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RESEARCH ARTICLE

THE RELIABILITY AND VALIDITY OF THE TURKISH VERSION OF THE TAMPA SCALE FOR KINESIOPHOBIA FOR TEMPOROMANDIBULAR DISORDERS

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ABSTRACT

Purpose: The objective of this study to translate the Tampa Scale for Kinesiophobia for Temporomandibular Disorders (TSK- TMD) and to examine its reliability and validity.
Material and Methods: The TSK- TMD was translated into Turkish as per international standards. The study included 111 patients with Temporomandibular Joint Disorder and aged 18-61 years. The research questionnaire collected demographic information, the Turkish version of TSK- TMD and Pain Catastrophizing Scale (PCS). Using the intraclass correlation coefficient (ICC) and Cronbach's alpha coefficient, respectively, internal consistency and test- retest reliability were examined. Construct validity was assessed using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).
Results: The total Cronbach's alpha coefficient was found to be 0.876. The item total correlation of was found to be between 0.410 and 0.706. The ICC coefficient was found to be 0.951. The correlation coefficient by PCS, measured in terms of parallel from reliability, was discovered to be 0.520. According to the findings of EFA and CFA, the 12-item scale had the same two-factor structure as the original.
Conclusions: These results demonstrate the Turkish version of the TSK- TMD item questionnaire to be a valid and reliable instrument. It can be applied to patients with TMJ problems to assess kinesiophobia.

Keywords: Temporomandibular Disorders, Kinesiophobia, The Tampa Scale, Reliability and Validity.

INTRODUCTION

Temporomandibular disorders (TMD) are a group of structural and functional diseases caused by the muscular and/or joint structure of the chewing system and causing dysfunction (1). Symptoms of TMD are expressed as pain in the temporomandibular joint or chewing muscles, joint or mouth opening and closing movements, click or crepitation sounds, restriction in mouth opening, locking, deviation, or limitation during mandibular movements (2). There are many physical pathologies that cause TMD, and it is also associated with psychological, behavioral, and social factors (3). Several studies have been published recently on the relationship between pain and fear. Chronic pain stimulates fear of re-injury and causes an increased perception of pain. This increased perception of pain

causes the fear of movement to occur and reveals the situation of avoiding acting in the long term, depression and defect (4). In their study Crombez et al. stated that fear associated with pain causes more disability than pain itself (5). As a result of fear and anxiety caused by painful injury and sensitivity to re-injury, avoiding moving the area has been defined as kinesiophobia. To assess kinesiophobia, one uses the 17-item "Tampa Scale for Kinesiophobia (TSK)" (6).

This scale is used more widely, especially in musculoskeletal diseases (7, 8). Musculoskeletal pain arising from the temporomandibular joint also has similar features to musculoskeletal pain. Turner et al. stated that catastrophic thoughts play an important role in jaw movements and pain in TMD (9). In another studies, it was emphasized that kinesiophobia may cause injury and craniofacial pain in patients with TMD, and therefore, kinesiophobia is clinically important in the evaluation and treatment of patients (10, 11). In 2010, Visscher et al. adapted and reshaped TSK according to patients with temporomandibular joint problems, suggesting that their patients with TMD could be distinguished from other musculoskeletal diseases by the 'Tampa Scale for Kinesiophobia for Temporomandibular Disorders (TSK- TMD)' they described. The scale consists of 18 questions. They also added the "symptom checklist" section to the scale to determine whether the complaints were caused by pain, joint sound, deadlock, slipping, or other causes. According to the statistical analysis results of the scale, they suggested the use of the short version with 12 items (12). The validity and reliability of the TSK- TMD China, Brazilian Portuguese, Korean and Spanish, languages have been demonstrated (13-16).

It will be helpful to evaluate the presence and level of kinesiophobia in the patient population with TMD and then to plan appropriate treatment programs. The purpose of this study was to translate and cross-culturally adapt the TSK- TMD into the Turkish version and to assess the reliability and validity.

