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Translation and Cross-cultural Adaptation of the International Knee Documentation Committee Subjective Knee Form Into Turkish

STUDY DESIGN: Clinical measurement.

OBJECTIVE: To translate and culturally adapt the International Knee Documentation Committee (IKDC) Subjective Knee Form into Turkish and to determine selected psychometric properties of the translated version.

BACKGROUND: The IKDC Subjective Knee Form is widely used to evaluate disability associated with knee injuries, but it has not yet been translated or culturally adapted for Turkish-speaking individuals.

METHODS: The IKDC Subjective Knee Form was translated into Turkish, consistent with published methodological guidelines. The process included 2 forward translations, followed by the synthesis of these translations, and 2 backward translations, followed by an analysis of the translations and creation of the final version. The measurement properties of the Turkish IKDC Subjective Knee Form (internal consistency, construct validity, and floor and ceiling effects) were tested in 103 patients (52 male; average ± SD age, 34.9 ± 11.9 years) with a variety of knee pathologies. Reproducibility was tested in 58 patients (28 male; age, 33.7 ± 10.6 years) over 3 to 14 days, and responsiveness was tested in 33 patients (23 male; age, 30.8 ± 8.0 years) with anterior cruciate ligament reconstruction. Cronbach alpha was used to assess internal consistency, and intraclass correlation coefficients were used to estimate the test-retest reliability. Construct validity was analyzed with the Turkish version of the Lysholm knee score, the Kujala Anterior Knee Pain Scale, and the Medical Outcomes Study 36-Item Short-Form Health Survey.

RESULTS: The Turkish version of the IKDC Subjective Knee Form showed excellent internal consistency (Cronbach coefficient α = .89) and test-retest reliability (intraclass correlation coefficient = 0.91). The correlation coefficients between the IKDC Subjective Knee Form and the Lysholm knee score and Kujala Anterior Knee Pain Scale were 0.64 and 0.89, respectively (P<.001). The highest correlations between the IKDC Subjective Knee Form and the Medical Outcomes Study 36-Item Short-Form Health Survey were observed in the physical functioning subscale and the physical component summary score (r = 0.69 and r = 0.70, respectively; P<.05); the lowest correlations were observed in the mental health subscale and mental component summary score (r = 0.13 and r = 0.05, respectively). We observed no floor or ceiling effects. The IKDC Subjective Knee Form demonstrated a large effect size with the group tested (2.09; 95% confidence interval: 1.61, 2.59).

CONCLUSION: The Turkish version of the IKDC Subjective Knee Form has sufficient reliability and validity to measure patient-reported outcomes for Turkish-speaking individuals with a variety of knee disorders. *J Orthop Sports Phys Ther 2014;44(11):899-909. Epub 16 October 2014. doi:10.2519/jospt.2014.4865*

KEY WORDS: *ACL, IKDC, reliability, validity*

Patient-reported outcome (PRO) measures provide insights from the patient's perspective of the impact of disease and treatment on health and quality of life. Patient-reported outcome measures are categorized as generic, disease specific, or joint specific. Generic measures often reflect health-related quality-of-life questions that are relevant across different diseases and populations. In contrast, specific measures include areas of importance related to a specific disease.[36] In research, both generic and disease-specific measures are often included, with disease-specific measures often considered as the primary outcome.[34]

Many PRO measures have been developed for the assessment of knee injuries, including the Lysholm knee score, Cincinnati Knee Rating System, Kujala Anterior Knee Pain Scale, Knee injury and Osteoarthritis Outcome Score, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), the Knee Outcome Survey-activities of daily living subscale, and the International Knee Documentation Committee (IKDC) Sub-

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jective Knee Form.[2,4,12,15,21,35] Of these, the IKDC Subjective Knee Form was designed to measure symptoms and limitations in function and sports activity for a variety of knee conditions, including ligament, meniscus, and cartilage injuries, as well as patellofemoral pain.[12]

Before a PRO measure can be used in a society other than the one in which it was developed, it must be translated and culturally adapted. Additionally, the psychometric properties of the translated version of the PRO measure need to be assessed and compared to those of the original version. The knee PRO measures that have been translated into Turkish and psychometrically tested include the WOMAC, the Knee Outcome Survey-activities of daily living subscale, the Lysholm knee score, and the Knee injury and Osteoarthritis Outcome Score.[5,8,33,37] The WOMAC was developed to assess individuals with hip and knee osteoarthritis; however, its psychometric properties for other knee-related injuries have not been evaluated. The Knee injury and Osteoarthritis Outcome Score was developed as an extension of the WOMAC, with the purpose of evaluating short- and long-term symptoms and function in people with a variety of knee injuries and osteoarthritis.[4] The Knee Outcome Survey-activities of daily living subscale focuses on the effects that symptoms have on daily activities. Although the Lysholm knee score was originally designed to evaluate patients after knee ligament injury, the questions do not assess limitations during high-level athletic activities. The IKDC Subjective Knee Form is used extensively worldwide and demonstrates strong psychometric characteristics and normative data that have been established in the population of the United States.[1] It has been translated to different cultural settings and into many languages, including Dutch, Italian, Thai, Portuguese (Brazilian), Chinese, and Korean.[9,11,18,24,28,32] Data obtained from the cross-culturally adapted versions contribute to a better understanding of the instrument's measurement properties. The translated versions of the IKDC Subjective Knee Form have been found to be reliable, valid, and responsive for patients with a variety of knee injuries.[9,11,18,24,28,32] Therefore, a Turkish version of the IKDC Subjective Knee Form would likely be a PRO measure that would be helpful in the medical management of the Turkish-speaking population with knee injuries. The purpose of this study was to translate and culturally adapt the English version of the IKDC Subjective Knee Form into Turkish and to investigate the reliability, validity, and responsiveness of the translated version.

