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Research Article

Cross-cultural adaptation and validation of the Turkish version of the Musculoskeletal Tumor Society scoring system in patients with musculoskeletal tumors

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ABSTRACT

Objective: This study aimed to translate and cross-culturally adapt the musculoskeletal tumor society (MSTS) scoring system into Turkish and to determine the reliability and validity of the translated version for the functional evaluation of patients with musculoskeletal tumors.

Methods: A total of 36 patients (16 women, 20 men; mean age=36.6; age range=13–75 years) who underwent limb-salvage surgery owing to benign aggressive or malignant musculoskeletal tumors were included in the study. Translation and back translations of the MSTS were performed according to the published guidelines. Short form (SF) 36 physical component, Western Ontario and McMaster Universities Arthritis Index (WOMAC), disabilities of the arm, shoulder, and hand (DASH), and range of motion scale (ROMS) that were previously analyzed for Turkish validation were used for validity. Reliability of MSTS Turkish version was evaluated by calculating test-retest reliability and internal consistency. Intraclass correlation coefficient (ICC) was used to evaluate the inter-observer consistency and test-retest reliability. Alpha coefficient (Cronbach's alpha) was used to evaluate the internal consistency.

Results: It was observed that total MSTS score has a strong negative correlation with DASH ($r=-0.689$; $p<0.001$) and WOMAC scores ($r=-0.634$; $p<0.001$) and moderate correlation with the ROMS score ($r=0.521$; $p<0.001$). Total MSTS score also had a statistically significant strong correlation with SF-36 scores (r values ranging from 0.425 to 0.609, $p<0.001$). Inter and intra-observer reliability of the MSTS scale was found to be excellent (Cronbach's $\alpha=0.97$ $p<0.001$; ICC: 0.97 (0.96–0.99; $p<0.001$). Unlike other subscales, statistical correlation between dexterity and hand-positioning subscales of MSTS with DASH scores was found to be insignificant ($r=-0.533$, $p=0.061$ and $r=-0.336$, $p=0.261$, respectively).

Conclusion: The Turkish version of the MSTS scoring system seems to be a valid and reliable scale that measures the correct and desired values in the evaluation of health-related quality of life in orthopedic oncology. Reliability coefficients of the Turkish version of MSTS were determined to be strong.

Level of Evidence: Level II, Diagnostic Study

Introduction

Patients with musculoskeletal tumors can have significant heterogeneity in terms of individual factors such as age, sociocultural level, and the nature and location of the tumor. Therefore, the appropriate treatment option for each patient can differ. From this perspective, it is useful to use a patient-specific tool to determine the perceived physical and mental health of individuals with musculoskeletal tumors (1).

The musculoskeletal tumor society (MSTS) scoring system was developed to measure functional results and the patient's quality of life after treatment of musculoskeletal system tumors (2). The original scoring system was written in English and then translated into Chinese (3), Danish (4), Portuguese (5), and Japanese (6). It includes 6 items for the upper and lower limbs, but 3 items vary depending on the function of the limbs. Pain, function, and emotional acceptance are used for all extremities. The use of any external support, walking ability, and gait alteration are only used for the lower limbs, and positioning of the hand, manual dexterity, and lifting ability are only used for the upper limbs. Each domain is scored on a scale from 0 to 5, with higher scores indicating better function. The total score, ranging from 0 to 30, can be transformed to a point scale of 0% to 100% (3).

The MSTS scoring system has become one of the most widely used functional assessment tools after resection of musculoskeletal sarcomas (7, 8), Although limb-salvage techniques for musculoskeletal tumors are widely used in our country (9-14), there is no study showing the validity and reliability of the MSTS scoring system in Turkish. This study aimed to translate and cross-culturally adapt the MSTS scoring system to Turkish for the functional evaluation of patients with musculoskeletal tumors and to evaluate the reliability and validity of the Turkish version.

