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ORIGINAL ARTICLE

Is the cause of kinesiophobia in stroke patients pain, or is it due to a lack of postural control, the affected side, and depression?

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ABSTRACT

Objectives: This study aimed to examine the relationship between kinesiophobia and postural control, depression, pain, and affected side in stroke patients.

Patients and methods: The cross-sectional study was conducted between February 2019 and July 2019. Patients who had a stroke at least six months ago and had a Functional Ambulation Scale score of Level 2 or above were included. In the study, the patients' kinesiophobia scores (Tampa Kinesiophobia Scale [TKS] and Visual Analog Scale [VAS] kinesiophobia assessment), postural control (Postural Assessment Scale for Stroke [PASS]), depression severity (Beck Depression Inventory), pain (VAS) were evaluated.

Results: Thirty patients (20 females, 10 males; mean age: 62.5±5.9 years; range, 48 to 70 years) were included in the study. A moderate negative correlation was found between PASS and VAS-kinesiophobia ($r=-0.662$, $p<0.05$), a moderate positive correlation was found between Beck Depression Inventory and TKS ($r=0.368$, $p<0.045$), and a high positive correlation was found between VAS-pain and TKS ($r=0.719$, $p<0.05$). While there was a significant difference in TKS ($p<0.001$) between the groups of patients with and without pain, there was no significant difference in VAS-kinesiophobia assessment ($p>0.05$). No association was found between kinesiophobia and the affected side ($p>0.05$).

Conclusion: Tampa Kinesiophobia Scale includes an assessment of pain-focused kinesiophobia. There is a need to develop other scales to evaluate kinesiophobia by questioning findings such as loss of postural control and severity of depression. Identifying kinesiophobia and its etiology in stroke patients could positively affect the rehabilitation process.

Keywords: Depression, kinesiophobia, pain, postural control, stroke.

Cerebrovascular disease is a clinical picture that can result in full or partial recovery, disability, or death.[1] Loss of consciousness, sudden onset headache, loss of vision, speech disorder, gait, balance, and coordination disorders are common symptoms of the disease.[2] Studies demonstrated pain, loss of postural control and balance, and an increase in depression levels in stroke patients.[3] When the causes of kinesiophobia, which is an anxious state that prevents movement over time, are examined, similar symptoms, including muscle weakness, decrease in physical activity, pain, and loss of balance, are encountered.[4] The Tampa Kinesiophobia Scale (TKS) was generally employed to assess kinesiophobia in the literature.[5] In a study of stroke patients, kinesiophobia was associated with stroke severity and disease duration but not with neuropathic pain.[6] In other studies, it was found to be connected with fear of falling.[7] Kinesiophobia in different disease groups was found to be associated with the loss of postural control,[8] severity of depression,[9] and pain.[10] These symptoms are also observed frequently in patients with stroke; however, there are no studies investigating the relationship of kinesiophobia with the loss of postural control, severity of depression,

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pain, and the affected side in stroke individuals. When the TKS items are reviewed, it is seen that kinesiophobia is mostly evaluated with a focus on pain. However, studies in the literature show that reasons other than pain, such as depression, loss of balance, and posture disorders, can also cause kinesiophobia in stroke patients. A scale that comprehensively evaluates kinesiophobia is not yet available in the literature.[11] Visual Analog Scale (VAS) is a tool that aims to assess patient outcomes in different parameters such as pain, quality of life, function, sleep quality, and strength.[12-14]

Based on this information, two different kinesiophobia assessments were used in the study. This study aimed to determine the presence of kinesiophobia, which may affect rehabilitation in individuals with stroke, and to investigate the relationship between kinesiophobia and postural control, depression, pain, and the affected side.