MATERIALS AND METHODS

Translation and cross-cultural adaptation

The TSK- TMD has been translated and cross-culturally adapted in accordance with accepted standards outlined by Guillemin et al. (17). Firstly, permission was obtained from Dr. Corine Visscher, who developed and published the original TSK- TMD scale, to translate it into Turkish on November 23, 2015. The scale was translated into Turkish by two physiotherapist and one dentist who had a very good level of English and were independent of each other. The three translations thus created were made into a single scale by correcting the conceptual errors and inconsistencies in the translations by the two physiotherapists. One person whose mother language is English and who has a decent command of Turkish translated the scale from Turkish back into English. This person did not see the original version of the survey beforehand. All translations were compared with two physiotherapists, one dentist and one foreign language lecturer group, and the Turkish version was obtained. The created Turkish scale was applied to 10 patients for pilot purposes. For each question, the "Clarity Assessment Form", consisting of 1-completely understood to 5-understanding

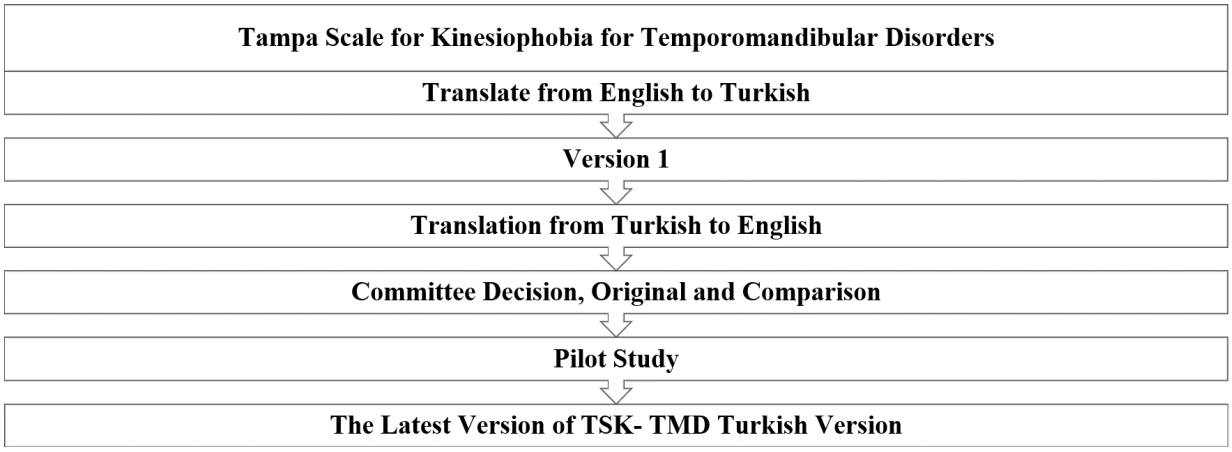

Figure 1. Flow chart of the translation the Tampa Scale for Kinesiophobia for Temporomandibular Disorders (TSK-TMD) from English to Turkish.

options, was used, and an item called “What would be your suggestion sentence?” was added for easier understanding. Finally, the Turkish version was accepted by deciding for the items that were not fully understood by the patients (Figure 1).

Sample size, participants, study design and ethics

While determining the sample size, both generally accepted statistical methodology recommendations and calculations were considered. Fayers et al. suggested that in studies of cultural adaptability, validity, and reliability, the sample size should be at least five times the number of items and at least 100 (18). The Turkish TSK- TMD consists of 12 items. In our study, we had to reach 60 (12x5) patients according to the number of items in the scale, but we reached 111 patients, above our target. The necessary sample size was computed using G-power 3.1 software with an effect size of 0.5, error probability of 0.05, and power 0.80 in order to examine the test-retest reliability of the Turkish TSK- TMD (19).

The study included patients diagnosed with TMD according to the Research Diagnostic Criteria/ Temporo- Mandibular Disorders (RDC/ TMD) (20) and was completed between January 2017 and September 2017 were included. The study was conducted with TMD patients who were followed up at Istanbul Aydın University, Faculty of Dentistry Polyclinic. 111 patients (75 female and 36 male) with an average age of 34±11 years participated in this study. The following requirements had to be met to be eligible for enrollment in the study: willingness to participate as a volunteer, age range of 18 to 65, presence of symptoms for at least six months, literacy, and the ability to comprehend and respond to questions. Participants with toothaches and cognitive impairment that would have made it difficult for them to comprehend and complete the survey questionnaire were not allowed to participate in the study.