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Materials and Methods

Study design

The current methodologic study was conducted at the Gazi University faculty of medicine, department of orthopedic surgery and traumatology, between 2007 and 2012. The records of the "bone and soft tissue tumors council" of our institute were retrospectively evaluated, and patient selection and data collection were performed according to the mentioned records. The patients meeting the following inclusion criteria were selected for the study: diagnosis of malignant bone and soft tissue sarcoma or benign aggressive bone tumor; age between 12 and 75 years; and at least 18 months of follow-up after the definitive treatment.

Patients with loss of exertion and function related to cardiovascular, respiratory, rheumatologic, and neurologic disorders were excluded from the study. Descriptive information of the patients such as age, sex, pathologic diagnosis, stage, location, and surgical treatment was retrospectively evaluated by extracting them from the council records and patient data files.

Written informed consent was obtained from each patient or the patient's parents or the patient's legal representative if the patient was underage. Ethical approval was obtained from the Gazi University medical research and ethics committee (Date: 26.09.2012; No: 330). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Translation and cross-cultural adaptation and pretesting

The Turkish version of the MSTS scoring system was developed using expert translation and back-translation methods with the method determined by Beaton et al. (15, 16). In the first stage, the scale was translated from English to Turkish independently by 2 bilingual professionals, 1 of whom was a physician. The translated scale was evaluated by the committee consisting of public health, orthopedics, physiotherapy, and Turkish language experts, and the necessary corrections and cross-cultural adaptations were made. The prepared Turkish version was translated back to English by 2 different professional interpreters (back translation) who were not involved in the first stage. The back translation and Turkish version were reevaluated by the committee, and a trial form was prepared (Figure 1). The prepared trial scale was administered to 20 patients selected from an outpatient clinic using the haphazard sampling method, which is 1 of the non-probability sampling methods. During the pilot study, the patients were asked if they had any problems in understanding the questions on the scale, and the answers were noted. All feedback was discussed by the expert committee, and the final version of the scale was approved without any changes (Appendix).

Patient-reported outcome (PRO) questionnaires

In the convergent validity analysis of the MSTS scoring system, as there was no disease-specific questionnaire for musculoskeletal oncology patients, the short form-36 (SF-36), the Western Ontario and McMaster Universities arthritis index (WOMAC) for the lower extremity division, and the disabilities of the arm, shoulder, and hand (DASH) questionnaire was used for the upper extremity division.

The SF-36 is a scale that has 36 questions (17). It has 8 subheadings: physical functioning (10 questions), physical role functioning (4 questions), bodily pain (2 questions), and general health perceptions (5 questions), as the physical component of SF-36; and social functioning (2 questions), emotional role functioning (3 questions), mental health (5 questions), energy and vitality (4 questions), as the mental component of SF-36. For each question, the scores are coded, summed, and transformed on a scale from 0 (worst possible health state measured by the questionnaire) to 100 (best possible health state).

The DASH questionnaire includes 30 questions divided into 3 parts (18) of which 21 questions assess the difficulties of the patient during daily life activities, 5 evaluate the symptoms (pain, activity-related pain, tingling, stiffness, and weakness), and the remaining 4 assess social function, work, sleep, and patient self-confidence.

The WOMAC scale detects significant changes in health status following a variety of treatments in the field of pharmacology, surgery, and physical therapy (19). It comprises 24 questions in 3 parts in which pain (5 questions), stiffness (2 questions), and physical function (17 questions) are investigated. Higher scores indicate severe symptoms, maximal limitations, and poor quality of life.

Final testing

The Turkish version of the MSTS scoring system was administered by 2 senior orthopedic residents (BO and MY) because the items required clinical evaluation in different rooms, and 2 results (MSTS11 and MSTS12) were obtained. The correlation between MSTS11 and MSTS12 was evaluated to test inter-observer reliability. The SF-36 quality of life scale was given to all patients simultaneously, WOMAC was administered to patients with lower limb disorders, and the DASH questionnaire was administered to patients with upper limb disorders. In addition, the range of motion of the limbs of all patients was recorded. All PRO questionnaires and physical examination records were noted by the same health professionals to eliminate practitioner-dependent differences. During the 15-day period, no treatment was given so as to not change the patient's examination findings, and the patients were retested at the end of the period (MSTS2). The correlation between MSTS11 and MSTS2 was evaluated for test-retest reliability.

