pain, ROM, strength, physical activity level and function, there is no consensus on which factor can be more effective [16–20]. There are a limited number of studies investigating factors that contribute to the development of kinesiophobia pain patients with OA [18–20]. For all these reasons, it is very important to determine the factors that affect kinesiophobia in OA and to draw an appropriate treatment plan for disease progression.The research question of this study are which factors are more related to kinesiophobia in patients with knee OA.Thus, it was aimed to reveal the capacity of OA to affect the functional outcomes.It was aimed to determine the factors that cause fear of movement in knee osteoarthritis, and to form a guiding qualification for clinicians who work in this field to primarily focus on these factors while shaping treatment programs.

Subjects and Methods

60 individuals (64 ± 11 years) who were diagnosed with grade 2-3 bilateral, primary knee OA according to Kellgren Lawrence scoring, [23] were included in the study. Patients with the knee OA were recruited by a physician during routine consultations at the University Hospital. The demographic characteristics of the patients participating in the study are shown in ▶ **Table 1**. All participants were informed verbally and in writing about the purpose of the research and the evaluation methods to be applied. Written informed consents were obtained from each participant. Permission was taken from the Clinical Trials Ethical Committee for the study. The criteria for inclusion in the study were the acceptance of participation in the study, being between the ages of 40-80, and being diagnosed with grade 2-3 osteoarthritis according to the Kellgren Lawrence scoring. Patients with other neurological, musculoskeletal, rheumatic diseases and trauma-induced OA that affect balance and muscle strength, patients with past knee surgery, patients with severe comorbidities, and pregnants were excluded from the study.

Evaluation methods

Kinesiophobia

A transculturally adapted version of the Tampa Scale of Kinesiophobia (TSK), which was developed to measure the fear of movement/re-injury of patients, was used [24]. The scale contains 17 ques-

▶ **Table 1** The demographic characteristics of the patients.

	Mean ± SD (n = 60)
Age	64 ± 11
Height(cm)	159,5 ± 22
Weight (kg)	75,3 ± 14,2
BMI(kg/m²)	28,7 ± 5

SD: Standard deviation, BMI: Body Mass Index.

tions including injury/re-injury and fear-avoidance parameters that are about falling and fear of movement; and, it is used in acute and chronic back pain, fibromyalgia and musculoskeletal injuries and whiplash-related diseases [12, 25]. The 4-point Likert scale (from strongly disagree (score = 1) to strongly agree (score = 4)) is used on the scale. The high score (maximum 68) indicates that the patient's fear of falls and movements is excessive [26]. The test-retest reliability of the transcultural version of the Tampa Scale of Kinesiophobia was shown to be 0.806 (95 % CI = 0.720-0.867) [19].

Pain Intensity

Knee pain severities of all the cases participating in the study were measured using the Visual Analog Scale (VAS) during activity and rest. The cases were asked to mark the pain levels they felt on a horizontal line of 100 millimeters (mm). 0 indicated no pain, 10 indicated maximum pain refering to too much pain to tolerate. The point marked on the line was measured with a ruler, and the intensity of the pain felt by the persons was recorded in cm [27].

Physical Evaluations

Quadriceps muscle strength

The muscle strength was measured using the Lafayette manual muscle testing system (Range: 0-300lbs; 136.1 kg). In order to measure the quadriceps muscle strength, the patient was asked to perform a knee extension against the dynamometer stabilized in the bed by placing perpendicularly on the tibia immediately above the malleoli, while the patient was in sitting position with the knees in a 90-degree flexion position. The value displayed in the digital dynamometer was recorded as the quadriceps muscle strength [28].

Hamstring muscle strength

While the patient was lying in the supine position, the dynamometer was placed just above the ankle joint, and the patient was asked to flex his leg. The value displayed in the digital dynamometer was recorded as the knee flexion muscle strength [28].

Range of Motion

The patient was placed in a supine position, and the normal joint motion range of the knee joint in the direction of flexion and extension was passively measured using a manual goniometer [29].

Balance

The Berg Balance Scale (BBS) was used to assess the balance [30]. This test assesses the ability of individuals to maintain their balances while performing their functional activities. This balance test consists of 14 items, and each section is rated between "0", the lowest level of function, and "4" the highest level of function. It measures the level of dependence and/or independence when performing positions, such as standing up from the sitting stance, standing with the feed together, standing in tandem stance and balancing on one leg. It also measures whether the person can switch positions. The highest score from the BBS shows the best balance. A score of 0-20 shows high, 21-40 medium and 41-64 low risk of fall [31].

Mobility

The Timed Up and Go (TUG) Test was used to measure the main balance and mobility including ambulance, transfer and turning ability [32]. The cases, while in sitting stance on a chair, were asked to get up and walk for 3 meters. And then they were asked to turn and sit back. The elapsing time was recorded [33].