An evaluation form was created using the RDC/ TMD form prepared in 1992 by Dworkin at al. to evaluate the personal and disease information of the cases (20). In the evaluation form created, the patient's sociodemographic information (age, gender, height, weight, marital status, occupation, educational status), presence of systemic disease, history of complaints, and parafunctional habits were questioned. For the patient's complaints of temporomandibular joint (TMJ), the presence of pain, severity (with the Visual Analogue Scale- VAS), spread, sound from the joint, lock in the jaw movements, dislocation, slipping, and stiffness were performed. After this information was obtained, the patients had a TMJ examination. In the TMJ examination, the maximum mouth opening measurement was made using calipers, and whether there was any sound during TMJ movements and palpation of the TMJ and surrounding muscles was also assessed. Patients were asked to fill the Pain Catastrophizing Scale (PCS) in addition to TSK-TMD. To determine the reliability of Turkish TSK-TMD questionnaire, the scale was replied to by 40 patients after 3- 5 days for the 'test- retest' method.

According to the Helsinki Declaration's ethical precepts, this study was conducted. All participants received comprehensive study information, and their written informed permission was collected. The study was approved by the Okan University Institute of Health Sciences Ethics Committee (Date: 19.10.2016, Decision no: 7).

Tampa Scale for Kinesiophobia in Temporomandibular Disorders (TSK- TMD)

The original TSK- TMD is an English scale with 18-items that assesses patients with TMD's dread of movement. It uses a 4-point Likert scale (1 for strongly disagree, 2 for slightly disagree, 3 for partially agree, and 4 for strongly agree). Reversing the scores for items 4, 8, 12, and 16 yields the final score. According to the confirmatory component analysis of the scale, Visscher et al. shortened the scale to 12-items and recommended adopting a short form made up of two subfactors: activity avoidance and somatic focus. The first component, avoiding action, reflected the idea that activity might lead to re- injury or more pain (items 1, 2, 7, 9, 10, 11, and 12). The belief in significant underlying medical issues was represented in the second factor, somatic focus (3, 4, 5, 6, and 8 items). By accumulating all the points on this brief form, scores ranging from 12 to 48 are possible. The more kinesiophobia a person has, the higher their score suggests it is. As a result of the structural reliability assessment, they claimed that the 12-items version had good reliability and validity and was better appropriate for evaluation in TMD patients (12). In our study, a short form of 12-items was used.

Pain Catastrophizing Scale (PCS)

This scale was developed to identify patients' past usage of inadequate pain coping strategies as well as

