The Journal of Foot & Ankle Surgery 56 (2017) 1209–1212

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Validity and Reliability of Turkish Version of Olerud-Molander Ankle Score in Patients With Malleolar Fracture

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ARTICLE INFO

Level of Clinical Evidence: 3

Keywords:
ankle
malleolus
OMAS
reliability
validity

ABSTRACT

The present study was planned to translate and culturally adapt the Olerud-Molander Ankle Score (OMAS) and assess the validity and reliability of the Turkish translation of the OMAS in patients with surgically treated malleolar fracture. The OMAS was adapted for use in Turkish by first translating it and then back-translating it in accordance with published guidelines. The final Turkish version of the OMAS was administered to 91 patients participating in the present study. The OMAS questionnaire was repeated 7 days later to assess test–retest reliability. Spearman's rank correlation analysis was used for each question's score and the total score, and the intraclass correlation coefficient was calculated for test–retest reliability. The internal consistency of the OMAS-TR was assessed using Cronbach's α. Concurrent validity was evaluated by comparing the OMAS with the Foot and Ankle Outcome Score and global self-rating function (GSRF). The GSRF has 5 options: very good, good, fair, poor, and very poor. These are assessed using a 5-point Likert scale. Before validity analysis, the GSRF score was reduced to 3 groups. In the test–retest reliability assessment, the OMAS showed high correlation ($r = 0.882$). The intraclass correlation coefficient was 0.942. Cronbach's α was 0.762 and 0.731 at days 1 and 7 (adequate internal consistency). The correlation coefficients versus the 5 subscales of the Foot and Ankle Outcome Score ranged from $r = 0.753$ to $r = 0.809$ ($p = .000$) and versus the GSRF was $r = -0.794$ ($p = .000$). According to results of the present study, the Turkish version of the OMAS demonstrated adequate test–retest reliability, excellent internal consistency, and evidence of validity for Turkish-speaking patients treated surgically for ankle fracture.

Ankle fractures are one of the most common fractures in the lower extremity, with an incidence rate of 101 fractures/100,000 person-years (1). Ankle fractures can occur in the medial, lateral, and posterior malleolus, and the usual causes are falls and traffic accidents (2). The tendency for surgical stabilization has increased in recent years, although the rehabilitation protocols and short- and long-term clinical outcomes remain controversial (3,4).

Several scores have been developed to assess the clinical outcomes after ankle injuries (5). The Foot and Ankle Outcome Score (FAOS) is a patient-reported outcome scale consisting of pain, other symptoms, function in daily living, function in sports and recreation, and foot- and ankle-related quality of life subscales, with 100 indicating no symptoms and 0 indicating extreme symptoms (6).

The global self-rated function (GSRF) scale is a patient-reported ordinal 5-grade rating scale. Patients define their present ankle function as very good, good, fair, poor, and very poor. This rating scale can be assessed using a linear analog scale or a 5-point Likert scale (7).

The Olerud-Molander Ankle Score (OMAS) is a patient-reported scale developed in 1984 to evaluate the symptoms and function of patients after ankle fracture. It consists of 9 questions: pain (0 to 25), stiffness (0 to 10), swelling (0 to 10), stair climbing (0 to 10), running (0 to 5), jumping (0 to 5), squatting (0 to 5), use of supports (0 to 10), and work/activity level (0 to 20), with higher scores indicating better outcomes (8).

The English (8) and Swedish version (7) of the OMAS is frequently used in clinical studies. Thus, we aimed to translate and culturally adapt the OMAS and assess the validity and reliability of the Turkish translation of the OMAS (OMAS-TR) in patients with surgically treated malleolar fractures.

Materials and Methods

The OMAS scale was translated into Turkish with permission from Dr. Claes Olerud (Department of Surgical Sciences, Uppsala University Hospital, Uppsala, Sweden) on

Financial Disclosure: None reported.
Conflict of Interest: None reported.
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http://dx.doi.org/10.1053/j.jfas.2017.06.002

September 17, 2015. The Pamukkale University noninvasive clinical research ethics committee approved the present study (approval no. 27.10.2015/18). All patients who participated in the study provided written informed consent.

Subjects

Patients who had undergone surgical treatment for ankle fractures from 2012 to 2014 were screened from the Pamukkale University hospital registry system. Eligible patients were contacted by telephone and invited to participate in the present study. A total of 91 volunteer patients were evaluated from November 2015 to January 2016. The first evaluation was completed at the clinic, and the second evaluation was performed at the clinic or by telephone interview for all patients.

