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Spanish Translation, Cross-Cultural Adaptation, and Validation of the Olerud-Molander Ankle Score (OMAS) for Ankle Fractures

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Abstract

Background: The aim of this study was to translate and cross-culturally adapt the Olerud-Molander Ankle Score (OMAS) into Spanish and to assess its reliability and validity.

Methods: The translation and adaptation to develop the Spanish version of the OMAS (OMAS-Sp) was performed according to current international guidelines. The OMAS-Sp was administered to 98 patients with a surgically treated ankle fracture, and it was repeated 7-14 days later to assess construct reliability of each question's score and the total score. Test-retest reliability and the internal consistency were calculated, and concurrent validity was assessed by comparing the OMAS-Sp with the Foot and Ankle Outcome Score (FAOS). The presence of floor and ceiling effects was also analyzed.

Results: Adequate internal consistency was found with a Cronbach α of 0.821. Excellent test-retest reliability was demonstrated with an interclass correlation coefficient for the total score of 0.970 (95% CI 0.956-0.980; $P < .001$). Spearman correlation coefficients (r's) between the OMAS-Sp total score and the 5 FAOS subscales ranged from 0.944 to 0.951 ($P < .001$). No floor or ceiling effects were found.

Conclusion: The OMAS-Sp demonstrated adequate psychometric properties and is a valid and reliable tool for assessing outcomes in Spanish-speaking patients with surgically treated ankle fractures.

Level of Evidence: Level II, prospective cohort study.

Keywords: patient-reported outcomes, outcome studies, trauma, Spanish, ankle fracture, validation, score, OMAS, Olerud-Molander

Introduction

Ankle fractures are one of the most common fractures in active patients with an estimated incidence of 101 to 187 fractures per 100 000 person-years in different age groups and genders.[7,8,10] The incidence of ankle fractures peaks twice, being higher among young males and females over 65 years.[7] In recent years, the choice of surgical treatment has become increasingly preferred to achieve early recovery; however, clinical outcomes are not always as good as expected, and these suboptimal results have been frequently associated with unnoticed lesions.[23]

Patient-reported outcomes measures (PROMs) are designed to assess a patient's health status at a specific point in time. PROMs are particularly useful in quantifying

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a patient's subjective perception of their disease. Several tools have been designed to measure PROMs in the foot and ankle, but only a few are specific to measuring ankle fractures outcomes.[16,23] The Olerud-Molander Ankle Score (OMAS) was originally created in Swedish. It was later translated to English by the original authors, Drs Olerud and Molander, and to Turkish.[5,22,29] It is one of the few measurement tools that has been specifically designed for ankle fractures.[16,23] For this reason, it is often used to measure the subjective perception of function in this group of patients.[1,10,13,17,19,31]

The aim of this study is to translate and cross-culturally adapt the OMAS into Spanish. Additionally, it is intended to evaluate the reliability and validity of the Spanish OMAS version (OMAS-Sp) in comparison with the Foot and Ankle Outcome Score (FAOS).

Materials and Methods

The OMAS scale was translated into Spanish with permission from Dr Claes Olerud (Department of Surgical Sciences, Uppsala University Hospital, Uppsala, Sweden). All patients were informed about the purpose of the study, and their consent was obtained.

Translations and Cultural Adaptation

The process of translation and cross-cultural adaptation was carried out according to the guidelines provided by Beaton et al.[3] Two independent polyglot Spanish translators performed the forward translation. One of the translators was a specialist in orthopaedics, whereas the other was not associated with the health sector. On comparing the translations, an agreement was reached. Two independent English-speaking translators, whose native language was English and whose second language was Spanish, back-translated the Spanish 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 Spanish OMAS was obtained. The prefinal version was completed by 13 patients to investigate their general opinions about the comprehensibility of the OMAS-Sp. Some minor changes were made according to the prefinal version results. An explanatory note was added to the "stiffness" item because it was not clearly understood by the patients ("*por ejemplo, incapacidad para mover el pie o el tobillo después de despertarse"*) as Büker et al[5] suggested. In the "swelling" item, "only evenings" was changed to "*sólo por la noche o después de un uso excesivo*" because the patients reported that they had experienced swelling after work or intense activities independently of the hour. This was also done in other translations with the acceptance of the original author, Dr Olerud.[5,21] The OMAS-Sp version is given in Table 1.