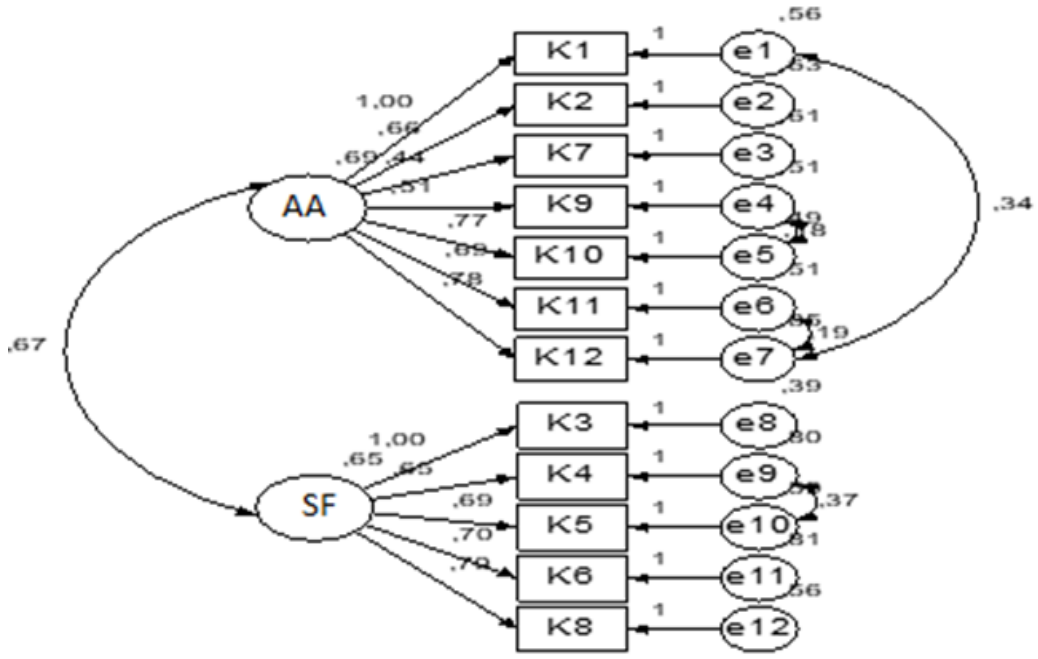

Figure 2. Diagram of the confirmatory factor analysis of the Tampa Scale for Kinesiophobia for Temporomandibular Disorders (AA: Activity Avoidance, SF:Somatic Focus)

catastrophic thoughts or feelings. It depicts the various feelings and emotions that people may have while enduring misery. Thirteen components make up the PCS, which also has three factors including expansion, self-reflection, and helplessness. Likert type scoring ranges from 0 to 4 points. From 0 to 52 is the possible total score. It demonstrates that people who perform well also have high disaster risk levels. (21). It was adapted into Turkish by Suren M. et al. (22).

Statistical Analysis

Using the SPSS 22 statistical analysis tool, the research's data were statistically evaluated. The scale model with 12 items was the subject of statistical analyses. Descriptive statistical techniques, such as number, percentage, minimum, maximum, average values, and standard deviation were computed in the examination of the data. 'Single Sample Kolmogorov- Smirnov Test' was used to test whether the research variables had a normal distribution.

The analysis of the hypothesis testing was done using parametric techniques. When comparing quantitative continuous data between two independent groups, the t-test was used, and when comparing quantitative continuous data between more than two independent groups, the One-Way ANOVA test was employed. The Scheffe test was employed as a supplemental post-hoc study after the ANOVA test to identify the differences. The study's continuous variables were analyzed using the Pearson's correlation method. The results were assessed using a 5% significance threshold and a 95% confidence range.

To ascertain the structural validity of the original scale form, a confirmatory factor analysis was conducted. The association between PCS and TSK- TMD scores was investigated using the equivalent (parallel) technique.

Internal consistency was assessed using the Cronbach alpha coefficient, item analysis, and the interclass correlation coefficient (ICC) value.

RESULTS

A total of 111 patients participated in our study. The average age ranges 34±11 (range 18–61). The t-test used to assess whether the averages of activity avoidance and somatic focus variables and total movement fear ratings varied by gender variable did not reveal any statistically significant differences between the groups (p> 0.05) (Table 1). The TSK-TMD's total score result, pain intensity, maximum

Table 1. Mean and standard deviation values of fear of motion and comparison results acoording to the gender

	Group	N	Mean	Sd	t	p
Avoiding Activity	Woman	75	19,120	4,638	-0,455	0,650
	Male	36	19,556	4,896		
Somatic Focus	Woman	75	12,733	3,681	0,278	0,782
	Male	36	12,528	3,582		
Fear of Movement	Woman	75	31,853	7,675	-0,146	0,884
	Male	36	32,083	7,937		

Table 2. Mean and standard deviation values of pain intensity, maximum mouth opening, PCS and TSK- TMD total scores

	N	Mean	Standard Deviation	Min.	Max.
VAS	111	4,460	2,392	0,000	9,000
Maximum Mouth Opening (mm)	111	36,937	5,847	25,000	50,000
PCS	111	27,982	9,897	6,00	52,00
TSK- TMD	111	31,801	7,870	12,00	48,00

VAS: Visual Analog Scale. PCS: Pain Catastrophizing Scale. TSK- TMD:The Tampa Scale for Kinesiophobia for Temporomandibular Disorders

Table 3. Normal and acceptable values of confirmatory factor analysis and index values of the scale