METHODS

Translation and Cross-cultural Adaptation

Translation and cross-cultural adaptation of the IKDC Subjective Knee Form was performed in 5 stages, consistent with the stages recommended by Beaton et al.[3] In the first stage, 2 Turkish individuals with a good command of English were responsible for the literal and conceptual translation of the IKDC Subjective Knee Form. The informed translator was a physical therapist, and the uninformed translator was a teacher. Both translators were fluent in English and spoke Turkish as their mother tongue. The translations were completed independently. In the second stage, both translations were compared and reviewed by a bilingual individual who highlighted any conceptual errors or inconsistencies in the translations to establish the first Turkish translation. In the third stage, after the first Turkish translation was agreed upon, 2 native English speakers with a good command of Turkish separately translated the finalized Turkish translation back into English. Both translators were unaware of the purpose of the study and had no access to the original English version. In the fourth stage, the back-translated version of the IKDC Subjective Knee Form was compared to the initial English version of the IKDC Subjective Knee Form by a committee consisting of a methodologist, a language professional, and the 4 translators. The committee evaluated the 4 translations and compared the discrepancies. After discussing the discrepancies, the committee finalized and approved the Turkish version of the IKDC Subjective Knee Form. In the final stage, preliminary testing was performed to determine comprehension of the Turkish version.

Preliminary Testing

Preliminary testing was conducted on 20 patients (6 male, 14 female; mean ± SD age, 27.4 ± 6.3 years; range, 17-39 years; body mass index [BMI], 25.4 ± 4.8 kg/m^2) who fulfilled the eligibility criteria of the study to determine comprehension of the Turkish version. Following completion of the questionnaire by each patient, physical therapists performed an interview in which the patients were asked if they had any difficulties understanding the questions. The questions that were difficult to understand were noted, and the patients were asked for their recommendations for revisions.

PRO Questionnaires

The IKDC Subjective Knee Form is a region-specific outcome measure of symptoms, function, and sports activity. The IKDC Subjective Knee Form includes 18 questions and was designed to measure symptoms, function, and sports activity in patients with a variety of knee conditions, including ligament and meniscal injuries, articular cartilage lesions, and patellofemoral pain. The form is scored by summing the scores for the individual items and then transforming the score to a scale that ranges from 0 to 100, with 100 indicating the absence of symptoms and higher levels of functioning.[12]

The Lysholm knee score is a region-specific outcome measure used by clinicians to measure limp, locking, pain, support, stair climbing, instability, swelling, and squatting. The scale was originally designed to evaluate patients after anterior cruciate ligament injury, but has subsequently been used for a variety of

knee injuries. The scale includes 10 questions scored on a 101-point scale (0-100), with zero representing the worst condition and 100 the best.[25]

The Kujala Anterior Knee Pain Scale is a disease-specific outcome measure of anterior knee pain that documents responses to questions about 6 activities specifically associated with anterior knee pain. These questions ask whether there is pain while walking, squatting, running, jumping, or during prolonged sitting with the knee in flexion; whether there is limping, swelling, or subluxation of the patella; and whether there is a need for a walking aid. There are also questions about the amount of atrophy in the quadriceps muscle, flexion deficiency, and pain. The Kujala Anterior Knee Pain Scale consists of 13 questions, and the total score ranges from 0 to 100, with the highest value indicating the best score.[21]

The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) is a generic score that is used to establish a health profile. It consists of 8 scaled scores, in which each subscale is directly transformed into a scale from 0 to 100 to identify the patient's physical and mental state. These 8 sections include physical functioning, physical role functioning, bodily pain, general health perceptions, vitality, social function, emotional role functioning, and mental health. In addition, the sum of the physical functioning, physical role functioning, bodily pain, and general health perceptions subscales generates a physical component summary score (PCS), and the sum of the vitality, social function, emotional role functioning, and mental health subscales generates a mental component summary score (MCS). Standardized scores range from 0 to 100, with higher scores indicating better health status.[27] Cross-sectional data from population studies have shown that the SF-36 is reliable and able to detect differences between groups defined by age, sex, socioeconomic status, geographical region, and clinical conditions. The SF-36 may therefore be a useful tool for monitoring changes in health in the population. In addition, the SF-36 questionnaire is an outcome measure with good methodological properties.[20,27]

Global rating of change (GRC) scales are commonly used in clinical research, particularly in the musculoskeletal area.[16] These scales are designed to quantify a patient's improvement or deterioration over time, usually either to determine the effect of an intervention or to chart the clinical course of a condition. The responses for the GRC are "much better," "slightly better," "stayed the same," "slightly worse," or "much worse."[30]

Participants

Before inclusion in the study, potential participants were asked to read and sign an informed-consent form, which was approved by the Ethics Committee at Istanbul University (protocol 2010/891-281). The study was performed between March 2011 and January 2013. The eligibility criteria were (1) 16 years of age or older; (2) knee pathology, including traumatic ligament and meniscal injuries, fractures, patellofemoral joint pain, or mild osteoarthritis; and (3) ability to read and write in Turkish. Diagnoses were established by a physician based on the history, physical examination, and diagnostic imaging (**TABLE 1**). The diagnosis given by the physician was recorded for the purpose of this study. One hundred fifteen consecutive patients with a variety of knee injuries were invited to complete the Turkish version of the IKDC Subjective Knee Form (**APPENDIX**) and the previously validated Turkish versions of the Lysholm knee score, Kujala Anterior Knee Pain Scale, and SF-36.[5,19,22] The physical therapists administered the listed questionnaires in random order to patients in waiting rooms prior to an appointment with an orthopaedic surgeon. The patients were also asked to complete the Turkish IKDC Subjective Knee Form again 3 to 14 days after their first completion to determine test-retest reliability. To minimize the risk of short-term clinical change, no treatment was provided during this period. The GRC was provided before the retest assessment to determine whether the patients' condition was stable. Only those individuals who reported that they "stayed the same" were included in the reliability analysis. Responsiveness was assessed in a subgroup of 33 patients who had anterior cruciate ligament reconstruction. The patients were treated postsurgery for 3 months at the clinic and subsequently referred to a sports medicine center to be treated with a sport-specific exercise program. Reassessment was performed 1 year postsurgery.