Table 1. Spanish Version of Olerud-Molander Ankle Score (OMAS-Sp).

Puntuación	Parámetro	Grado
	Dolor	
25		Nada
20		Al caminar en superficies irregulares
10		Al caminar sobre terreno llano
5		Al caminar por casa
0		Continuo y severo
	Rigidez (por ejemplo, incapacidad para mover el pie o el tobillo después de despertarse)	
10		Nada
0		Sí
	Hinchazón	
10		Nada
5		Sólo por la noche o después de un uso excesivo
0		Continuo
	Subir escaleras	
10		Sin problemas
5		Con dificultad
0		Imposible
	Correr	
5		Posible
0		Imposible
	Saltar	
5		Posible
0		Imposible
	Ponerse en cuclillas	
5		Sin problemas
0		Imposible
	Uso de ayudas	
10		Ninguna
5		Vendaje o tobillera
0		Bastón o muleta
	Trabajo y actividades de la vida diaria	
20		Igual que antes de la lesión
15		Pérdida del ritmo de la marcha
10		Cambio a un trabajo más sencillo o a tiempo parcial
0		Reducción severa de la capacidad de trabajo

Subjects

Patients who had undergone surgical treatment for ankle fractures from June 2021 to June 2022 at our center were screened from the registry system. Eligible patients were contacted by telephone and invited to participate in the present study. The inclusion criteria were as follows: surgically treated ankle fracture, >18 years old, and fluent Spanish speaker. The exclusion criteria were as follows: cognitive problems, concomitant injury, and/or previous lower limb injury and/or surgery.

Demographic data collected included age, sex, affected side, AO/OTA fracture classification, length of stay, follow-up period between surgery and first telephonic interview, and responsible surgeon.

Instruments

The OMAS scale is an ordinal rating scale from 0 points (totally impaired function) to 100 points (completely unimpaired function) and is based on 9 different items given different points: pain (0-25), stiffness (0-10), swelling (0-10), stair climbing (0-10), running (0-5), jumping (0-5), squatting (0-5), supports (0-10), and work/activity level (0-20). The score is calculated as the sum of each rated item. Reliability and validity, and measurement properties of the original version, have shown satisfactory results.[16,21,24]

The Foot and Ankle Outcome Score (FAOS) is a scale consisting of 42 questions that measure pain, other symptoms, function in daily living, function in sports and recreation, and foot and ankle-related quality of life. Each item gets a score from 0 to 4, and each of the 5 subscale scores is calculated as the sum of the rated items included. Raw scores are then transformed to a scale 0 (indicating extreme symptoms) to 100 (indicating no symptoms).[26] Initially validated for ankle ligament reconstruction, it has also shown high reliability and validity for ankle fractures, and FAOS Spanish version has also been successfully validated.[6,14,20]

Data Collection

After subject selection, data were collected prospectively. The patients were asked to complete by telephonic interview the OMAS-Sp and the FAOS to evaluate the validity. One to 2 weeks later, they were contacted again to complete OMAS-Sp for reliability testing.

Reliability

Cronbach α coefficient was used to assess the homogeneity of the questions for internal consistency within the test. A Cronbach α coefficient of 0.70 is considered to indicate acceptable reliability.[28] As OMAS-Sp is an ordinal scale, nonparametric correlation coefficient (Spearman rho) was used with a coefficient level of <0.5 considered as low, 0.5 to 0.69 as moderate, 0.7 to 0.89 as high, and 0.9 to 1.0 very high.[28] The test-retest reliability of each item and the total score was assessed with the intraclass correlation coefficient (ICC) using a 2-way, mixed-model analysis under consistency between both OMAS-Sp data. The ICC ranges from 0 (no reliability) to 1 (perfect reliability) and describes the reproducibility of test results for repeated measurements during a period where the clinical condition of the patient is stable. A reliable score should have an ICC of 0.75 or more.[25]

Validity

For concurrent validity, Spearman correlation coefficient between the first OMAS-Sp assesment and FAOS subscales were analyzed. 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.[5]

Floor and Ceiling Effects

Floor and ceiling effects were assessed for both the first and second administrations of the OMAS-Sp to determine content validity. An effect was regarded as being present if more than 30% of the patients reached the lowest or highest possible score.[15]