PATIENTS AND METHODS

This cross-sectional study was conducted at the Gözde Academy Hospital, Department of Physical Therapy between February 2019 and July 2019. Patients aged 25 to 70 years with a history of stroke with at least six months after the cerebrovascular accident, who were diagnosed with hemiplegia or hemiparesis, and who were Level 2 or above according to the Functional Ambulation Classification were included. Those with a major rheumatological, musculoskeletal, or neurological pathology (e.g., rheumatoid arthritis, cervical disc herniation, multiple sclerosis, and Parkinson disease) other than stroke, who had a history of falling, did not allow mental evaluation, had aphasia, could not complete the scales, those with amputation in the lower extremities, those with active malignancy and related chemotherapy or radiotherapy, those with cardiac problems, and individuals with shoulder-hand syndrome and shoulder subluxation were excluded. Individuals who accepted to join the study by meeting the inclusion criteria were chosen from the population by random sampling method. For all participants, demographic variables, including sex, age, weight, and height, and the dominant hand were collected. The study protocol was approved by the İnönü University Health Sciences Non-Interventional Clinical Research Ethics Committee of Clinical Research (date: 05.02.2019, no: 2019/3-22). This study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants. The study was registered at the Clinical Trials Protocol Registration and Results System (https://register.clinicaltrials.gov/; number of registration: NCT05538468; date of registration: January 31, 2022).

Functional Ambulation Scale (FAS) is classified according to the motor skills required for functional ambulation of individuals and evaluates ambulation. It consists of six stages from 0 to 5. Stage 0 indicates that the patient has a nonfunctional ambulation, and Stage 5 indicates independent ambulation.[15]

Kinesiophobia was assessed using two different methods. First, the TKS, which consists of 17 questions, was used to evaluate fear of movement. The Turkish validity and reliability study was conducted by Yılmaz et al.[16] in 2011. A 4-point Likert-type scoring was used in the scale (strongly disagree=1, disagree=2, agree=3, totally agree=4). The score ranges from 17 to 68. A higher score indicates an increased fear of movement.[17] Second, kinesiophobia was evaluated using the VAS.[12,14,18] A horizontal line was drawn, ranging from 0 (no fear of movement) to 100 (severe fear of movement), and individuals were asked to mark their fear of standing movement on that line before exercise.

Depression severity was assessed with the Beck Depression Inventory (BDI), consisting of 21 questions. A score of 30 to 63 points indicates severe depression, 17 to 29 points indicates moderate depression, 10 to 16 points indicates mild depression, and 0 to 9 points indicates minimal symptoms.[19]

Postural control was assessed with the Postural Assessment Scale for Stroke (PASS). The scale has two parts: the ability to change (seven items) and maintain (five items) posture. The score of each section varies between 0 and 3. Total score ranges from 0 to 36.[20]

Pain assessment was conducted with VAS. The beginning was marked 0 (no pain) and the end was marked 10 (unbearable pain) on a 10-cm horizontal line. Patients were asked to mark according to the degree of pain they felt. The line's indicated point was then measured in centimeters.[21]

Statistical analysis

The sample size was determined by a power analysis utilizing the freely accessible statistical program Openepi version 3.0

(http://www.openepi.com). During the study, 30 patients were assessed. The power analysis was conducted with $\alpha=0.05$ and $1-\beta$ (power)=0.80, assuming that the difference between the pain values of stroke patients (60.17±26.74) and those without pain (28.66±29.33) was 31.45 mm.[22] It was computed that at least 26 subjects should be recruited.

Statistical analysis was performed using the IBM SPSS version 23.0 software (IBM Corp., Armonk, NY, USA). In the evaluation of the demographic data obtained, frequency (percentage) for categorical variables, values of parametric numerical variables (mean ± standard deviation), and nonparametric numerical variables (median, interquartile range) were given. The suitability of the variables to the normal distribution was examined using analytical (Shapiro-Wilk test) and visual methods (probability plots and histograms). Nonparametric statistical techniques were employed for nonnormally distributed variables, and parametric statistical techniques were used for normally distributed variables. The Pearson chi-square test was utilized to evaluate the relationship between two categorical variables. In the analysis of the differences between two independent groups, the independent sample t-test was used for the data with normal distribution, and the Mann-Whitney U test was used for data that did not fit the normal distribution. Pearson correlation analysis for normally distributed data and Spearman correlation analysis for nonnormally distributed data were used to examine the relationship between two numerical variables. Regression analysis was performed to examine the effects of pain and depression on kinesiophobia.[23] A p-value <0.05 was considered statistically significant.