Convergent validity

Convergent validity is the supporting evidence for construct validity (20). Turkish versions of the WOMAC, DASH, and SF-36 scales, whose validity and reliability were previously tested, were used to test convergent validity. Convergent validity was evaluated using correlation coefficients between the MSTS scoring system and other scale measurements (physical component of SF-36, DASH, and WOMAC). In addition, validity was tested by calculating the Spearman correlation coefficient between the range of motion scale (ROMS) and MSTS scoring system measurements of the patients. ROMS measurements were made using neutral zero methods with a goniometer (21). The angle measured was proportional to the normal maximum angle of the joint and classified into 5 classes: 100%, 4; 75%–99%, 3; 50%–74%, 2; 25%–49%, and 1; 0%–24%, 0: no movement.

HIGHLIGHTS

- For the first time, we were successfully translated and verified the Turkish version of MSTS scoring system. No linguistic or cultural inconsistency was encountered during the translation process.
- Current study showed that the Turkish version of MSTS had sufficient internal consistency, reliability and construct validity.
- Turkish translation of the MSTS scoring system can be used safely in the assessment of health-related quality of life in orthopedic oncology.

Discriminant Validity

Discriminant validity is considered as a subcategory of construct validity. It tests the ability of the scale to distinguish groups of different structures and characteristics (22). The patients were grouped according to age (over 35 years versus under 35 years), sex, and marital status (married versus single), and the MSTS scoring system scores were compared between the groups using the Mann-Whitney U test. The MSTS scoring system total score was compared in these groups to test the discriminant validity of the questionnaires.

Reliability

The reliability of the Turkish version of the MSTS scoring system was evaluated by calculating test-retest reliability and internal consistency. For the test-retest reliability, the test was administered to the same individuals for the second time after a 15-day interval. The Wilcoxon test and intraclass correlation coefficient (ICC) were used to evaluate the inter-observer consistency and test-retest reliability. ICC values could range from 0.00 to 1.00. Values between 0.60 and 0.80 are proof of good reliability, and values over 0.80 indicate excellent reliability (23). Alpha coefficient (Cronbach's alpha) was used to evaluate internal consistency. An alpha coefficient between 0.80 and 1.00 is proof of high reliability (23).

Statistical analysis

The Statistical Package for the Social Sciences (SPSS) for Windows 15.0 analysis program (SPSS Inc.; Chicago, IL, USA) was used for statistical analysis, and $p<0.05$ was considered statistically significant. Continuous variables were presented as mean±standard deviation (SD), and categorical variables were presented as numbers and percentages. Normal distribution for continuous variables was assessed using visual (histograms and probability graphics) and analytic methods (the Kolmogorov-Smirnov and Shapiro-Wilk tests). The continuous variables were not normally distributed. For continuous variables without normal distribution, the difference between 2 independent groups such as age (over 35 years versus under 35 years), sex, and marital status (married versus single) was evaluated using the Mann-Whitney U test. The Wilcoxon test was used to compare the scale scores of the same group in the test and retests. The relationship between numerical variables was examined using Spearman's correlation test.

The sample size of this study was calculated using the G*Power 3.1 program. A minimum of 26 patients was planned to be included in the study according to the sample size calculation by adjusting the effect size as 0.5, power as 80%, and alpha error as 0.05.

Results

Participants and score distribution

A total of 66 patients who met the criteria within the specified date range were identified, but only 36 patients agreed to participate in the study. The post-hoc power of this study, which was completed by reaching 36 patients between 2007 and 2012, was calculated as 0.919. The mean age of the study group was 36.6 (range, 13–75) years, and the mean follow-up period of the patients was 30.4 (range, 21–48) months (Table 1). Of the patients, 56% were men (n=20), and 61% (n=22) had completed secondary education. When the histopathologic diagnoses of the patients were examined, bone sarcoma was present in 24 patients (66.5%), soft tissue sarcoma in 8 (22.2%), and benign aggressive bone tumor in 4 (11.1%) (Table 1). The distribution of the scores that the patients achieved from the MSTS scoring system sub-dimensions is presented in Table 2.