Statistical Analysis

Data analysis was performed using IBM SPSS Statistics, version 26.0 (IBM Corp, Armonk, NY, USA). The scores were reported as mean values ± SD for continuous variables; median and range were used for ordinal variables and a P value of .05 was regarded as significant.[30]

Results

Patient Characteristics

A total of 136 patients with ankle fractures were operated between June 2021 and June 2022 at our center. Ninety-eight patients (72.7% females) who met the inclusion criteria accepted to participate in this study and completed both telephonic interviews. They were operated by 8 different surgeons. The mean age was 58.24 years (±17.97 SD), and the mean follow-up period from surgery to first phone call was 19.57 months (±3.39 SD). The most affected side was left (51.2%), the most frequent AO/OTA type of fracture was 44B1.2 (27.3%), and the mean length of stay was 8.05 days (±7.81 SD) (Table 2).

The scores for OMAS-Sp total score, and the FAOS subscales scores, are presented in Table 3.

Reliability

Acceptable internal consistency was observed for the OMAS-Sp with a Cronbach α value of 0.821 on the last interview. The OMAS-Sp demonstrated excellent test-retest reliability with an ICC for the total score of 0.970 (95% CI 0.956-0.980; $P=.000$), and construct reliability showed good results too (rho: 0.973; $P=.000$). The OMAS-Sp ICC of each item and their CI, together with correlation coefficients, are presented in Table 4.

Table 2. Patient Demographics (N = 98 Patients).

Characteristic	Value
Age (y)	
Range	18-98
Mean ± SD	58.24 ± 17.97
Sex, n (%)	
Male	26 (26.50)
Female	72 (73.50)
Affected side, n (%)	
Right	47 (47.5)
Left	51 (51.5)
Fracture type[a], n (%)	
B1.2	27 (27.3)
B1.3	6 (6.1)
B2.2	17 (17.2)
B2.3	1 (1.0)
B3.1	1 (1.0)
B3.2	26 (26.3)
B3.3	15 (15.2)
C1.1	1 (1.0)
C2.2	2 (2.0)
C3.3	2 (2.0)
Days of hospital admission	
Range	1-53
Mean ± SD	8.05 ± 7.81
Follow up (mo)	
Range	12.90-24.80
Mean ± SD	19.57 ± 3.39

[a]AO/OTA classification for malleolar fractures.

Construct Validity

The Spearman correlation coefficients between the OMAS-Sp total score and the 5 subscales of the FAOS showed an excellent convergent correlation ($r = 0.944$-0.951) (Table 3).

Floor and Ceiling Effects

In the overall OMAS-Sp, none of the patients achieved the minimum score of 0; thus, there is no floor effect. Eleven percent of the patients in the first assessment and 12% of the patients in the second assessment reached the maximum score of 100, so no ceiling effect was found.

Discussion

The aim of the present study was to translate and culturally adapt the OMAS into Spanish, and to assess the validity and reliability of the Spanish version in patients with surgically treated malleolar fractures. Based on our sample population, the OMAS-Sp demonstrated its good internal consistency, test-retest reliability, and construct validity to be used as a PROM questionnaire for Spanish-speaking individuals with surgically treated ankle fractures.

Ankle fractures have a considerable impact on quality of life in different cultures; however, PROMs are predominantly available in English. Spanish is the second most spoken native language in the world; therefore, there is a need for reliable and valid PROMs in Spanish.[4,11,12]

The OMAS has been shown to be the most commonly used PROM in interventional trials for ankle fractures.[16] The scoring system is structured in 3 domains: the first 3 questions deal with primary complaints, the next 4 questions cover the ability to perform simple tasks, and finally 2 questions concern the patient's situation in everyday life.[22] Previously published studies have used OMAS in the Spanish-speaking population although neither formal translation nor validation data had been provided until the present study.[9,18,27]

We assessed the psychometric properties of OMAS-Sp and showed good internal consistency (Cronbach $\alpha = 0.821$), higher than the Swedish version (Cronbach $\alpha = 0.760$), and between both published values for the Turkish version of OMAS (Cronbach $\alpha = 0.762$ and 0.840).[5,29] The OMAS-Sp showed excellent test-retest reliability (ICC = 0.970). The original version of the OMAS did not include any psychometric properties so we can only compare our results with the Swedish version (ICC = 0.940) and the Turkish version (ICC = 0.942 and 0.980), which are similar to our results.[5,21,29] For the aim of this study, the time interval between both interviews should be enough to prevent a memory effect but not too long to avoid the occurrence of a real change in a patient's condition, so we repeated the test within 7-14 days.[2]