RESULTS

Forty-eight patients were evaluated, and 16 of these patients were not eligible for the trial since they did not match the requirements for inclusion.

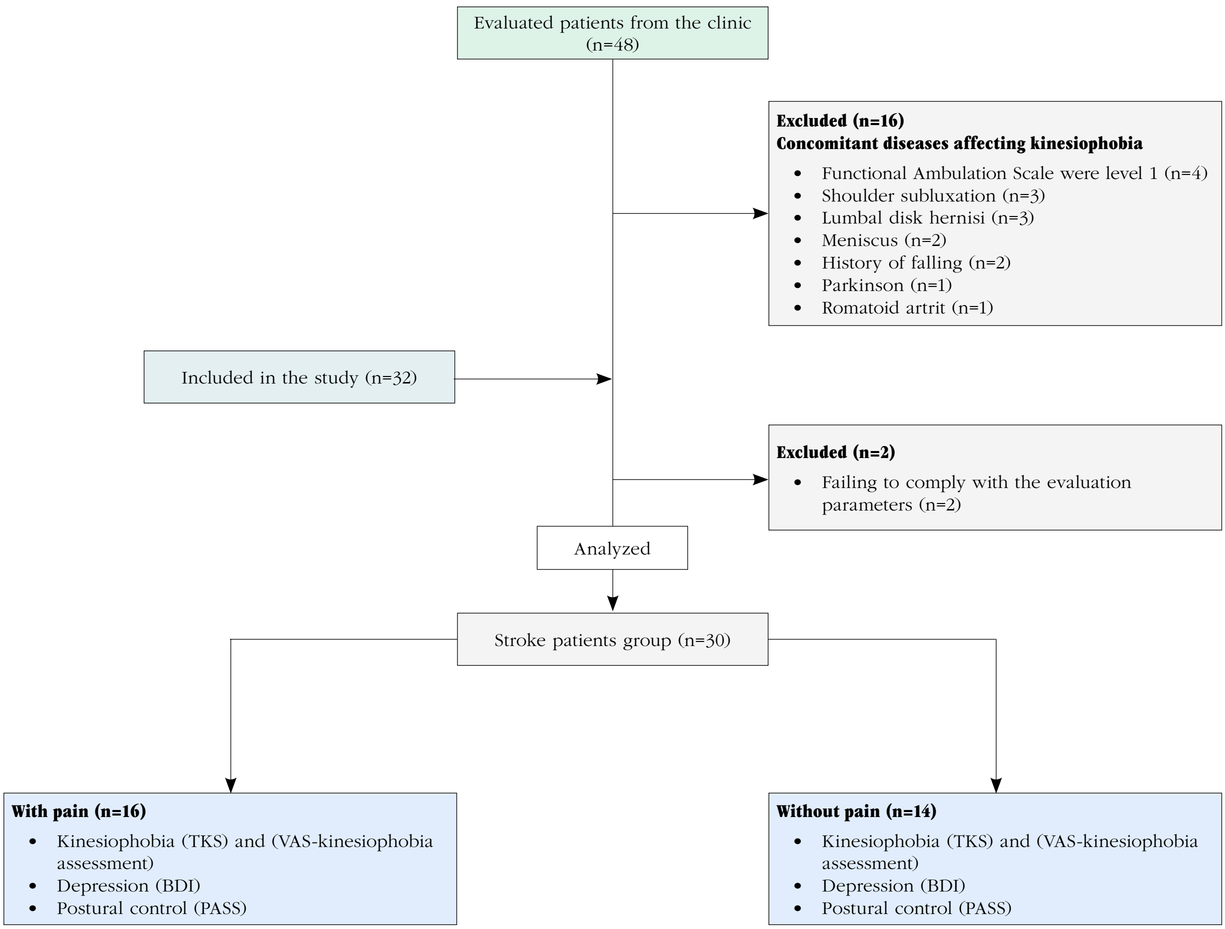

Figure 1. Flowchart of the study.

TKS: Tampa Kinesiophobia Scale; VAS: Visual Analog Scale; BDI: Beck Depression Inventory; PASS: Postural Assessment Scale for Stroke.