Physical activity level

The validated version of International Physical Activity Questionnaire (IPAQ) short form was used to determine the level of physical activity [34]. The questionnaire was developed by Craig et al. to determine the physical activity levels of adults [35]. In the evaluation of all the activities in the questionnaire, it is taken as a criterion that each activity is done at least 10 minutes at a time. A score of "MET-minute/week" is obtained by multiplying the minutes, days and MET values. Physical activity levels were classified as physically inactive (< 600 MET-min/week), low in physical activity (600-3000 MET-min/week) and adequate in physical activity (> 3000 MET-min/week) [35].

Psychosocial Evaluations

Disability

The assessment of the pain, stiffness and physical function of the individuals included in the study was made using transcultural adaptation of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) [36]. WOMAC is an OA-specific, valid and reliable measure that includes 24 questions in three sub-headings consisting of pain, stiffness and physical function. Each question was rated according to the Likert scale, by accepting 0 = None, 1 = Slight, 2 = Moderate, 3 = Very, 4 = Extremely. The score of each section was calculated within itself. A high score indicates an increase in pain and stiffness, and physical function impairment [37].

Health-related quality of life (HRQOL)

The transcultural adaptation version of the Nottingham Health Profile (NHP) was used to assess the health-related quality of life [38]. The Nottingham Health Profile is a general quality of life questionnaire designed to measure perceived health problems and the extent to which these problems affect normal daily activities. The survey had a total of 38 questions consisting of six sub-sections: lack of energy (3 items), pain (8 items), emotional reaction (9 items), sleep disturbance (5 items), social isolation (5 items), and physical mobility (9 items). The questions are answered as "yes" or "no" by

the cases; and the best score to be taken in the sub-sections is "0", and the worst score is "100".

Depression and anxiety

A valid and reliable version of the Hospital Anxiety and Depression Scale (HADS) was used to assess the psychological status of the patients [39]. The scale was prepared to screen for anxiety and depression in those with bodily disease. It was developed by Zigmond and Snaith [40] to determine the risk of anxiety and depression, and to assess its level, severity and change. A 3-point Likert scale was used in this scale consisting of 14 questions. The cut-off points of the Turkish version of HADS were set to be 10 for the anxiety subscale and 7 for the depression sub-scale [39].

Statistical Analysis

The statistical package program SPPS 20 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) was used to evaluate the data. The variables are expressed as mean ± standard deviation, percent and frequency values. The assumption of normality was checked by the "Shapiro-Wilk" test. The relationship between two continuous variables was assessed by the Pearson Correlation Coefficient. It was assessed by the Spearman Correlation Coefficient when parametric test assumptions were not met. Forward stepwise multiple regression analysis was performed to ascertain which combination of variables related most closely to the Tampa scale. The statistical significance level was accepted as $p < 0.05$. A sample size of 60 produces a two-sided 95 % confidence interval with a width equal to 0.397 when the sample correlation is 0.480. In this case, it is expected that the power of the test will be about 80.03 %.

Results

The demographic characteristics of the patients participating in the study are shown in ▶ **Table 1**. The mean scores of all measured parameters are given in ▶ **Table 2**. There was a statistically significant weak negative correlation between the Tampa score and the Nottingham Health Profile total score, pain score, emotional reaction score and physical activity score (▶ **Table 3**). There was a statistically significant weak positive correlation between the Tampa score and the depression score measured by HAD, and all sub-scales of WOMAC (▶ **Table 3**). There was no statistically significant relationship between the Tampa score and pain intensity, muscle strength, ROM, physical activity level, balance, mobility and anxiety values (▶ **Table 3**). Forward stepwise regression revealed that 34,4 % of the variation in Tampa sacle of kinesiophobia could be explained by a combination of nothingham health profile (17,9 %) ($p < 0.001$), and womac disability scale (16,5 %) ($p < 0.001$).

▶ **Table 2** The mean scores of all measured parameters.

		Mean ± SD (n = 60)
TUG		1,46 ± 0,50
Berg Balance Scale		50,26 ± 6,47
IPAQ		810,51 ± 1856,21
Tampa Scale		40,26 ± 5,51
Nottingham Health Profile	Energy	47,42 ± 35,86
	Pain	49,16 ± 24,91
	Emotional reaction	63,98 ± 32,13
	Sleep	61,53 ± 33,88
	Social isolation	78,00 ± 35,06
	Physical mobility	58,80 ± 21,98
	Total	24,38 ± 8,04
HAD Scale	Anxiety	5,76 ± 4,39
	Depression	6,40 ± 4,17
WOMAC	Pain	7,50 ± 4,16
	Stiffness	2,80 ± 1,83
	Physical function	25,86 ± 14,94
	Total	36,06 ± 19,63
Quadriceps muscle strength	Right	79,20 ± 35,32
	Left	75,40 ± 30,15
Hamstring muscle strength	Right	67,49 ± 29,18
	Left	67,83 ± 30,02
Extension ROM	Right	12,72 ± 27,62
	Left	14,02 ± 30,30
Flexion ROM	Right	104,24 ± 18,42
	Left	104,42 ± 17,82
Pain intensity	During the activity	4,79 ± 2,96
	During rest	1,58 ± 2,03
	Night	2,87 ± 3,02