The validity of the OMAS-Sp was tested by studying its relationship with the FAOS. The correlation coefficients between the OMAS-Sp and all FAOS subscales were excellent, as reported in Table 4. Our values are higher than those reported for the Swedish and Turkish versions, which also used FAOS to asses validity.[5,21] The Spanish version of the FAOS has been validated with several foot and ankle conditions, including ankle fractures.[20] However, it consists of 32 questions and is time consuming for the patient to complete. It includes several items included in OMAS, as Büker et al[5] remarked, requiring less time to complete the latter.

No floor or ceiling effects were reported in this study. The absence of a ceiling or floor effect provides support for the content validity of the OMAS for the studied population.

As a limitation, we could not report the responsiveness data to evaluate a change in the patient's health status because of the characteristics of our study. However, OMAS minimum clinically important differences have been recently established in a range from 10.5 to 15.0 at 3- to 6-month follow-up and from 7.5 to 11.4 at 6- to 12-month follow-up.[24]

Table 3. Descriptive Data for Total All 5 FAOS Subscales, OMAS-Sp Score, and Correlation Between OMAS-Sp and the 5 Subscales (N = 98 Patients).

Variable	Median (IQR)	Mean ± SD	OMAS-Sp (Spearman Correlation)	*P* Value
FAOS				
Pain	82 (69-89.8)	78.73 ± 16.84	0.949	<.001
Symptoms	82 (68-96)	79.94 ± 18.48	0.944	<.001
Daily life activities	85 (75-97)	82.99 ± 15.91	0.947	<.001
Sports	70 (49-80)	62.35 ± 27.10	0.951	<.001
Quality of life	56 (43-77)	56.58 ± 27.53	0.95	<.001
OMAS-Sp total score (0-100)	70 (50-85)	68.67 ± 20.54		

Abbreviations: FAOS, Foot and Ankle Outcome Score; IQR, interquartile range; OMAS-Sp, Olerud-Molander Ankle Score–Spanish version.

Table 4. Values of Olerud-Molander Ankle Score (OMAS) at First and Second Measurements (N = 98 Patients).

OMAS	First Test, Mean ± SD	Last Test, Mean ± SD	*r*; *P* Value	ICC (95% CI); *P* Value
Pain	17.6 ± 6.51	19.03 ± 5.82	0.816; <.001	0.811 (0.730-0.869); <.001
Swelling	5.61 ± 2.71	5.82 ± 2.46	0.931; <.001	0.926 (0.892-0.950); <.001
Stair climbing	7.19 ± 3.67	7.24 ± 3.74	0.840; <.001	0.840 (0.771-0.890); <.001
Running	2.76 ± 2.5	2.86 ± 2.49	0.628; <.001	0.628 (0.491-0.734); <.001
Jumping	2.96 ± 2.47	3.06 ± 2.45	0.916; <.001	0.916 (0.877-0.943); <.001
Squatting	3.06 ± 2.45	3.32 ± 2.38	0.629; <.001	0.629 (0.493-0.735); <.001
Supports	7.91 ± 2.95	7.86 ± 3.05	0.900; <.001	0.900 (0.854-0.932); <.001
Work/activity level	16.07 ± 4.94	16.02 ± 5.02	0.933; <.001	0.932 (0.901-0.954); <.001
Total score	68.67 ± 20.54	70.61 ± 22.04	0.973; <.001	0.970 (0.956-0.980); <.001

Abbreviations: ICC, interclass correlation coefficient; *r*, Spearman correlation.

Conclusions

The OMAS-Sp demonstrated good measurement properties in patients with surgically treated ankle fractures. The test-retest reliability of the OMAS-Sp was very high and the concurrent validity using FAOS was high too. OMAS-Sp can thus be used as an outcome measure after a surgically treated ankle fracture in Spanish-speaking patients.

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Ethical Approval

Ethical approval for this study was obtained from the Research Ethics Committee of the University Hospital of Leon, Spain (Reference: 17108).