Table 1. Baseline characteristics of the patients

Characteristics	Patients (n=36)
Age (years)	
Mean	36.6 (13–75)
Sex, n (%)	
Men	20 (55.6)
Women	16 (44.4)
Histological type, n (%)	
Bone sarcoma	
Osteosarcoma	6 (16.6)
Chondrosarcoma	14 (38.8)
Ewing Sarcoma	4 (11.1)
Soft tissue sarcoma	
Rhabdomyosarcoma	2 (5.6)
Undifferentiated pleomorphic sarcoma	2 (5.6)
Synovial Sarcoma	1 (2.8)
Fibrosarcoma	2 (5.6)
Angiosarcoma	1 (2.8)
Benign aggressive bone tumor	
Giant cell tumor of bone	3 (8.3)
Chondroblastoma	1 (2.8)
Time of follow-up (month)	30.4 (21–48)
Type of surgery	
Endoprosthetic reconstruction	23 (63.9)
Wide resection	9 (25)
Curettage with grafting	1 (2.8)
Biological reconstruction	3 (8.3)
Tumor location (%)	
Shoulder girdle	9 (25)
Knee	8 (22.2)
Femur	7 (19.5)
Forearm and elbow	4 (11.1)
Hip and pelvis	8 (22.2)
Surgical stage system	
1A	1 (2.8)
1B	4 (11.1)
2A	17 (47.3)
2B	14 (38.8)
3	0

Validity

Construct validity-convergent validity

It was observed that the total MSTS scoring system score had a strong negative correlation with DASH ($r=-0.689$; $p<0.001$) and WOMAC scores ($r=-0.634$; $p<0.001$), and moderate correlation with ROMS score ($r=0.521$; $p<0.001$) (Table 3). Statistically significant moderate-to-strong negative correlations between the MSTS scoring system subscales and WOMAC scores were also found (r values ranging from −0.545 to −0.685) (Table 3). All MSTS scoring system subscales, except dexterity and hand-positioning subscales, had a statistically significant correlation with DASH scores (r values ranging from −0.592 to −0.689) (Table 3). The total MSTS scoring system score also had a statistically significant strong correlation with all SF-36 scores (r values ranging from 0.425 to 0.609, $p<0.001$) (Table 4).

A statistically significant positive correlation was observed between MSTS scoring system subscales and ROMS, ranging from 0.369 to 0.820, except for the pain and dexterity subscales (Table 3).

Discriminant Validity

It was found that the MSTS scores differed significantly according to the age groups ($p=0.025$), which showed that the scale could distinguish

between different age groups. The MSTS scoring system scores were similar between the sex (p=0.739) and marital status (p=0.705) groups.

Reliability

To evaluate the consistency between observers (MSTS11-MSTS12), the difference between the scores of the same patient from the 2 different observers was evaluated using the Wilcoxon test (Table 5). It was found that there was no significant difference between the observers when the observers scored the patients consistently between themselves (p=0.197, p=0.405, p=0.102, p=0.564, p=0.705, p=0.180, p=0.157, and p=0.564, respectively). In addition, the consistency between the observers was evaluated using ICC values. In the first application, the consistency between the observers was found as ICC=0.96 (0.94–0.99; p<0.001) for the total score. It was observed that the ICC coefficients obtained for the inter-observer consistency of the subdivisions of the MSTS scoring system varied between 0.68 and 0.96 (Table 5). For the test-retest reliability, the total score was ICC=0.97 (0.96–0.99; p<0.001). The ICC values ranged between 0.77 and 0.98 for the test-retest reliability of the subscales of the MSTS scoring system (Table 5). When the results between the observer's consistency and test-retest reliability were evaluated, good and perfectly reliable results were obtained. Cronbach's alpha coefficients were calculated to evaluate internal consistency. The Cronbach alpha was 0.97.