The inclusion criteria were as follows: an isolated malleolar fracture, age >20 years, and native Turkish speaker. The exclusion criteria were as follows: cognitive problems and/or previous lower limb injury and/or surgery.

Translations and Cultural Adaptation

The translation and cross-cultural adaption process followed the guidelines of Beaton et al (9). Two independent, bilingual, native Turkish-speaking translators performed the forward translation. One of the translators was an orthopedist and one was a physiotherapist with clinical experience in malleolar fractures. After comparing the translations, an agreement was reached. Two independent English-speaking translators whose native language was English and whose second language was Turkish back translated the Turkish version of the OMAS. The translators did not know the original version of the scale. After expert committee (article authors and forward and backward translators) consensus, a prefinal version of the Turkish OMAS was obtained. The prefinal version was completed by 25 patients to investigate their general opinions about the comprehensibility of the Turkish version of the OMAS. Some minor changes were made according to the prefinal version results. For example, an example was added to the "stiffness" item because it was not clearly understood by the patients (*örn, uyandıktan sonra ayak, ayak bileğini rahat hareket ettirememe*). In the "swelling" item, "only evenings" was changed to "*sadece akşamları veya aşırı kullanım sonrası*" because the patients reported that they had experienced swelling after activities such as standing for a long time and so forth. In the "work, activities of daily life" item, "loss of tempo" was changed to "*istenilenden daha azını yapabilme*"; the phrase "change to a simpler job/part-time work" was changed to "*daha basit/yarı zamanlı işe geçiş*"; and the phrase "severely impaired work capacity" was changed to "*iş gücünde ciddi düzeyde azalma*." The OMAS-TR version is given in the Appendix.

Reliability

Test–retest stability was evaluated at 7-day interval to analyze the reliability of the OMAS-TR. Spearman's rank correlation analysis was used for each question's score and the total score. The correlation strength categories were accepted as follows: <0.5 indicated low, 0.5 to 0.69 as moderate, 0.7 to 0.89 as high, and 0.9 to 1.0 as very high (10).

The intraclass correlation coefficient (ICC) was used for test–retest reliability. Based on the 95% confidence interval (CI) of the ICC estimate, values >0.90 are indicative of excellent reliability (11). The internal consistency of the OMAS-TR was measured using Cronbach's α (12). A Cronbach α coefficient of ≥0.70 is considered to indicate acceptable reliability (13).

Validity

Concurrent validity was evaluated by comparing the responses to the OMAS with those from the FAOS and GSRF. Correlations analysis was performed between the OMAS and FAOS function in daily living subscale (Spearman's correlation test) and the OMAS and other subscales of the FAOS (Pearson's correlation test).

The statistical analysis of the validity of the OMAS versus the GSRF was analyzed using Spearman's correlation test. The 5 options (very good, good, fair, poor, and very poor) of the GSRF were reduced to 3 groups (group 1 included very good and good, group 2 included fair, and group 3 included poor and very poor). Validity was considered using the following criteria: excellent, $r = 0.81$ to 1.0; very good, $r = 0.61$ to 0.80; good, $r = 0.41$ to 0.60; acceptable, $r = 0.21$ to 0.40; and fair, $r = 0$ to 20 (6). Statistical analysis was conducted using SPSS, version 16.0, for Windows (IBM Corp., Armonk, NY). The probability value was $p < .05$.

Results

Patient Characteristics

A total of 91 patients (63 [69.2%] males, 28 [30.8%] females) with malleolar fracture participated in the present study. The mean average follow-up period was 27.92 ± 8.94 months, and the affected side was the right in 45 (49.5%) and the left in 46 (50.5%; Table 1). The scores for the outcome measures (OMAS, FAOS, and GSRF) are presented in Table 2.

Table 1
Demographic characteristics of the study population (N = 91 patients)

Characteristic	Value
Age (y)	
Range	20–60
Mean ± SD	41.54 ± 13.28
Height (cm)	
Range	150–187
Mean ± SD	170.54 ± 0.08
Weight (kg)	
Range	44–115
Mean ± SD	79.57 ± 15.81
BMI (kg/m^2)	
Range	15.41–37.98
Mean ± SD	27.37 ± 5.14
Sex	
Male	63 (69.2)
Female	28 (30.8)
Affected side	
Right	45 (49.5)
Left	46 (50.5)
Educational level	
Primary education	36 (39.6)
Basic education	14 (15.4)
High school	25 (27.5)
University	12 (13.2)
No education	4 (4.4)

Abbreviations: BMI, body mass index; SD, standard deviation.
Data in parentheses are percentages.