Statistical Analysis

All statistical analyses were performed with Stata Version 11 (StataCorp LP, College Station, TX). Descriptive statistics were calculated for all variables. These included frequency counts and the percentage for nominal variables and measures of central tendency (means and medians) and dispersion (standard deviations and ranges) for continuous variables. The measurement properties analyzed in this study for the instruments included internal consistency, test-retest reliability, construct validity, and ceiling and floor effects.

Internal Consistency Internal consistency was assessed using Cronbach alpha. This test indicates the homogeneity between the items within a questionnaire or the subdomains of a questionnaire. The test was used here to determine the interrelatedness among the items of the IKDC Subjective Knee Form. An inter-item correlation matrix was used to indicate whether one of the items did not correlate positively with the other items. A Cronbach alpha value ranging from .70 to .95 was considered to be adequate.[36] High values are not necessarily desirable because this may indicate a redundancy of the questionnaire items. In this study, data from the patients included in the first administration of the IKDC Subjective Knee Form were used to assess internal consistency.

Test-Retest Reliability Test-retest reliability represents a scale's ability to yield consistent results when administered

TABLE 1 Patient Demographics

Characteristic	n (%)
Gender	
Female	51 (49.5)
Male	52 (50.5)
Education	
Literate (but did not complete any school)	8 (7.8)
Primary school	12 (11.7)
High school	24 (23.3)
University degree	49 (47.6)
Masters degree	8 (7.8)
Doctorate	2 (1.9)
Involved side	
Right knee	56 (54.4)
Left knee	47 (45.6)
Diagnosis	
ACL injury	12 (11.7)
ACL and lateral meniscus lesion	1 (0.9)
ACL and MCL and meniscus injury	3 (2.9)
Multiple-ligament injury	1 (0.9)
Patellofemoral pain	40 (38.8)
Patellofemoral pain and meniscus injury	2 (1.9)
Patellar dislocation	1 (0.9)
Meniscus injury	4 (3.9)
Osteoarthritis	5 (4.9)
Surgery	
ACL reconstruction	14 (13.6)
ACL reconstruction and meniscus repair	10 (9.7)
ACL revision and meniscectomy	3 (2.9)
MPFL reconstruction	1 (0.9)
Meniscectomy	4 (3.9)
Microfracture	1 (0.9)

Abbreviations: ACL, anterior cruciate ligament; MCL, medial collateral ligament; MPFL, medial patellofemoral ligament.

on separate occasions during a period when an individual's status has remained stable.[14] The patients who reported no change in their condition between the first and second administration of the outcome measure according to the GRC were included in the analysis of test-retest reliability. Intraclass correlation coefficients (ICCs) were calculated using a 2-way, mixed-model analysis of variance. Values of 0.4 or greater were considered satisfactory (r = 0.81-1.0, excellent; 0.61-0.80, very good; 0.41-0.60, good; 0.21-0.40, fair; and 0.00-0.20, poor).[23,26]

Agreement Agreement was assessed with the standard error of measurement (SEM) and minimal detectable change (MDC). The ICC was used to calculate the SEM, which is an index of measurement precision. The SEM was calculated as $SD \times \sqrt{1 - ICC}$. The MDC refers to the minimal amount of change that is within measurement error. The SEM was used to determine the MDC at the 95% limits of confidence (MDC_{95}), which was calculated using the formula $1.96 \times \sqrt{2} \times SEM$.[7]

Validity Validity is represented by the extent to which a score retains its intended meaning and interpretation.[31] In this study, we examined 3 aspects of validity: construct, convergent/divergent, and content validity. Evidence for construct validity of the Turkish IKDC Subjective Knee Form was provided by determining its relationship with the Kujala Anterior Knee Pain Scale, Lysholm knee score, and the PCS of the SF-36. The physical functioning, physical role functioning, and PCS domains of the SF-36 were used to assess convergent validity. Evidence for divergent validity was provided by determining the relationships with the mental health, emotional role functioning, and MCS domains of the SF-36. Pearson correlation coefficients and their 95% confidence intervals (CIs) were calculated to assess construct and convergent/divergent validity. Content validity was assessed by the distribution of the scores and occurrence of ceiling and floor effects. Floor and ceiling effects of the IKDC Subjective Knee Form at the first and second completion of the form were assessed by calculating the proportion of patients scoring the minimum or maximum values on the scale relative to the total number of patients. We considered scores between 0% and 10% to be minimum scores and scores between 90% and 100% to be maximum scores. Floor and ceiling effects were considered to be relevant if greater than 30% of the patients had a score at the limits of the scale.[31]

Responsiveness Responsiveness determines whether an instrument can detect clinical changes. Effect size was determined by calculating the differences in the means of baseline and follow-up data, divided by the standard deviation at baseline.[7] A value between 0.20 and 0.50 was considered to be a small effect, between 0.51 and 0.80 a moderate effect, and higher than 0.80 a large effect.[17]

RESULTS

Translation and Cross-cultural Adaptation

During the translation process, the translators had difficulty translating the words "pivoting" and "giv-

ing way." Pivoting was left as is because it could not be replaced by a Turkish word, and it is also used by Turkish medical professionals and athletes. "Giving way" was translated as *boşalma*, which means "loss of control." However, the pilot study indicated that some patients still had difficulty understanding the words "pivoting" and "giving way." Therefore, an explanation was provided in parentheses for "pivoting" that described the situational term as "the external or internal rotation of the body while the foot is stable on the ground." "Giving way" was also explained in parentheses as "anterior translation, slipping, or sense of looseness within the knee." These phrases helped the patients understand the questions. The patients required approximately 5 minutes to complete the Turkish IKDC Subjective Knee Form.