Table 2. Mean MSTS and subscale scores of the patient group

MSTS	Mean score	SD	95% CI
Total (%)	73.75	16.79	40.47–105.66
Function	3.56	0.54	2.50–4.62
Pain	4.01	0.92	2.20–5.81
Emotional acceptance	3.78	0.62	2.56–4.99
Walking ability	3.97	0.77	2.46–5.48
Gait	4.21	0.79	2.66–5.75
Support	4.19	0.73	2.76–5.62
Dexterity	3.89	0.81	2.30–5.47
Hand positioning	3.12	0.88	1.40–4.84
Lifting ability	3.66	0.71	2.27–5.05

MSTS: musculoskeletal tumor society; SD: standard deviation; CI: confidence intervals

Table 3. Results of validity analysis: correlations of total MSTS and MSTS subscales with WOMAC, DASH, and ROMS

	WOMAC	DASH	ROMS
	r (p)	r (p)	r (p)
MSTS total	−0.634 (<0.001)	−0.689 (<0.001)	0.521(<0.001)
Function	−0,618 (0.002)	−0.620 (<0.001)	0.434 (0.008)
Pain	−0.545 (0.001)	−0.601 (0.030)	0.295 (0.081)
Emotional acceptance	−0.685 (<0.001)	−0.592 (0.033)	0.369 (0.004)
Walking ability	−0.602 (0.002)	–	0.601 (0.002)
Gait	−0.652 (0.001)	–	0.598 (0.003)
Support	−0.616 (0.002)	–	0.604 (0.003)
Dexterity	–	−0.533 (0.061)	0.477 (0.099)
Hand positioning	–	−0.336 (0.261)	0.820 (0.010)
Lifting ability	–	−0.607 (0.028)	0.717 (0.006)

r: Spearman's correlations coefficient; WOMAC: Western Ontario and McMaster Universities Arthritis Index; DASH: disabilities of the arm, shoulder, and hand; ROMS: range of motion scale; MSTS: musculoskeletal tumor society

Discussion

Cross-cultural translation aims to ensure the equivalence of content between the original and translated versions of the tests. Equality is achieved through correct linguistic translation and by ensuring cultural harmony (16). The original MSTS scoring system is a well-accepted scale that facilitates the evaluation of functional results after limb sarcoma surgery. To the best of our knowledge, this is the first study in terms of the cross-cultural adaptation and validation of the Turkish version of the MSTS scoring system. No linguistic or cultural inconsistency was encountered during the translation process. Although there were minor differences in the translation and back-translation phase of the MSTS scoring system, inconsistencies were resolved with the consensus of the evaluation committee. There was little difference in the cultural adaptation because the functional skills questioned by the original scoring system were often used globally. This study showed that the Turkish version of MSTS scoring system had sufficient internal consistency, reliability, and construct validity. Thus, a Turkish version of the MSTS scoring system, both semantically and conceptually similar to the original, could be created.

Before this study, the original version of the MSTS scoring system had been translated into many other languages, and it was confirmed through analysis that they had sufficient reliability and validity. The ICCs obtained as a result of test-retest analysis were 0.92, both in the Japanese (24) and Brazilian (24) populations. The ICC for the inter-observer reliability was calculated as 0.98 in the Brazilian population. For the Chinese population, the ICC was 0.91 for test-retest and 0.90 inter-observer reliability (3).