TABLE 1
Demographic characteristics of stroke patients (n=30)

Demographics	n	%	Mean±SD
Age (year)			62.5±5.9
Height (cm)			164±0.11
Weight (kg)			70.30±7.05
Body mass index (kg/m²)			26.13±2.08
Sex			
Female	10	33.3	
Male	20	66.7	
Affected side			
Right	15	50	
Left	15	50	

SD: Standard deviation.

TABLE 2
Relationship between TKS and VAS-kinesiophobia and BDI, PASS and VAS-pain scores in stroke patients

The correlation	TKS (17-68)	VAS-kinesiophobia assessment (0-100)
BDI (0-84)		
r	0.368	0.329
p	**0.045***	0.176
PASS (0-36)		
r	–0.058	–0.662
p	0.761	**<0.001***
Pain-VAS (0-100)		
r	0.719	0.211
p	**<0.001***	0.263

TKS: Tampa kinesiophobia scale; VAS: Visual Analog Scale; BDI: Beck Depression Inventory; PASS: Postural Assessment Scale for Stroke Patients; p: Spearman's correlation test; * Statistically significant p<0.05 value.

Two more patients were excluded because they were unable to proceed with the study. Consequently, a total of 30 patients (20 females, 10 males; mean age: 62.5±5.9 years; range, 48 to 70 years) were analyzed (Figure 1). The main characteristics of both groups are presented in Table 1. The mean body mass index of was 26.13±2.08 (Table 1).

As a result of the analyses performed to examine whether TKS, VAS-pain (VAS-pain assessment), PASS, BDI, and VAS-kinesiophobia (VAS-kinesiophobia assessment) values differed between male and female stroke patients, male patients had higher TKS scores than female patients (p=0.003). Other parameters did not show a statistically significant sex difference (p>0.05).

According to the correlation analysis to examine the relationship between TKS and VAS-kinesiophobia and BDI, PASS, and VAS-pain in stroke patients, a high positive correlation was observed among VAS-pain and TKS (r=0.719, p<0.001). While a moderately positive correlation was observed between BDI and TKS (r=0.368, p=0.045), there was a moderate negative correlation between PASS and VAS-kinesiophobia values (r=0.662, p<0.001). No statistically significant correlation was found in other parameters (p>0.05; Table 2). In addition, according to the correlation analysis performed to examine the relationship between BDI, PASS and VAS-pain in stroke patients, there was a moderate negative correlation between BDI and PASS (r=–0.362, p=0.049), and no statistically significant correlation was found in the other parameters (p>0.05).

Age, height, weight, and body mass index of patients with or without pain were similar (p>0.05), while sex distributions (p=0.038) and affected side (right/left hemiplegia; p=0.028) were not similar. According to the correlation analysis conducted to examine the relationship between TKS and VAS-kinesiophobia in stroke patients with and without pain, no relationship was found between TKS and VAS-kinesiophobia in stroke patients without pain (p>0.05). In stroke patients with pain, there was a moderate positive correlation between TKS and VAS-kinesiophobia (r=0.487), but this relationship could not reach a statistically significant level (p=0.056; Figure 2).

A significant difference was found between the groups according to the analysis performed for the comparison of TKS scores in stroke patients with and without pain (p=0.001). No significant results were found in the comparison of patients with and without pain according to the VAS-kinesiophobia scores (p=0.792; Table 3).

In the analysis conducted to examine the relation between the kinesiophobia score and the affected side in stroke patients, the TKS and VAS-kinesiophobia scores of patients whose left and right sides were affected were similar (p>0.05; Table 4). According to linear regression analysis, it was determined that TKS had a positive effect on BDI (p=0.024) and VAS (p=0.001; Table 5).