Measurement Properties and Testing

TABLE 1 provides the demographic and clinical characteristics of the patients. The descriptive statistics for the scores at baseline and at the second administration of the Turkish IKDC Subjective Knee Form are provided in **TABLE 2**. The mean ± SD duration of symptoms was 6.4 ± 3.2 months. Among all patients included in the study, 4 patients declined to answer any of the questionnaires, 3 declined to complete the SF-36, and 5 left half of the questionnaires incomplete. The remaining 103 patients (52 male; mean ± SD age, 34.9 ± 11.9 years; range, 17-72 years; BMI, 25.4 ± 4.8 kg/m^2) completed all of the questionnaires at the first assessment. Twenty-three patients did not return to the clinic for the second assessment. Of the remaining 80 patients, 5 indicated that they had received treatment before the second assessment of the PRO measures, and 17 patients indicated that their condition was not the same according to the GRC. Therefore, of the 103 patients who participated at the baseline assessment, 58 patients (28 male; age, 33.7 ± 10.6 years; range, 17-69 years; BMI, 26.2 ± 2.9 kg/m^2) participated in the second assessment for test-retest reliability analysis.

TABLE 2 Descriptive Statistics for the Patient-Reported Outcome Measures*

Measure	Mean ± SD (95% CI)
IKDC Subjective Knee Form assessment 1	47.6 ± 19.8 (44.5, 51.0)
IKDC Subjective Knee Form assessment 2	49.5 ± 12.2 (46.0, 53.1)
Kujala Anterior Knee Pain Scale	64.7 ± 18.3 (60.6, 70.4)
Lysholm knee score	67.1 ± 19.1 (63.6, 70.9)
SF-36 physical functioning	65.0 ± 23.1 (60.5, 69.5)
SF-36 physical role functioning	42.2 ± 40.7 (34.3, 50.2)
SF-36 bodily pain	51.5 ± 23.1 (47.1, 56.1)
SF-36 general health perceptions	62.8 ± 23.4 (58.2, 67.4)
SF-36 vitality	54.5 ± 19.3 (50.8, 58.4)
SF-36 social function	67.2 ± 25.2 (62.2, 72.1)
SF-36 emotional role functioning	60.3 ± 40.5 (52.4, 68.3)
SF-36 mental health	63.8 ± 19.5 (60.1, 67.7)
SF-36 PCS	40.5 ± 10.2 (38.6, 42.5)
SF-36 MCS	46.8 ± 10.5 (44.8, 48.9)

Abbreviations: CI, confidence interval; IKDC, International Knee Documentation Committee; MCS, mental component summary score; PCS, physical component summary score; SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey.
**The Turkish versions of the patient-reported outcome measures were used in this study.*

TABLE 3 Psychometric Properties of the IKDC Subjective Knee Form, Including the Turkish Version

Study	Language Version	Test-Retest Reliability, ICC	Time Interval, d*	Cronbach Alpha
Irrgang et al[12]	English	0.95	49.7	.92
Padua et al[32]	Italian	0.90	5	.91
Haverkamp et al[11]	Dutch	0.96	7	.92
Crawford et al[6]	English	0.95	28	.77
Lertwanich et al[24]	Thai	0.92	7	.92
Greco et al[10]	English	0.91, 0.93	182, 365	.93
Metsavaht et al[28]	Brazilian Portuguese	0.99	7	.92, .93
Fu and Chan[9]	Chinese	0.87	7-10	.97
Kim et al[18]	Korean	0.94	14	.91
Present study	Turkish	0.91	5.6	.89

Abbreviations: ICC, intraclass correlation coefficient; IKDC, International Knee Documentation Committee.
**Days between administrations of the test, to calculate ICC.*

Internal Consistency

The internal consistency of the first assessment of the Turkish IKDC Subjective Knee Form was strong, with a Cronbach alpha value of .89. The interitem correlation matrix did not show any low or negative interitem correlation. The results of internal consistency and comparisons with other translated versions of the IKDC Subjective Knee Form are provided in **TABLE 3**.

Test-Retest Reliability

The average ± SD interval between the 2 assessments was 5.6 ± 2.2 days. The test-retest assessment indicated excellent reliability, with an ICC of 0.91 (**TABLE 3**).

TABLE 4 Correlations Between Different Versions of the IKDC Subjective Knee Form and the Domains of the SF-36

	Turkish	English[12]	Dutch[11]	Italian[32]	Thai[24]	Brazilian Portuguese[28]	Chinese[9]	Korean[18]
SF-36 physical functioning	0.69*	0.63	0.71	0.67	0.75	0.75	0.64	0.66
SF-36 physical role functioning	0.53*	0.47	0.55	0.56	0.37	0.54	0.50	0.49
SF-36 bodily pain	0.47*	0.64	0.69	0.75	0.76	0.63	0.64	0.30
SF-36 general health perceptions	0.32	0.30	0.41	0.26	0.21	0.54	0.50	0.11
SF-36 vitality	0.24	0.39	0.40	0.36	0.29	0.46	0.44	0.15
SF-36 social function	0.40	0.47	0.42	0.58	0.22	0.43	0.41	0.48
SF-36 emotional role functioning	0.22	0.26	0.30	0.44	0.34	0.50	0.24	0.30
SF-36 mental health	0.13	0.25	0.21	0.65	0.29	0.40	0.41	0.15
SF-36 PCS	0.70*	0.66	...	0.60	0.63	0.79	...	...
SF-36 MCS	0.05	0.16	...	0.40	0.37	0.51	...	...