In this study, the ICC was 0.97 for the test-retest analysis of the Turkish version and 0.96 for inter-observer reliability. The Turkish version of the MSTS scoring system was shown to have high reliability levels, as in other languages. Furthermore, the Cronbach's alpha value was 0.87 for the Japanese version, 0.84 for the Portuguese version, and 0.86 for the Chinese version, and it was calculated as 0.97 for the Turkish version. The results of this study indicate that the Turkish

Table 4. Results of validity analysis: correlations between MSTS and SF-36 scores

	SF-36 (PF)	SF-36 (PRF)	SF-36 (BP)	SF-36 (GHP)
	r (p)	r (p)	r (p)	r (p)
MSTS total	0.607 (<0.001)	0.609 (<0.001)	0.479(0.003)	0.425 (<0.001)
Function	0.486 (0.003)	0.468 (0.010)	0.144 (0.402)	0.396 (0.017)
Pain	0.471 (0.003)	0.317 (0.059)	0.471 (0.004)	0.455 (0.005)
Emotional Acceptance	0.554 (<0.001)	0.478 (0.003)	0.429 (0.009)	0.470 (0.004)
Walking ability	0.697 (<0.001)	0.574 (0.004)	0.389 (0.067)	0.594 (0.003)
Gait	0.703 (<0.001)	0.486 (0.019)	0.195 (0.373)	0.392 (0.003)
Support	0.712 (<0.001)	0.472 (0.023)	0.167 (0.447)	0.471 (0.023)
Dexterity	−0.308 (0.305)	−0.114(0.711)	0.087 (0.778)	−0.114 (0.711)
Hand positioning	0.392 (0.198)	0.595 (0.032)	0.407 (0.007)	0.175 (0.568)
Lifting ability	−0.093 (0.762)	0.373 (0.090)	0.505 (0.078)	−0.208 (0.495)

r: Spearman's correlations coefficient, MSTS: musculoskeletal tumor society; SF: short form; PF: physical functioning; PRF: physical role functioning; BP: bodily pain; GHP: general health perceptions

Table 5. Results of reliability analysis

	MSTS11–MSTS12 (Inter– observer reliability)	MSTS11–MSTS12 (Inter– observer reliability)	MSTS11–MSTS2 (Test-retest reliability)	MSTS11–MSTS 2 (Test-retest reliability)
	p*	ICC**	p*	ICC**
Function	0.132	0.95 (0.92–0.98; <0.001)	0.132	0.95 (0.92–0.99; <0.001)
Pain	0.197	0.75 (0.53–0.85; <0.001)	0.102	0.84 (0.72–0.92; <0.001)
Emotional acceptance	0.405	0.90 (0.89–0.97; <0.001)	0.653	0.86 (0.75–0.93; <0.001)
Walking ability	0.102	0.95 (0.89–0.98; <0.001)	0.096	0.97 (0.94–0.99; <0.001)
Gait	0.564	0.96 (0.91–0.99; <0.001)	0.206	0.97 (0.94–0.99; <0.001)
Support	0.705	0.92 (0.84–0.96; <0.001)	0.439	0.98 (0.96–0.99; <0.001)
Dexterity	0.180	0.71 (0.26–0.90; <0.001)	0.655	0.80 (0.47–0.94; <0.001)
Hand positioning	0.157	0.68 (0.12–0.82; <0.001)	0.083	0.77 (0.41–0.93; <0.001)
Lifting ability	0.564	0.72 (0.38–0.92; <0.001)	0.480	0.91 (0.73–0.97; <0.001)

*Wilcoxon test
**ICC: Intraclass correlation coefficients (95% confidence interval; p value); MSTS: musculoskeletal tumor society