In the analysis to investigate the relationship between the affected side and PASS, VAS, and BDI scores in hemiplegic patients, among patients with a VAS score >40, scores of patients with right-sided

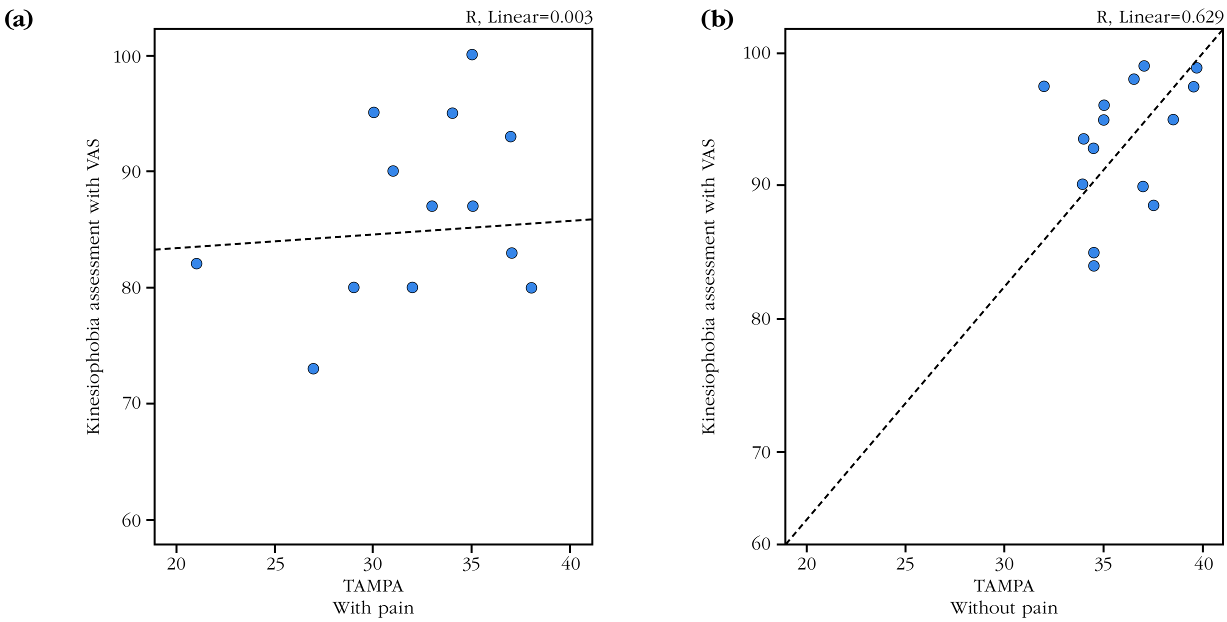

Figure 2. Scatterplot showing the relationship between TKS and VAS-Kinesiophobia assessment in stroke patients **(a)** with and **(b)** without pain.

TKS: Tampa Kinesiophobia Scale; VAS: Visual Analog Scale.

hemiplegia were statistically significantly higher than those with left-sided hemiplegia (p=0.028). The PASS and BDI scores of the patients with right- and left-sided hemiplegia were similar (p>0.05).

According to the results of the correlation analysis performed to examine the relationship between PASS, VAS, and BDI in patients with right-sided hemiplegia, no statistically significant relationship was observed (p>0.05). According to the correlation analysis performed to examine the relationship between PASS, VAS, and BDI in patients with left-sided hemiplegia, there was a moderately positive relationship between VAS and BDI (r=0.613, p=0.015), and a statistically significant relationship was not observed for other parameters (p>0.05).

TABLE 3
Comparison of TKS and VAS-kinesiophobia scores in stroke patients with and without pain

	With pain (n=16)	Without pain (n=14)	
	Mean±SD	Mean±SD	*p*‡
TKS (17-68)	50.25±7.74	32.57±4.71	0.000*
VAS-kinesiophobia assessment (0-100)	83.25±17.06	84.64±10.29	0.792

TKS: Tampa kinesiophobia scale; VAS: Visual Analog Scale; SD: Standard deviation; r: Correlation coefficient; p: Spearman's correlation test; ‡ Independent groups t test; * Statistically significant p<0.05 value.

DISCUSSION

This study investigated the correlation between kinesiophobia and postural control, depression, pain, and affected side in stroke patients. Kinesiophobia was also associated with the severity of depression and pain, was associated with loss of postural control according to the VAS-kinesiophobia assessment. However, no association was found between kinesiophobia and affected side according to both assessment scores.