Abbreviations: IKDC, International Knee Documentation Committee; MCS, mental component summary score; PCS, physical component summary score; SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey.
**P<.05. Level of significance is only reported for the data of the current study.*

TABLE 5 Responsiveness of the IKDC Subjective Knee Form in the Literature and Turkish Version

Study	ES	SRM	Time Interval, mo	Pathology
Irrgang et al[13] (n = 207)	1.13	0.94	6-28	ACL reconstruction
Crawford et al[6] (n = 100)	2.11	1.5	...	Meniscus injuries
Greco et al[10] (n = 51)	0.76	0.57	6	Focal articular cartilage defects
	1.06	1.00	12	
Kim et al[18] (n = 104)	...	0.68	3	ACL reconstruction
Present study (n = 33)	2.09	...	12	ACL reconstruction

Abbreviations: ACL, anterior cruciate ligament; ES, effect size; IKDC, International Knee Documentation Committee; SRM, standardized response mean.

Agreement

The SEM and MDC were determined to be 6.0 and 16.4, respectively.

Construct Validity

The Turkish IKDC Subjective Knee Form demonstrated an excellent correlation with the Kujala Anterior Knee Pain Scale ($r = 0.89$, $P<.001$) and very good correlation ($r = 0.64$, $P<.001$) with the Lysholm knee score. The correlations between the IKDC Subjective Knee Form and the SF-36 are presented in **TABLE 4**. In sum, the IKDC Subjective Knee Form was most strongly associated with the physical functioning subscale and the PCS ($r = 0.69$ and $r = 0.70$, respectively; $P<.05$) of the SF-36. The weakest associations between the IKDC Subjective Knee Form and the SF-36 were noted for the mental health subscale and the MCS ($r = 0.13$ and $r = 0.05$, respectively).

Floor and Ceiling Effects

Floor and ceiling effects and the number of items answered were identical during the test and retest examinations. None of the patients' scores were at the maximal or minimal value, indicating no floor or ceiling effect.

Responsiveness

Preoperative scores on the IKDC Subjective Knee Form were compared with the 1-year post–anterior cruciate ligament reconstruction scores for 33 patients (23 male; age, 30.8 ± 8.0 years; range, 16-45 years; BMI, 25.4 ± 1.5 kg/m^2). The mean ± SD of the preoperative and postoperative values of the IKDC Subjective Knee Form was 48.8 ± 14.9 and 80.1 ± 17.9, respectively, which resulted in a large effect size (2.09; 95% CI: 1.61, 2.59). The results of effect size and comparisons with literature on the IKDC Subjective Knee Form are provided in **TABLE 5**.

DISCUSSION

The aim of this study was to translate and culturally adapt the IKDC Subjective Knee Form into Turkish and provide reliability, validity, and responsiveness data for the translated version based on a sample of Turkish-speaking patients with knee injuries. Based on our sample, the Turkish version of the IKDC Subjective Knee Form demonstrated acceptable levels of reliability, validity, and responsiveness to be used as a PRO questionnaire for Turkish-speaking individuals with a variety of knee conditions.

Internal consistency of the Turkish version, using Cronbach alpha, was .89, which is considered excellent and is similar to values previously reported for the English and other translated versions of

the IKDC Subjective Knee Form (**TABLE 3**).[9,11,12,18,24,28,32] Test-retest reliability for the Turkish version of the IKDC Subjective Knee Form was also excellent and comparable to what has been previously reported in the literature (**TABLE 3**).[6,9-12,18,24,28,32] The time interval between repeat measurements is an important issue when determining test-retest reliability.[23] In general, the interval between repeat administrations for a PRO measure should be relatively brief (3-7 days) when the condition being measured is expected to change rapidly.[29] In the literature, the reported intervals for the estimation of test-retest reliability of the IKDC Subjective Knee Form range from 5 days to 12 months.[6,9-12,18,24,28,32] We repeated the test within 3 to 14 days and, to ensure an individual's condition had not changed, included only those who reported that they were "about the same" on the GRC. Thus, we believe that the patient's condition was stable between repeat administrations of the IKDC Subjective Knee Form. Only 1 of the patients was retested at 14 days, with a mean interval between repeat administrations of 5.6 days. The MDC was determined to be 16.4, meaning that a change of less than this value on repeated administrations of the Turkish IKDC Subjective Knee Form should be considered a reflection of measurement error rather than a true change in the patient's condition. The MDC value for the Turkish IKDC Subjective Knee Form is higher than that of the English version (MDC, 9) as a result of the high standard deviation of the data from our sample.

In recent studies, evidence for the validity of the English version of the IKDC Subjective Knee Form has been investigated by determining its relationship with many other PRO measures, including the Lysholm knee score, Cincinnati Knee Rating System, WOMAC, visual analog scale, and Lower Extremity Functional Scale.[10,11,28,29] In these studies, the highest levels of association were with the Cincinnati Knee Rating System (r = 0.70 to r = 0.91)[10] and the Lysholm knee score (r = 0.89),[28] with the lowest level of association being observed with the visual analog scale (r = −0.62).[11] In the present study, evidence for construct validity was obtained by determining the relationship between the IKDC Subjective Knee Form and the Lysholm knee score, as well as the Kujala Anterior Knee Pain Scale. The correlation coefficient between the IKDC Subjective Knee Form and the Lysholm knee score was very good (r = 0.64, P<.001), but not as strong as that observed in the Brazilian Portuguese (r = 0.89) and Korean (r = 0.82) versions.[18,28] Ours is the only study, to our knowledge, that used the Kujala Anterior Knee Pain Scale to provide evidence for the construct validity of the IKDC Subjective Knee Form, with the results showing an excellent level of association between the 2 outcome measures (r = 0.89, P<.001).