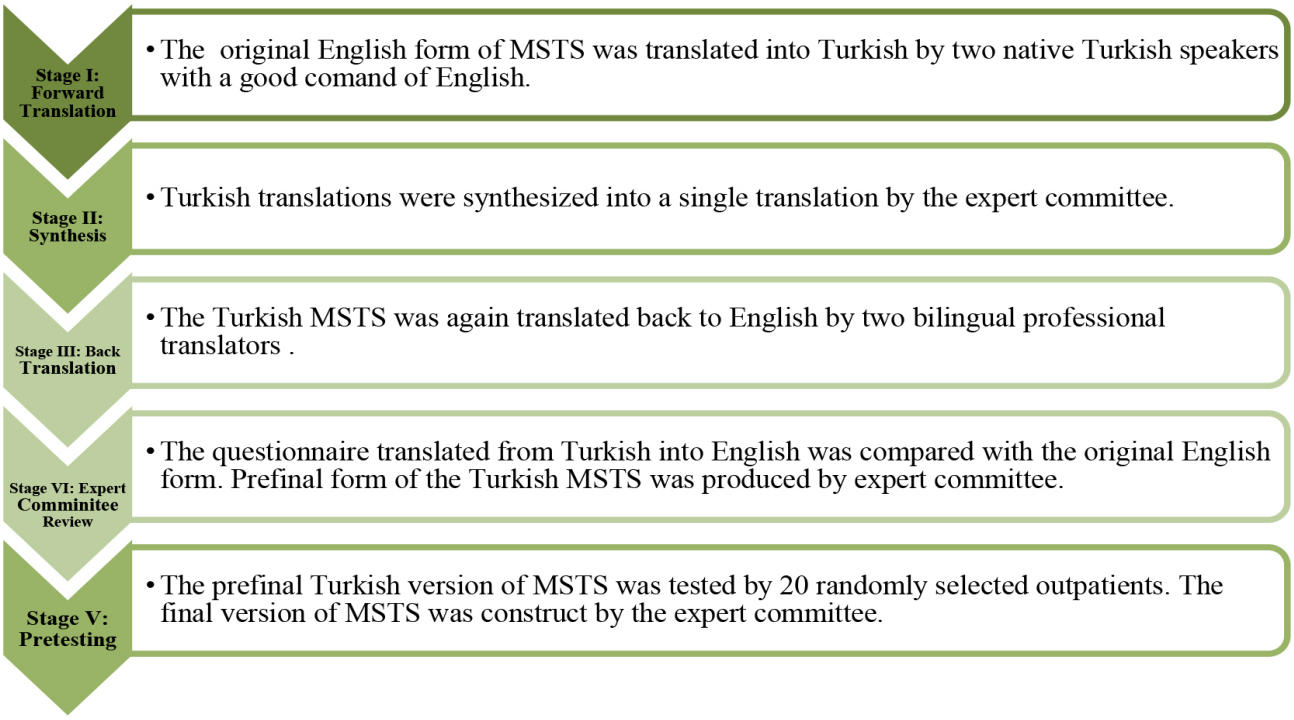

Figure 1. Flowchart depicting the processes used for the Translation and Cross-cultural Adaptation

version of MSTS scoring system is an internally stable system and coherent with similar validity and reliability studies.

Using disease-specific scoring systems could provide stronger results when performing a convergent validity analysis. However, a measure for evaluating the functional results and quality of life of patients after treatment for musculoskeletal system tumors that was validated for the Turkish population was absent. It was reported that structurally similar scores could be used in these situations (17). SF-36, WOMAC, and DASH scores that were previously approved in the Turkish population were used owing to the similar domains in the MSTS scoring system. Strong statistical correlation proved the convergent validity of the Turkish MSTS scoring system. It was evaluated both completely and separately with its subscales and strong validity for the total scores and subscales was demonstrated, except for dexterity and hand-positioning subscales.

Our results suggest that high ICC and Cronbach alpha values were determined, and strong internal consistency, reliability, and construct validity were provided. Another strength of the study was the inclusion of tools that demonstrate overall quality of life to validate the Turkish MSTS scoring system. In a previous study, smaller surgical procedures were generally reported to have good functional results, which could affect the analysis results (24). In our study, 32 (89%) patients had malignant musculoskeletal tumors, and these patients underwent major surgical procedures, such as wide resection and/or endoprosthetic reconstruction. Therefore, the high number of major surgical interventions in this study was another advantage of the study.