Kinesiophobia was studied in patients with stroke, although uncommon.[24] The study by Jo et al.[25] concluded that stroke patients had kinesiophobia, and the severity of kinesiophobia was associated with a fear of falling. In the study of Koca et al.,[6] it was revealed that the kinesiophobia score was high in stroke patients, and kinesiophobia was associated with the severity of stroke and disease duration but not with neuropathic pain. Although the high kinesiophobia score in stroke patients in our study was similar to other studies, we did not find any studies examining the relationship between kinesiophobia and postural control, depression,

TABLE 4
The relationship between the affected side and the evaluation of TKS and VAS-kinesiophobia scores in stroke patients

Affected side		Right (n=15) n	Right (n=15) %	Left (n=15) n	Left (n=15) %	Total (n=30) n	Total (n=30) %	*p*
TKS	<41	5	33.3	10	66.7	15	50	0.068
(17-68)	≥41	10	66.7	5	33.3	15	50	
VAS-kinesiophobia assessment	<87	6	40	8	53.33	14	46.67	0.464
(0-100)	≥87	9	60	7	46.67	16	53.33	

TKS: Tampa Kinesiophobia Scale; VAS: Visual Analog Scale kinesiophobia assessment; p: Pearson chi-square test.

TABLE 5
Linear regression analyses for TKS

	VAS				BDI				
	Unstandardized coefficients		Standardized coefficients		Unstandardized coefficients		Standardized coefficients		Adjusted R square
	B	SE	Beta	*p*	B	SE	Beta	*p*	
TKS	0.214	0.026	0.799	0.000	0.270	0.113	0.229	0.024	0.744

TKS: Tampa Kinesiophobia Scale; VAS: Visual Analog Scale; BDI: Beck Depression Inventory; SE: Standard error; B: Unstandardized coefficient.

and the affected side. Thus, the present study adressed a gap in the literature in this regard.

Depression is a common issue after stroke.[26] There is research in the literature showing a connection among the severity of poststroke depression, loss of balance, physical function,[3] the frequency of falls,[27] and loss of trunk stabilization.[28] In our study, depression and postural control were moderately correlated. Loss of postural control leads to balance disorders and falls and negatively affects activities of daily living. It can be considered that this situation may affect the individual psychologically and be connected to depression. In the study examining the factors affecting kinesiophobia in stroke patients, it was concluded that depression may cause kinesiophobia.[29] According to our regression analysis results, depression affected kinesiophobia. We believe that depression, which affects the physical and psychological health of the individual, could be one of the causes of kinesiophobia.

Studies suggested that the loss of postural control was the main cause of falls[30] and that it was associated with the frequency of falls.[31] Our study showed that there was a relationship between VAS-kinesiophobia and loss of postural control but not between TKS and loss of postural control. The majority of TKS parameters evaluate pain. No scale in the literature questions fear of movement with parameters other than pain, such as loss of postural control, loss of balance, and psychological state. As a result of the deficiency to process and neglect the sensory information observed in stroke patients, they have issues in performing functional activities where stability and mobility are required at the same time.[32] Patients who had a stroke may avoid movement and be afraid due to loss of postural tone or incoordination. We believe that one reason for this fear may be the loss of postural control.

Pain is a significant factor that affects prognosis and is prevalent after a stroke.[33] The relationship between kinesiophobia and pain is attempted to be explained according to the fear-avoidance model. Pain after any injury is considered a warning and should be protected. This reaction is either confronted or avoided. In the case of avoidance, movement is perceived as a threat and a phobic situation occurs, presenting as kinesiophobia.[34] The idea that pain will increase with increased movement and that reinjury may occur is common in individuals with kinesiophobia and is associated with pain severity.[35] According to the results of regression analysis in our study, it was concluded that pain affected kinesiophobia. However, in a study conducted with elderly individuals in the literature, it was observed that there were individuals who did not have pain but had kinesiophobia.[36] Supporting this study, there were also paralyzed patients in our study who had no pain but avoided movement. When patients were grouped as those with and without pain, there was a difference between the two groups according to TKS, and kinesiophobia values evaluated by VAS were surprisingly similar. Therefore, even if the TKS value was low, there was fear of movement according to the VAS-kinesiophobia assessment. In addition, the high correlation between pain intensity and TKS score explains that TKS mostly evaluates kinesiophobia resulting from pain intensity. Moreover, the lack of a relationship between VAS-pain severity and VAS-kinesiophobia scores showed that there were also patients who did not experience pain but were afraid to move. The results of the comparison of TKS and VAS-kinesiophobia between the two groups also confirmed this situation. We believe that kinesiophobia is a multifactorial condition and may occur due to pathologies other than pain. This condition shows us that there is a need to improve scales that evaluate kinesiophobia more comprehensively by questioning the common findings in stroke patients, such as depression, postural control, and loss of balance, which are not pain-based.