To determine convergent and divergent validity, we determined the level of associations between the scores on the IKDC Subjective Knee Form and the 8 subscales and 2 summary scores for the SF-36. The IKDC Subjective Knee Form was more strongly related to concurrent measures of physical and social function than to concurrent measures of mental function.[9,11,12,18,24,28,32] In this study, the correlation between the Turkish version of the IKDC Subjective Knee Form and SF-36 physical functioning subscale was higher than that of the English (r = 0.63), Italian (r = 0.67), Chinese (r = 0.64), and Korean (r = 0.66) versions of the IKDC Subjective Knee Form, but lower than that of the Dutch (r = 0.71), Thai (r = 0.75), and Brazilian Portuguese (r = 0.75) versions. The levels of association between the IKDC Subjective Knee Form and the mental domains of the SF-36 were similar to the results found with other translated versions.[13,24,28,32]

Responsiveness, based on the completion of the Turkish IKDC Subjective Knee Form prior to and 1 year after anterior cruciate ligament reconstruction, indicated an effect size of 2.09 (95% CI: 1.61, 2.59), which is higher than that of the English version of the IKDC Subjective Knee Form (effect size, 1.13).[13] Our data on responsiveness were obtained only for patients post–anterior cruciate ligament reconstruction, with a 1-year interval, likely responsible for the large effect-size value. Responsiveness has previously been reported for different pathologies, but no previous studies have reported responsiveness in a group 1 year after anterior cruciate ligament reconstruction.[6,10,13,18] Future studies are necessary to assess responsiveness with other knee injuries over a shorter period. In addition, future work should determine the minimal clinically important difference for the Turkish version of the IKDC Subjective Knee Form for different knee pathologies that commonly affect an active population.

CONCLUSION

The IKDC Subjective Knee Form is brief and easy to administer and interpret, with a minimal investment of time required for either the clinician or researcher. The Turkish IKDC Subjective Knee Form also has sufficient reliability, validity, and responsiveness to be used as a PRO measure for Turkish-speaking individuals with various knee pathologies. The Turkish IKDC Subjective Knee Form is also the first validated knee outcome measure in Turkish to evaluate high-level athletes. ◉

KEY POINTS

FINDINGS: The Turkish version of the IKDC Subjective Knee Form has sufficient reliability, validity, and responsiveness, with values similar to those reported for the original and other translated versions.

IMPLICATIONS: The Turkish version of the IKDC Subjective Knee Form can be used as a PRO measure for Turkish-speaking individuals with various knee pathologies.

CAUTION: Future studies are necessary to further assess responsiveness and to determine the minimal clinically important difference for the Turkish version of the IKDC Subjective Knee Form for various knee conditions.