ROM: Range of Motion, SD: Standard deviation, TUG: Timed Up and Go, IPAQ: The International Physical Activity Questionnaire, HAD: Hospital Anxiety and Depression Scale, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, SD: Standard deviation.

Discussion

This study examined the relationship between kinesiophobia and parameters related to quality of life and physical performance in patients with knee OA. The main findings of this study show that kinesiophobia is related to quality of life, disability and depression, but there is no statistical correlation between kinesiophobia and pain intensity, muscle strength, shortness, ROM, physical activity level, balance, mobility and anxiety.

Pain

There was no significant relationship between pain intensity and kinesiophobia in our study. When the literature is examined, it is seen that there are contradictory publications on this subject. Studies show that chronic pain, not only in OA but also in various musculoskeletal problems such as back pain, fibromyalgia and whiplash, is a factor affecting kinesiophobia [8, 26, 41–43]. However, there are also publications showing that pain intensity is not related to kinesiophobia [44]. In our study, the absence of a direct relationship between kinesiophobia and pain intensity as assessed by using VAS may not mean that pain does not cause kinesiophobia. Because, the "inten-

▶ **Table 3** Correlation between the Tampa score and and parameters related to quality of life and physical performance.

		Tampa Scale	
		r	p
TUG		0,14	0,27
Berg Balance Scale		0,01	0,95
IPAQ		-0,05	0,68
Nottingham Health Profile	Energy	-0,21	0,09
	Pain	-0,29	**0,02** *
	Emotional reaction	-0,30	**0,01** *
	Sleep	-0,21	0,10
	Social isolation	-0,05	0,68
	Physical mobility	-0,28	**0,02** *
	Total	-0,34	**0,00** *
HAD Scale	Anxiety	0,23	0,06
	Depression	0,28	**0,02** *
WOMAC	Pain	0,26	**0,03** *
	Stiffness	0,28	**0,02** *
	Physical function	0,27	**0,03** *
	Total	0,29	**0,24** *
Quadriceps muscle strength	Right	0,12	0,34
	Left	0,13	0,29
Hamstring muscle strength	Right	0,12	0,33
	Left	0,09	0,45
Extension ROM	Right	0,06	0,64
	Left	0,04	0,70
Flexion ROM	Right	-0,05	0,69
	Left	-0,01	0,92
Pain intensity	During the activity	0,07	0,56
	During rest	-0,02	0,87
	Night	0,09	0,46

ROM: Range of Motion, SD: Standard deviation, TUG: Timed Up and Go, IPAQ: The International Physical Activity Questionnaire, HAD: Hospital Anxiety and Depression Scale, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, r: Pearson's correlation coefficient, *$p < 0,05$.

sity of pain" and the "presence of pain" are two different concepts. There was a direct relationship between kinesiophobia and the presence of pain parameter questioned as part of the quality of life index in our study. This suggests that the presence of pain may be the cause of kinesiophobia, but it is not possible to make a clear judgment on the effect of pain intensity on kinesiophobia. Considering that the average level of pain intensity in the OA patients of our study was mid-level (activity 4.7, resting 1.5), because the pain intensity was not high enough to cause kinesiophobia, it can be suggested that we could not find relationship. Therefore, the severity of the pain that is felt can be creating a kinesiophobia when it rises above a certain level.

Disability and Depression

Another important finding of our study is that kinesiophobia is closely related to disability and depression, and the sub-parameters of quality of life: pain, sensory reaction and physical mobility. Vlaeyen et al. showed that the most important determinant of fear of movement or fear of re-injury in patients with back pain was the level of disability reported by the patient [12, 26]. However, it is a debatable issue whether disability causes kinesiophobia or disability develops due to kinesiophobia. The general opinion is that fear of movement is the predecessor of disability, not a consequence [26]. Patients' basic abilities are questioned at most of quality of life scales, so the occurrence of disability is one of the main reasons for the deterioration of the quality of life. However, it is a fact that not all patients with disability have kinesiophobia. This suggests that the mechanism of kinesiophobia may be multifactorial. However, there is insufficient evidence as to which factor triggers the formation of kinesiophobia more.