Reliability

The ICC was 0.942 (95% CI 0.710 to 1.00; $p \leq .001$). Cronbach's α was 0.762 and 0.731 at day 1 and day 7 (adequate internal consistency), respectively. The test–retest correlation of the scale was $r = 0.882$ ($p = .000$; Table 3).

Validity

The OMAS showed a high positive correlation ($r = 0.753$ to 0.809) with the 5 subscales of the FAOS and a high negative correlation ($r = -0.794$) with the GSRF (Table 4).

Discussion

The aim of the present study was to translate and cultural adapt the OMAS to Turkish and assess the validity and reliability of the OMAS-TR in patients with surgically treated malleolar fractures. The OMAS-TR demonstrated adequate test–retest reliability, excellent internal consistency, and evidence of validity for Turkish-speaking patients treated surgically for ankle fracture.

The OMAS has been used in many studies related to the clinical outcomes of ankle fractures (14–16). The first 3 questions relate to primary complaints (ie, pain, stiffness, swelling). These symptoms are usually seen after surgical treatment and delay the functional recovery of the patient. The next 4 questions cover the ability to perform some tasks (eg, stair climbing, running, jumping, and squatting). After ankle surgery, patients will be unable to perform such activities. Finally, 2 questions concern the patient's situation in everyday life (eg, supports needed, work, activities of daily living) and aim to determine the limitations of patients in their present situation. We believe the OMAS might be preferred by surgeons and other health professionals in terms of the ease of use, because it is a very short and understandable and can be completed within a short period. It can clearly

Table 2
Descriptive data for all outcome measures (N = 91 patients)

Variable	Value
FAOS	
Pain	
Range	28–100
Mean ± SD	81.11 ± 19.80
Symptoms	
Range	18–100
Mean ± SD	79.38 ± 20.18
ADL	
Range	38–100
Mean ± SD	84.97 ± 17.74
Sports	
Range	0–100
Mean ± SD	62.42 ± 31.78
Quality of life	
Range	0–100
Mean ± SD	56.34 ± 28.96
OMAS	
Pain (0 to 25)	
Range	0–25
Mean ± SD	20.22 ± 6.32
Stiffness (0 to 10)	
Range	0–10
Mean ± SD	5.82 ± 4.96
Swelling (0 to 10)	
Range	0–10
Mean ± SD	5.93 ± 4.08
Stair climbing (0 to 10)	
Range	5–10
Mean ± SD	8.02 ± 2.46
Running (0 to 5)	
Range	0–5
Mean ± SD	2.69 ± 2.51
Jumping (0 to 5)	
Range	0–5
Mean ± SD	2.64 ± 2.51
Squatting (0 to 5)	
Range	0–5
Mean ± SD	3.52 ± 2.30
Supports (0 to 10)	
Range	0–10
Mean ± SD	9.29 ± 2.53
Work/activity level (0 to 20)	
Range	0–20
Mean ± SD	14.45 ± 6.43
Total score	
Range	10–100
Mean ± SD	72.58 ± 23.27
GSRF	
Good	53 (58.2)
Fair	28 (30.8)
Poor	10 (11.0)

Abbreviations: ADL, activities of daily living; FAOS, Foot and Ankle Outcome Score; GSRF, global self-rating function; OMAS, Olerud-Molander Ankle Score; SD, standard deviation.
Data presented as n (%).

determine the overall condition of the patient without entering into detail.

The internal consistency of the OMAS-TR was adequate (Cronbach's α of 0.762). This result is similar to the result from the Swedish version study (Cronbach's α of 0.76) but lower than that from the Turkish version study (Cronbach's α of 0.84) conducted by Turhan et al (17). Similar to previous studies (Swedish version, ICC of 0.94, Turkish version by Turhan et al [(17)], ICC of 0.98), the test–retest reliability of the OMAS-TR was excellent (ICC of 0.942). We also used Spearman's rank correlation coefficient for test–retest reliability, which was high ($r = 0.882$; $p = .000$). In the Swedish version, the investigators reported very high values ($r = 0.95$). The first evaluation of the OMAS-TR was completed at the clinic, and the second evaluation was performed

Table 3
Values of Olerud-Molander Ankle Score at first and second measurements and correlation between them (N = 91 patients)