This study had several limitations. The limited number of patients and the patients' oncologic distribution characteristics (that is, tumor type, type of surgery, local recurrence, metastasis, and disease progression) might have affected the results. In addition, time-based

evaluations and comparisons of the Turkish translation of the MSTS scoring system (0–3–6–12–24–36 months) were not performed during the study period; time contributes to the healing of musculoskeletal system diseases over time. The 15 days that passed before the retest of the MSTS scoring system in this study could have affected the results. Although it is necessary to wait for this period in validity studies, this was one of the limitations of our study. Another limitation of the study is that there is no scale related to tumor function in Turkish that we could evaluate for convergent validity of the MSTS scoring system. In such cases, different scales with domains similar to the MSTS scoring system can be used for convergent validity. Although these scales are not developed for this patient group, the Turkish versions are valid and reliable. In addition, the ceiling and floor effects could not be evaluated owing to the limited sample size. In studies with fewer than 50 samples, the results can be misleading. In this study, we preferred to test the validity of the scale with construct validity (21, 25).

In conclusion, although the MSTS scoring system has weaknesses such as the lack of a patient-reported outcome scale structure and concise domains, the Turkish translation of the MSTS scoring system is a reliable scale that measures the correct and desired values in the evaluation of health-related quality of life in orthopedic oncology. The reliability coefficients of the Turkish MSTS scoring system were determined to be strong. It should also be noted that the MSTS scoring system, which should be used as a standard tool when evaluating quality of life after limb-salvage surgery, is not sufficient to evaluate non-physical factors. It would be beneficial to develop a scale in which the patient's mood can also be evaluated when determining treatment outcomes.

Ethics Committee Approval: Ethics committee approval was received for this study from the Local Ethics Committee of Gazi University (26.09.2012; No: 330).

Informed Consent: Written informed consent was obtained from the patients who participated in this study.

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Appendix: Turkish version of Musculoskeletal Tumor Society scoring system

MUSKULOSKELETAL TÜMÖR DERNEĞİ SKORLAMA SİSTEMİ

Ad – Soyad: Dosya No: Cinsiyet: Tarih:				Tanı: Taraf: Evre: Ameliyat Tarihi:		Cerrah Tipi: Rekonstrüksiyon Tipi:	
Alt Uzuv Bilgisi		AĞRI	İŞLEVSELLİK	DUYGUSAL KABULLENME	DESTEKLER	YÜRÜME KAPASİTESİ	YÜRÜYÜŞ ŞEKLİ
	5	Yok	Kısıtlama yok	İstekli	Yok	Sınırsız	Normal
	4	-	-	Orta düzey	-	-	-
	3	Hafif	Eğlenmeyi engelleyen kısıtlama var	Memnun	Cihaz kullanımı	Sınırlı	Hafif kozmetik
	2	-	-	Orta düzey	-	-	-
	1	Orta	Kısmi iş görememe	Kabullenmeme	Bir koltuk değneği	Sadece ev içinde	Belirgin Kozmetik, Hafif işlevsel yetersizlik
	0	Ciddi	Tam iş görememe	Beğenmeme	İki koltuk değneği	Yardımsız yürüyememe	Belirgin işlevsel yetersizlik
Üst Uzuv Bilgisi		AĞRI	İŞLEVSELLİK	DUYGUSAL KABULLENME	EL POZİSYONU	EL BECERİSİ	KALDIRMA YETENEĞİ
	5	Yok	Kısıtlama yok	İstekli	Sınırsız	Normal	Normal
	4	-	-	Orta düzey	-	-	-
	3	Hafif	Eğlenmeyi engelleyen kısıtlama var	Memnun	Omuz hizasından yukarı kaldıramama Supinasyon – pronasyon yapamama	İnce hareketlerin kaybı	Sınırlı
	2	-	-	Orta düzey	-	-	-
	1	Orta	Kısmi iş görememe	Kabullenmeme	Bel hizasından yukarı kaldıramama	Kıstırma, çimdikleme yapamama	Sadece yardım ile mümkün
	0	Ciddi	Tam iş görememe	Beğenmeme	Hiç hareket yok	Tutamama, kavrayamama	Hareket ettirememe

Toplam Skor _____ _____% derece

Maksimum Skor_____