There is no study in the literature on kinesiophobia according to the affected hemisphere in stroke patients. In our study, it was observed that the TKS and the VAS-kinesiophobia scores were higher in patients with left hemisphere lesions, but this result did not make a significant difference. Due to visual motor perceptual inadequacy, touch, and proprioceptive dysfunction, left hemiplegic patients may have a higher fear of movement, while right hemiplegic patients may have a higher fear of movement due to loss of communication skills and an increased incidence of depression.[37] There is a need for studies with higher participation on this subject.

When the literature is examined regarding the relationship between depression severity and hemisphere involvement in stroke patients, there are studies linking both hemisphere effects.[38] In our study, although the severity of depression was higher in stroke patients with right-sided involvement, this did not reach a statistically significant level. In previous studies, the presence of depression in right hemiplegic patients may have been overlooked due to the exclusion of these patients, who may have depression due to language speech disorders, which is common as a result of left hemisphere lesions. We think that this situation also affects reliability at the level of depression. Although there are studies in the literature arguing that loss of postural control is more common in left hemiplegic patients,[39] there is also a study[40] that did not observe a significant difference between the two groups in the assessment of postural control and balance in right and left hemiplegic patients. Vertical perception is weaker in right hemisphere lesions, which are effective in spatial perception. This explains why the loss of postural control and balance may be higher in patients with right hemisphere lesions.[41] In our study, no relationship was found between the postural control and the affected side. Although some studies in the literature suggested that pain intensity and right hemisphere involvement were related to individuals with stroke,[42,43] other studies did not associate the hemiplegic side with pain.[2,44] We believe our study brings a perspective on this issue, for which there is no consensus in the literature.

Recent studies highlighted the importance of motor learning in the rehabilitation of stroke patients.[45] Studies with animals showed that 400 repetitions per day were needed to establish a synaptic connection (learning a new movement).[46] It is clear that the appraisal of kinesiophobia, which is a state of avoidance of movement, and the determination of the affecting factors in stroke patients, where functional active movement is important in the rehabilitation process, will contribute positively to the treatment.

There were some limitations to this study. The small number of patients in the study may be viewed as a limitation, but the minimum number of patients was calculated as a result of the power analysis performed before the study. In addition, the study was planned with 80% power before the study started, and it was completed with 100% power, which was completed with 16 individuals with pain (80.31±7.94) and 14 individuals without pain (0±0), with a difference of 80.31 mm between the groups. Therefore, this limitation may be considered negligible.

In conclusion, kinesiophobia is a multifactorial condition with various factors contributing to its etiology. The evaluation of TKS suggests that the scale primarily measures pain-focused kinesiophobia and that it is insufficient to assess kinesiophobia associated with depression severity and postural control. We believe that the TKS does not comprehensively question the fear of movement in stroke patients. Therefore, more specific scales need to be developed to assess kinesiophobia in these patients. The perspective on kinesiophobia in stroke patients should be different from the perspective on patients with orthopedic problems. We believe that identifying kinesiophobia and the issues that cause kinesiophobia in these patients may guide the rehabilitation program, positively affecting the prognosis.

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

Author Contributions: Idea/concept, design, control/supervision, analysis and/or interpretation, writing the article: H.A., B.T.; Data collection and/or processing, literature review: H.A.; Critical review: B.T.

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