In the present study, it is revealed in regression analysis that 17,9 % of the variation in the Tampa scale of kinesiophobia could be explained simply by quality of life. An additional 16,5 % of Tampa scale of kinesiophobia changes could be explained by disability. These findings indicate that quality of life and disability level should be closely monitored during rehabilitation programmes designed to improve fear of movement among patients with OA.

The association of kinesiophobia with depression sub-scale in our study is an indication of the close relationship of kinesiophobia with psychological factors. Assessment of depression in the context of kinesiophobia has been shown to result in higher fear of exercise, physical activity, and movement in depressive individuals with chronic pain; and consequently, it has been shown to develop due to being more sensitive to pain and fear of re-injury [45]. When the guidelines published in this respect are examined, the identification and treatment of psychological aspects such as fear of movement and depression in chronic pain sufferers are expressed as one of the important steps in the prevention of worsening [46]. Interestingly, the anxiety sub-scale was not found to be a factor associated with kinesiophobia. The probable cause may be that scales measuring anxiety levels of concern and anxiety about the mental state of the patient, such as "worrying thoughts are passing through my mind," and "I can easily sit, and I feel relaxed", in which the patient is inactive. Thus, sometimes in clinical conditions, it may be inadequate to measure the effects of emotions such as fear, concern and anxiety on function and movement. In the literature, it has been shown that anxiety and depression also improve when kinesiophobia is treated [47, 48]. This supports the association of kinesiophobia with psychosomatic factors.

Muscle strength, ROM, Mobility and Balance

In our study, kinesiophobia was not found to be associated with muscle strength, ROM, and mobility. However, the deficits in these parameters are the ones that are applied at the first stage in routine treatment programs and that clinicians consider important to improve [49, 50]. This approach creates an important contradiction in managing the improvement of the functional capacity of the patient with kinesiophobia. Recently, Demoulin et al. and Ihsak et al. found no relationship between muscle strength and kinesiophobia in their studies investigating factors affecting kinesiophobia in chronic back

pain [44]. Because, pain-related fear is not only related to the weakness of the physical performance measured in the laboratory. In essence, how these parameters are influenced during their daily living activities should be questioned [26]. The results of our study also clearly show that there is no direct connection between these basic functionality measures and kinesiophobia.

One of the basic requirements of functional movement is balance. Therefore, balance-related parameters may be expected to change in the person with kinesiophobia. Balance and mobility are among the factors associated with kinesiophobia in musculoskeletal diseases seen in patients with vestibular and neurological problems or in the elderly [44, 51, 52]. No relationship was found between balance and kinesiophobia in our study. OA patients participating in our study had an average of 50 in the Berg Balance Scale and were included in the group with low risk of falling. In other words, the major functional impairment in OA patients is not associated with loss of balance due to vestibular, neurological or musculoskeletal system. Therefore, balance deficits in OA patients may not be a factor strong enough to create kinesiophobia. This result supports the view that the factor causing fear of movement is caused by the psychosocially-induced kinesiophobia.

Physical Activity Level

In our study, there was no relationship between individuals' levels of physical activity measured with IPAQ and kinesiophobia. Kinesiophobia and activity level seem to be related concepts, but the individuals participating in our study already had a low level of physical activity with an IPAQ average of 800 MET/min [53]. Therefore, this result may be insufficient to show the effect of kinesiophobia on activity level.

It is a limitation of the study that the sample consisted of sedentary OA patients. These results should therefore be considered when making generalizations to young and active patients experiencing kinesiophobia due to other pathologies. However, since primary findings of our study such as pain, disability, depression, and quality of life are less affected by age and pathology, these results are valuable in terms of understanding the kinesiophobia mechanism.

Conclusion

In conclusion, it can be said that in OA, factors such as quality of life, disability and depression play an important role in the formation of kinesiophobia, whereas parameters belonging to physical performance such as balance and muscle strength stay ineffective. The most important factors affecting kinesiophobia in patients with OA are quality of life and disability. Although the presence of pain was found to be a factor affecting kinesiophobia, there was no correlation between pain intensity and kinesiophobia. In terms of labor, time and cost, evaluation and treatment of physical performance parameters have a high place in routine health services. In OA cases with kinesiophobia, instead of focusing on these parameters, it may increase treatment success by reducing workload and cost for clinicians to try to develop treatment strategies to improve depression and quality of life. It may be useful to evaluate and manage the psychological parameters as a part of the problem and disability rather than as a separate subject so that the fear of movement that prevents the person from daily life in the knee osteoarthritis can be avoided more easily. Varied results may be reached by a larger sample and different population. Further longitudinal studies with another knee disorders such as total knee replacements to clarify the kinesiophobia related factors might be interesting.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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