OMAS	Test (Day 1)	Repeat Test (Day 7)	*r*; *p* Value*
Pain (question 1)	21.40 ± 4.90	21.20 ± 4.85	0.635; .001
Stiffness (question 2)	7.20 ± 4.58	6.80 ± 4.76	0.718; .000
Swelling (question 3)	7.40 ± 3.26	6.80 ± 3.78	0.625; .001
Stair climbing (question 4)	8.40 ± 2.38	8.40 ± 2.38	1.000; .000
Running (question 5)	3.00 ± 2.50	3.00 ± 2.50	0.833; .000
Jumping (question 6)	2.80 ± 2.53	3.00 ± 2.50	0.921; .000
Squatting (question 7)	3.60 ± 2.29	4.00 ± 2.04	0.802; .000
Supports (question 8)	10.00 ± 0.00	10.00 ± 0.00	0.100; .000
Work/activity level (question 9)	17.00 ± 2.89	16.80 ± 2.43	0.643; .001
Total score	80.80 ± 18.41	80.00 ± 15.74	0.882; .000

Abbreviation: OMAS, Olerud-Molander Ankle Score.
Data presented as mean ± standard deviation.
* Spearman's correlation coefficient.

at clinic or by telephone interview for all 91 patients. The Swedish version was completed at the clinic by 42 patients, and the Turkish version by Turhan et al (17) was completed by telephone interview by 100 patients. In the present study, the internal consistency and test–retest reliability results showed the OMAS-TR to be a reliable scale for Turkish-speaking patients treated surgically for ankle fracture.

The GSRF is commonly used in clinical research, requires no special skills or training, is simple to score, and easily interpreted. Owing to its simplicity, it is an attractive alternative for use in clinical practice. The GSRF offers the opportunity to assess the current health status of a patient and provides information about the patient's overall opinions on recovery and function after injury (18). We used a GSRF similar to the Swedish version, and the OMAS-TR showed a high negative correlation ($r = -0.794$) with the GSRF.

The FAOS is a valid and reliable self-reported questionnaire that is most frequently used by practitioners in almost all the countries of the world. However, it consists of 32 questions in 6 subscales and is long and time-consuming to complete. The interpretation of the clinical results of patients with ankle fracture using the total score can be misleading because the FAOS investigates patient outcomes under both weightbearing and non-weightbearing conditions. Nevertheless, we believe the FAOS includes many questions also included in the OMAS (pain, P1 to P9; stiffness, S6 and S7; swelling, S1; stair climbing, A1 and A2; running, SP2; jumping, SP3; squatting, SP5; activities of daily living, function questions [daily living, sports and recreational activities]). The FAOS does not assess the use of supports or work capacity. We used the FAOS similar to the Swedish version, and the OMAS-TR showed high positive correlation ($r = 0.753$ to 0.809) with the 5 subscales of FAOS. We believe that OMAS-TR is a quick and clear

Table 4
Validity of Olerud-Molander Ankle Score versus 5 subscales of Foot and Ankle Outcome Score and global self-rating function (N = 91 patients)

Variable	OMAS (Total Score)	
	Mean ± SD	*r*; *p* Value
FAOS		
Pain	81.11 ± 19.80	0.788; .000*
Symptoms	79.38 ± 20.18	0.753; .000*
ADL	84.97 ± 17.74	0.798; .000†
Sports	62.42 ± 31.78	0.809; .000*
QOL	56.34 ± 28.96	0.772; .000*
GSRF	NA	−0.794; .000†

Abbreviations: ADL, activities of daily living; FAOS, Foot and Ankle Outcome Score; GSRF, global self-rating function; NA, not applicable; OMAS, Olerud-Molander Ankle Score; QOL, quality of life; SD, standard deviation.
* Pearson's correlation coefficient.
† Spearman's correlation coefficient.

scale that can be used to manage increasing patient numbers with decreased time.

OMAS is a scale that can be used to assess both function and symptoms. No symptomatic evaluation item was included in the validation tests used in Turkish version study by Turhan et al (17). The Foot and Ankle Ability Measure was developed to assess physical function and the Short-Form 12-item Health Survey to assess health-related quality of life. We used the FAOS scale, which is a reliable and valid method that is frequently used worldwide and includes most of the OMAS items for validation. We also performed our study including patients who had undergone surgery in accordance with the original scale. In the study by Turhan et al (17), the patient group consisted of both surgical (57% open reduction and internal fixation) and conservative (43% closed reduction and a spica cast) treatment. The clinical outcomes of patients treated surgically and conservatively will differ.

In conclusion, the OMAS-TR is a short and easy-to-use clinical scale that not only assesses symptom and function, but also assesses patients' ability to return to work. The OMAS-TR showed good internal consistency and good construct validity for patients with ankle fracture who had undergone surgery.

Supplementary Material

Supplementary material associated with this article can be found in the online version at www.jfas.org (http://dx.doi.org/10.1053/j.jfas.2017.06.002).

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