Index	Normal Value Acceptable Value	Normal Value Acceptable Value	TSK- TMD
χ2/sd	<2	<5	1,761
GFI	>0.95	>0.90	0,902
AGFI	>0.95	>0.90	0,900
CFI	>0.95	>0.90	0,931
RMSEA	<0.05	<0.08	0,078
RMR	<0.05	<0.08	0,061

χ2/sd: chi-square / degree of freedom. GFI: Goodness of-fit index. AGFI: Adjusted goodness of-fit index. CFI: Comparative fit index. RMSEA: Root means square error of approximation. RMR: Root means squares residual.

mouth opening amount, and PCS total score results are shown in table 2.

Validity

Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis was performed to verify the factor structure of the original TSK- TMD for the construct validity of the scale. The reference values accepted for the fit indices used in this study and the index values after confirmatory factor analysis are shown in table 3.

Conformity statistics, calculated by confirmatory factor analysis, show that the model is at an acceptable level with the actual data collected from the participants (23). According to the results of the analysis, it indicates that the scale fits well according to the previously determined factor structure. This confirms the factors of activity avoidance and somatic focus, two sub-scales of the scale (Figure 2).

Parallel (Equivalent) Form Reliability

The positive relationship between the two equivalent forms indicates the sign of consistency. In the study, the PCS scale was used as a parallel form. The relationship coefficient (r) was evaluated between TSK- TMD and PCS. In TSK- TMD it was found to have a positive correlation with PCS as a parallel form (p 0.05) (Table 4).

Reliability

Cronbach's Alpha = 0.876 was discovered to be highly reliable in the reliability of the TSK- TMD (0.40 not reliable, 0.40 0.60 low reliable, 0.80 1.00 highly reliable) (24). This shows that the scale has internal

consistency. Item total correlation values were found between 0.410 and 0.706.

Test- Retest Reliability

The test- retest reliability analysis of the scale was based on the total scores of 40 patients in the first evaluation and the second evaluation. For test- retest reliability, the ICC coefficient was calculated using a 95% confidence interval, and the reliability of the study was found to be high (ICC= 0.951). The ICC value was classified as 0.4 weak, 0.4- 0.75 medium, and > 0.75 excellent. An intra-class correlation coefficient for each item was also calculated (Table 5).

Table 4. Correlation between the Pain Catastrophizing Scale and Tampa Scale for Kinesiophobia for Temporomandibular Disorders

		TSK- TMD
PCS	r	**0,520****
	p	0,001

*<0,05; **<0,01

DISCUSSION

The 12-items "Tampa Scale for Kinesiophobia for Temporomandibular Disorders" (TSK- TMD), which evaluates and measures fear of movement in TMJ disorders, was translated into Turkish for this study. It was found that the TSK- TMD is a valid and dependable scale based on the study of important findings and pertinent criteria. The original TSK- TMD has been translated into various languages, such as Chinese, Brazilian Portuguese, Korean, and Spanish, for the evaluation of movement- related fear in TMD patients (13-16).

The transition from acute to chronic pain and its continuation are both impacted by fear that results from painful conditions. Prolonged pain is perceived as a catastrophe, fostering pain- related fear and behavioral avoidance (25). Kinesiophobia is a pioneer in the disability of patients with various chronic pain conditions, including TMB. Fear of movement is more common, especially in patients with musculoskeletal disorders (26). Temporomandibular disorders are also a problem in the musculoskeletal structure, and as with other normal joint movements, avoiding moving and fearing the jaw joint should be evaluated (12).