REFERENCES

1. Anderson AF, Irrgang JJ, Kocher MS, Mann BJ, Harrast JJ. The International Knee Documentation Committee Subjective Knee Evaluation Form: normative data. *Am J Sports Med*. 2006;34:128-135. http://dx.doi.org/10.1177/0363546505280214
2. Barber-Westin SD, Noyes FR, McCloskey JW. Rigorous statistical reliability, validity, and responsiveness testing of the Cincinnati knee rating system in 350 subjects with uninjured, injured, or anterior cruciate ligament-reconstructed knees. *Am J Sports Med*. 1999;27:402-416.
3. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine (Phila Pa 1976)*. 2000;25:3186-3191.
4. Bellamy N, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *J Rheumatol*. 1988;15:1833-1840.
5. Çelik D, Coşkunsu D, Kılıçoğlu O. Translation and cultural adaptation of the Turkish Lysholm knee scale: ease of use, validity, and reliability. *Clin Orthop Relat Res*. 2013;471:2602-2610. http://dx.doi.org/10.1007/s11999-013-3046-z
6. Crawford K, Briggs KK, Rodkey WG, Steadman JR. Reliability, validity, and responsiveness of the IKDC score for meniscus injuries of the knee. *Arthroscopy*. 2007;23:839-844. http://dx.doi.org/10.1016/j.arthro.2007.02.005
7. de Vet HC, Terwee CB, Bouter LM. Current challenges in clinimetrics. *J Clin Epidemiol*. 2003;56:1137-1141.
8. Evcik D, Ay S, Ege A, Turel A, Kavuncu V. Adaptation and validation of Turkish version of the Knee Outcome Survey-Activities for Daily Living Scale. *Clin Orthop Relat Res*. 2009;467:2077-2082. http://dx.doi.org/10.1007/s11999-009-0826-6
9. Fu SN, Chan YH. Translation and validation of Chinese version of International Knee Documentation Committee Subjective Knee Form. *Disabil Rehabil*. 2011;33:1186-1189. http://dx.doi.org/10.3109/09638288.2010.524274
10. Greco NJ, Anderson AF, Mann BJ, et al. Responsiveness of the International Knee Documentation Committee Subjective Knee Form in comparison to the Western Ontario and McMaster Universities Osteoarthritis Index, modified Cincinnati Knee Rating System, and Short Form 36 in patients with focal articular cartilage defects. *Am J Sports Med*. 2010;38:891-902. http://dx.doi.org/10.1177/0363546509354163
11. Haverkamp D, Sierevelt IN, Breugem SJ, Lohuis K, Blankevoort L, van Dijk CN. Translation and validation of the Dutch version of the International Knee Documentation Committee Subjective Knee Form. *Am J Sports Med*. 2006;34:1680-1684. http://dx.doi.org/10.1177/0363546506288854
12. Irrgang JJ, Anderson AF, Boland AL, et al. Development and validation of the International Knee Documentation Committee Subjective Knee Form. *Am J Sports Med*. 2001;29:600-613.
13. Irrgang JJ, Anderson AF, Boland AL, et al. Responsiveness of the International Knee Documentation Committee Subjective Knee Form. *Am J Sports Med*. 2006;34:1567-1573. http://dx.doi.org/10.1177/0363546506288855
14. Irrgang JJ, Marx RG. Clinical outcomes in sport and exercise physical therapies. In: Kolt G, Snyder-Mackler L, eds. *Physical Therapies in Sport and Exercise*. Edinburgh, UK: Elsevier/Churchill Livingstone; 2007:206-219.
15. Irrgang JJ, Snyder-Mackler L, Wainner RS, Fu FH, Harner CD. Development of a patient-reported measure of function of the knee. *J Bone Joint Surg Am*. 1998;80:1132-1145.
16. Kamper SJ, Maher CG, Mackay G. Global rating of change scales: a review of strengths and weaknesses and considerations for design. *J Man Manip Ther*. 2009;17:163-170.
17. Kane RL. Outcome measures. In: *Understanding Health Care Outcomes Research*. Gaithersburg, MD: Aspen Publishers; 1997:17-18.
18. Kim JG, Ha JK, Lee JY, Seo SS, Choi CH, Lee MC. Translation and validation of the Korean version of the International Knee Documentation Committee Subjective Knee Form. *Knee Surg Relat Res*. 2013;25:106-111. http://dx.doi.org/10.5792/ksrr.2013.25.3.106
19. Koçyiğit H, Aydemir Ö, Fişek G, Ölmez N, Memiş A. [Reliability and validity of Turkish version of Short Form 36: a study of patients with rheumatoid disorder] *J Drug Ther.* 1999;12:102–106.
20. Kosinski M, Keller SD, Hatoum HT, Kong SX, Ware JE, Jr. The SF-36 Health Survey as a generic outcome measure in clinical trials of patients with osteoarthritis and rheumatoid arthritis: tests of data quality, scaling assumptions and score reliability. *Med Care*. 1999;37:MS10-MS22.
21. Kujala UM, Jaakkola LH, Koskinen SK, Taimela S, Hurme M, Nelimarkka O. Scoring of patellofemoral disorders. *Arthroscopy*. 1993;9:159-163.
22. Kuru T, Dereli EE, Yaliman A. Validity of the Turkish version of the Kujala patellofemoral score in patellofemoral pain syndrome. *Acta Orthop Traumatol Turc*. 2010;44:152-156. http://dx.doi.org/10.3944/AOTT.2010.2252
23. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33:159-174.
24. Lertwanich P, Praphruetkit T, Keyurapan E, Lamsam C, Kulthanan T. Validity and reliability of Thai version of the International Knee Documentation Committee Subjective Knee Form. *J Med Assoc Thai*. 2008;91:1218-1225.
25. Lysholm J, Gillquist J. Evaluation of knee ligament surgery results with special emphasis on use of a scoring scale. *Am J Sports Med*. 1982;10:150-154.
26. Marx RG, Menezes A, Horovitz L, Jones EC, Warren RF. A comparison of two time intervals for test-retest reliability of health status instruments. *J Clin Epidemiol*. 2003;56:730-735.
27. McHorney CA, Ware JE, Jr., Raczek AE. The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care*. 1993;31:247-263.
28. Metsavaht L, Leporace G, Riberto M, de Mello Sposito MM, Batista LA. Translation and cross-cultural adaptation of the Brazilian version of the International Knee Documentation Committee Subjective Knee Form: validity and reproducibility. *Am J Sports Med*. 2010;38:1894-1899. http://dx.doi.org/10.1177/0363546510365314
29. Metsavaht L, Leporace G, Riberto M, et al. Translation and cross-cultural adaptation of the Lower Extremity Functional Scale into a Brazilian Portuguese version and validation on patients with knee injuries. *J Orthop Sports Phys Ther*. 2012;42:932-939. http://dx.doi.org/10.2519/jospt.2012.4101
30. Norman GR, Stratford P, Regehr G. Methodological problems in the retrospective computation of responsiveness to change: the lesson of Cronbach. *J Clin Epidemiol*. 1997;50:869-879.
31. Nunnally JC, Bernstein IH. *Psychometric Theory*. 3rd ed. New York, NY: McGraw-Hill; 1994.
32. Padua R, Bondi R, Ceccarelli E, et al. Italian version of the International Knee Documentation Committee Subjective Knee Form: cross-cultural adaptation and validation. *Arthroscopy*. 2004;20:819-823. http://dx.doi.org/10.1016/j.arthro.2004.06.011
33. Paker N, Buğdaycı D, Sabırlı F, Özel S, Ersoy S. Diz incinme ve osteoartrit sonuç skoru: Türkçe sürümünün güvenilirlik ve geçerlilik çalışması. *Turkiye Klinikleri J Med Sci*. 2007;27:350-356.
34. Patrick DL, Deyo RA. Generic and disease-specific measures in assessing health status and quality of life. *Med Care*. 1989;27:S217-S232.
35. Roos EM, Roos HP, Lohmander LS, Ekdahl C, Beynnon BD. Knee Injury and Osteoarthritis Outcome Score (KOOS)—development of a self-administered outcome measure. *J Orthop Sports Phys Ther*. 1998;28:88-96. http://dx.doi.org/10.2519/jospt.1998.28.2.88
36. Terwee CB, Bot SD, de Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol*. 2007;60:34-42. http://dx.doi.org/10.1016/j.jclinepi.2006.03.012
37. Tüzün EH, Eker L, Aytar A, Daskapan A, Bayramoğlu M. Acceptability, reliability, validity and responsiveness of the Turkish version of WOMAC osteoarthritis index. *Osteoarthritis Cartilage*. 2005;13:28-33. http://dx.doi.org/10.1016/j.joca.2004.10.010
38. Ware JE, Jr., Sherbourne CD. The MOS 36-Item Short-Form Health Survey (SF-36). I. Conceptual framework and item selection. *Med Care*. 1992;30:473-483.