A total of 111 patients with TMJ complaints for ≥6 months were included in the study. Female patients accounted for 67.6%, while male patients accounted for 32.4%. The average age of the patients was 34±11. In our study, the gender distribution of TMD patients showed a higher occurrence in women compared to men. Other research, however, have found that the prevalence of TMD is not greater in women than in males, contradicting our findings (27). No significant gender difference was found in kinesiophobia among TMD patients in this study, consistent with the original scale by Visscher et al. This aligns with our findings, indicating agreement

Table 5. Results of ICC analysis of the Tampa Scale for Kinesiophobia for Temporomandibular Disorders Item

	ICC	Interval
Item 1	0,905	0,820-0,950
Item 2	0,927	0,862-0,961
Item 3	0,849	0,715-0,920
Item 4	0,959	0,922-0,978
Item 5	0,967	0,937-0,982
Item 6	0,935	0,877-0,966
Item 7	0,847	0,710-0,919
Item 8	0,887	0,786-0,940
Item 9	0,866	0,747-0,929
Item 10	0,882	0,777-0,938
Item 11	0,816	0,651-0,902
Item 12	0,871	0,755-0,932
Total	0,951	0,907-0,974

(ICC: interclass correlation coefficient)

with the original scale regarding the absence of a gender association with kinesiophobia.

TSK- TMD's internal consistency and homogeneity were assessed using Cronbach's alpha. For the Turkish translation, our investigation discovered a Cronbach's alpha coefficient of 0.87, showing strong internal consistency. The original scale's developers, Visscher et al., reported a Cronbach's alpha value of 0.83. If the Cronbach's alpha value is more than 0.80, the reliability is strong (12). The TSK- TMD scale exhibits good internal consistency, according to our findings. Item analysis evaluates the connection between the results of individual items and the scale's total score. If an item's overall correlation coefficient is less than 0.25, it is regarded as having insufficient dependability (24). Item- total correlations in this study varied from 0.410 to 0.706, demonstrating substantial connections between specific items and the Turkish TSK- TMD version's overall score. These correlations support the results of additional research and show consistently strong item- total correlation values.

Test- retest reliability analysis is another method used to determine the reliability of TSK- TMD. The correlation coefficient between the two measurements indicates the consistency of the measurement over time. In our study, 40 patients were retested within a 3-5-day interval. Each item's ICC value ranged from 0.816 to 0.967, and the overall score's ICC value was 0.951. Visscher et al. conducted a second evaluation for test- retest analysis with a 4-week interval involving 58 participants, resulting in an ICC value of 0.73 (12). In the Chinese version study by He et al., 30 patients completed the scale again after a 2-week interval, yielding an ICC value of 0.797 (13). Aguiar et al. conducted a Brazilian Portuguese study where 30 patients were retested after 1 week. Each item's ICC scores ranged from 0.75 to 0.92, and the overall score's ICC value was 0.95 (14). In the Korean version study by In Hee Park et al., all patients were retested within a 1-2-week period (15). The ICC value for the 18-item version was 0.764, and for the 12-item version, it was 0.752. In comparison to other studies, our study found higher ICC values, indicating a high level of consistency over time for our scale. We believe that this difference is due to the shorter retest interval used in our study compared to other studies.

Factor analysis was used in this study to evaluate the construct validity of the TSK- TMD. The scale's items are classified and their relationship with one another is examined by the structural validity (23). The scale has two factor structures, such as activity avoidance and somatic focus, according to the confirmatory factor analysis we carried out.

Visscher et al. conducted a factor analysis study on both the 18-items long model and the 12-items short model. They found that the statistical analysis results of the 12-items, two-factor short scale model provided stronger support for validity and reliability. They also conducted research on the 12- items short model for the Chinese version (12). Aguiar et al. examined the goodness of fit of three different models for the Brazilian Portuguese version (14).The first model was a two- factor model consisting of 18 questions, the second model was a 12-items, single-factor model obtained by excluding specific items from the 18-items scale, and the third model was a 12-items, two-factor model. The 12-items, two-factor model was shown to have the best fit by the statistical analysis results. In a study by In Hee Park et al. On the Korean version, both the original 18-items version and the 12-items version with two factors were analyzed. Based on the results, they suggested using the 12-items model with two factors (15). In the current study, we excluded four inverted questions and two questions that did not exhibit suitable factor loadings from the original scale. We utilized a two- factor, short 12-items model that was deemed appropriate based on previous research findings.