2000 IKDC SUBJEKTİF DİZ DEĞERLENDİRME FORMU

Tam Adınız
Bugünün Tarih: Gün/ Ay Yıl
Yaralanma Tarihi: Gün/ Ay Yıl

BELİRTİLER

Bulgularınızı ciddi belirtiler ortaya çıkmadan yapabileceğinizi düşündüğünüz en yüksek aktivite düzeyine göre derecelendirin. Normalde bu düzeyde aktivite yapmıyor olabilirsiniz.

1) Şiddetli diz ağrısı olmadan yapabileceğiniz en yüksek aktivite düzeyi nedir?

4.Zıplamak gibi zor aktiviteler veya basketbol ya da futboldaki gibi pivot (ayak yerde iken dizin içe veya dışa dönmesi) hareketleri.
3.Ağır fiziki işler, ya da tenis, kayak gibi yorucu aktiviteler
2. Orta düzeydeki fiziki işler, hızlı yürüyüş ya da koşmak.
1. Yürümek, ev işi veya bahçe işi gibi hafif aktiviteler
0. Yukarıda sayılan herhangi bir aktiviteyi diz ağrısı nedeniyle yapamama

2) Son 4 hafta içerisinde, ya da yaralanmanızdan beri, ne sıklıkla ağrınız oldu?

	0	1	2	3	4	5	6	7	8	9	10
Sürekli	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑ Asla

3) Eğer ağrınız olduysa, ne kadar şiddetli idi ?

Hayal edilebilen en kötü ağrı	0 ❑	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑	6 ❑	7 ❑	8 ❑	9 ❑	10 Ağrı yok ❑

4) Son 4 hafta içerisinde, ya da yaralanmanızdan beri, dizinizde şişlik ya da hareket kısıtlanması oldu mu?

4.Pek değil
3.Hafif
2.Orta düzeyde
1.Çok
0.İleri düzeyde

5) Dizinizde şişlik ortaya çıkmadan yapabildiğiniz en yüksek aktivite düzeyi nedir?

4. Zıplamak gibi zor aktiviteler veya basketbol ya da futboldaki gibi pivot (ayak yerde iken dizin içe veya dışa dönmesi) hareketleri.

3. Ağır fiziki işler, ya da tenis, kayak gibi yorucu aktiviteler

2. Orta düzeydeki fiziki işler, hızlı yürüyüş ya da koşmak

1. Yürümek, ev işi veya bahçe işi gibi hafif aktiviteler

0. Yukarıda sayılan herhangi bir aktiviteyi dizde şişme nedeniyle yapamama

6) <u>Son 4 hafta</u> içerisinde, ya da yaralanmanızdan beri, dizinizde kilitlenme ya da takılma oldu mu?

0❑Evet 1❑Hayır

7) Dizinizde ciddi boşalma hissi (dizin öne doğru kayması) olmadan yapabileceğiniz en yüksek aktivite düzeyi nedir?

4. Zıplamak gibi zor aktiviteler veya basketbol ya da futboldaki gibi pivot (ayak yerde iken dizin içe veya dışa dönmesi)hareketleri.

3. Ağır fiziki işler, ya da tenis, kayak gibi yorucu aktiviteler

2. Orta düzeydeki fiziki işler, hızlı yürüyüş ya da koşmak

1. Yürümek, ev işi veya bahçe işi gibi hafif aktiviteler

0. Yukarıda sayılan herhangi bir aktiviteyi dizde boşalma nedeniyle yapamama

<u>SPOR AKTİVİTELERİ</u>

8) Düzenli olarak katılabildiğiniz en yüksek aktivite düzeyi nedir?

4. Zıplamak gibi zor aktiviteler veya basketbol ya da futboldaki gibi pivot (ayak yerde iken dizin içe veya dışa dönmesi)hareketleri.

3. Ağır fiziki işler, ya da tenis, kayak gibi yorucu aktiviteler

2. Orta düzeydeki fiziki işler, hızlı yürüyüş ya da koşmak

1. Yürümek, ev işi veya bahçe işi gibi hafif aktiviteler

0. Yukarıda sayılan herhangi bir aktiviteyi dizde ağrı nedeniyle yapamama

9) Diziniz şunları yapmanızı ne kadar etkiliyor ?

		Pek zorlamıyor	Az miktarda zorluyor	Orta miktarda zorluyor	Ciddi düzeyde zorluyor	Yapamı yorum
a.	Merdiven çıkma	4❑	3❑	2❑	1❑	0❑
b.	Merdiven inme	4❑	3❑	2❑	1❑	0❑
c.	Diz üzerine çökme	4❑	3❑	2❑	1❑	0❑
d.	Çömelme	4❑	3❑	2❑	1❑	0❑
e.	Dizleri kırarak oturma	4❑	3❑	2❑	1❑	0❑
f.	Sandalyeden kalkma	4❑	3❑	2❑	1❑	0❑
g.	Düz koşma	4❑	3❑	2❑	1❑	0❑
h.	Zıplamak ve sorunlu bacağın üzerine inmek	4❑	3❑	2❑	1❑	0❑
i.	Ani olarak durmak veya harekete başlamak	4❑	3❑	2❑	1❑	0❑

FONKSİYON

10) 0 – 10 arasında değerlendirildiğinde, dizinizin durumunu nasıl puanlarsınız? 10 normal ve mükemmel, 0 hiçbir günlük aktiviteyi, spor aktiviteleri dahil yapamamaktır.

DİZ YARALANMASI ÖNCESİ FONKSİYON

Günlük Aktiviteleri Yapamıyorum — Kısıtlılık yok

0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 ❑ 7 ❑ 8 ❑ 9 ❑ 10 ❑

ŞU ANKİ DİZ FONKSİYONU

Günlük Aktiviteleri Yapamıyorum — Kısıtlılık yok

0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 ❑ 7 ❑ 8 ❑ 9 ❑ 10 ❑