In this study, we examined the correlation between TSK- TMD and pain severity assessed by VAS and PCS. The total TSK- TMD score, and VAS had a Pearson’s correlation coefficient of 0.466, showing that as patients' pain intensity increases, so does their anxiety of moving their jaw joint. The correlation coefficient between the total TSK- TMD score, and PCS total score was 0.520. Visscher et al. İnvestigated the convergent validity of the scale and found a Pearson’s correlation coefficient of 0.23 for the total TSK- TMD score. Aguiar et al. explored the relationship between TSK- TMD-Br and the individual Pain Catastrophizing Scale, Patient Health Scale (0.38), and Mandibular Dysfunction Questionnaire (0.43) (14). The correlation coefficient between PCS and total TSK- TMD was found to be 0.48. In another study, researchers examined the correlation between the original scale and the global oral health questionnaire in the Chinese version, obtaining a Pearson’s correlation coefficient of 0.563. Overall, our study demonstrated that the correlation between

TSK- TMD and PCS was highly significant and valid, supporting the scale's utility and reliability.

Patients who had TMD symptoms filled out a symptom checklist (pain, sound, locking, other) particular to their complaints to investigate the connection between kinesiophobia and those symptoms. According to Visscher et al., people suffered from chronic TMD who experienced more functional problems with the jaw joint showed higher degrees of dread of movement than pain perception. They showed a significant correlation between fear of motion and mechanical jaw issues such noises or locking (12). Patients, especially those making noise during jaw movements, attempted to avoid such noise by limiting their movements. Unlike musculoskeletal problems where avoidance behavior is typically driven by pain, this situation is slightly different. In a study by Gil-Martínez et al. on disability, pain intensity, and fear of movement in chronic temporomandibular disorders, no significant difference in kinesiophobia was found between patients with chronic joint disorders, myofascial pain, and mixed (jaw joint and myofascial pain) cases. This could be attributed to the fact that the patients in their study primarily presented with joint and muscle pain complaints rather than mechanical issues (10). Gil-Martínez et al. used TSK instead of TSK- TMD, which is specific to TMD. This may be due to patients' limited identification with their problems. Our study found that fear of movement is not strongly associated with voice or locking, but rather with temporamandibular joint pain. Pain appears to be the primary complaint among participants, expressed more frequently than voice or locking. The symptom checklist indicates that the scale can be used to assess kinesiophobia and understand general TMD symptoms.

The study revealed a negative correlation (-0.292) between active mouth opening capacity and kinesiophobia. This indicates that as the extent of mouth opening decreases or becomes restricted, patients tend to experience higher levels of fear associated with jaw movement.

Further research is needed to explore factors contributing to TMD and the impact of TMD types on kinesiophobia, including the disc, joint cartilage, chewing muscles, and other potential factors. Kinesiophobia plays a significant role in TMD, as fear-induced restrictions in jaw movements can lead to increased dysfunction, immobility, and long-term disability in the jaw joint. Evaluating kinesiophobia in TMD is essential for understanding its impact on jaw mobility, facilitating effective treatment, and improving quality of life. Utilizing a scale to assess kinesiophobia can greatly assist physiotherapists working with TMD patients, enabling comprehensive evaluation, tailored exercise programs, and preservation/restoration of jaw joint functions. Patient awareness of kinesiophobia can enhance adherence to exercise programs and improve their effectiveness. Thus, the TSK- TMD scale holds significant value as an assessment tool in this context.

CONCLUSION

The original TSK- TMD was translated according to international recommendations. The scale was shown to have validity and reliability to evaluate kinesiophobia in patients with TMD. TSK- TMD can be used by dentists and physiotherapists to determine the level of kinesiophobia of patients with temporomandibular disorders, thereby creating an effective treatment program and increasing the success of the treatment.

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Author(s) contribution(s): EK contributed to data acquisition, conception, design, data interpretation, and drafted and critically revised the manuscript. ET contributed to conception, design and data interpretation, performed statistical analysis, and drafted and critically revised the manuscript. GÇ contributed to conception, design, data interpretation, and drafted and critically revised the manuscript. All authors approved the final version of the manuscript.

Conflict of interest: The authors declare no potential conflicts of interest with respect to the research, authorship, or publication of this article.

Ethical approval: The study was approved by the Okan University Institute of Health Sciences Ethics Committee (Date: 19.10.2016, Decision no: 9). Clinical trial registration number of the study: NCT04644263

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