Declaration of Conflicting Interests

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References

1. Baumbach SF, Rellensmann K, Spindler FT, et al. Immediate weight bearing without immobilization for operatively treated ankle fractures is safe - a systematic review. *Foot Ankle Surg*. 2023;29(4):306-316. doi:10.1016/j.fas.2023.04.006
2. Beaton DE, Boers M, Tugwell P. Assessment of health outcomes. In: Firestein GS, Budd RC, Gabriel SE, McInnes IB, O'Dell JR, eds. *Kelley and Firestein's Textbook of Rheumatology*. Elsevier; 2017:496-508. doi:10.1016/B978-0-323-31696-5.00033-4
3. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*. 2000;25(24):3186-3191. doi:10.1097/00007632-200012150-00014

4. Brañes J, Barahona M, Carvajal S, Wulf R, Barrientos C. Validation of the Spanish version of the Goodman score in total hip arthroplasty. *J Orthop Surg Res*. 2021;16(1):517. doi:10.1186/s13018-021-02653-6
5. Büker N, Şavkın R, Gökalp O, Ök N. Validity and reliability of Turkish version of Olerud-Molander Ankle Score in patients with malleolar fracture. *J Foot Ankle Surg*. 2017;56(6):1209-1212. doi:10.1053/j.jfas.2017.06.002
6. Cortes A, Espinoza CA, Escudero MI, et al. Cross-cultural adaptation and validation of the Short Musculoskeletal Function Assessment (SMFA) into Spanish (Chile). *Foot Ankle Orthop*. 2022;7(4):2473011421S0063. doi:10.1177/24730114 21S00638
7. Court-Brown CM, Caesar B. Epidemiology of adult fractures: a review. *Injury*. 2006;37(8):691-697. doi:10.1016/j.injury.2006.04.130
8. Daly PJ, Fitzgerald RH, Melton LJ, Llstrup DM. Epidemiology of ankle fractures in Rochester, Minnesota. *Acta Orthop Scand*. 1987;58(5):539-544. doi:10.3109/17453678709146395
9. De-Las-Heras-Romero J, Lledo-Alvarez AM, Lizaur-Utrilla A, Lopez-Prats FA. Quality of life and prognostic factors after intra-articular tibial pilon fracture. *Injury*. 2017;48(6):1258-1263. doi:10.1016/j.injury.2017.03.023
10. Donken CC, Al-Khateeb H, Verhofstad MH, Van Laarhoven CJ. Surgical versus conservative interventions for treating ankle fractures in adults. *Cochrane Database Syst Rev*. 2012;8:CD008470. doi:10.1002/14651858.CD008470.pub2
11. Eberhard DM, Simons GF, Fenning CD. *Ethnologue: Languages of the World*. 26th ed. Published 2023. Accessed July 9, 2023. https://www.ethnologue.com/language/spa/
12. Garcés JBG, Winson I, Goldhahn S, et al. Reliability, validity and responsiveness of the Spanish Manchester-Oxford Foot Questionnaire (MOXFQ) in patients with foot or ankle surgery. *Foot Ankle Surg*. 2016;22(1):59-70. doi:10.1016/j.fas.2015.09.004
13. Haque A, Parsons H, Parsons N, et al. Use of cast immobilization versus removable brace in adults with an ankle fracture: two-year follow-up of a multicentre randomized controlled trial. *Bone Joint J*. 2023;105-B(4):382-388. doi:10.1302/0301-620X.105B4.BJJ-2022-0602.R3
14. Larsen P, Al-Bayati M, Elsøe R. The Foot and Ankle Outcome Score (FAOS) during early recovery after ankle fracture. *Foot Ankle Int*. 2021;42(9):1179-1184. doi:10.1177/10711007211002811
15. McHorney CA, Tarlov AR. Individual-patient monitoring in clinical practice: are available health status surveys adequate? *Qual Life Res*. 1995;4(4):293-307. doi:10.1007/BF01593882
16. McKeown R, Parsons H, Ellard DR, Kearney RS. An evaluation of the measurement properties of the Olerud Molander Ankle Score in adults with an ankle fracture. *Physiotherapy*. 2021;112:1-8. doi:10.1016/j.physio.2021.03.015
17. Meinert M, Colcuc C, Herrmann E, et al. Septic history limits the outcome of tibiotalocalcaneal arthrodesis. *J Clin Med*. 2023;12(10):3422. doi:10.3390/jcm12103422
18. Morales Muñoz P, Barroso Gómez V, De Los Santos Real R, De Dios Pérez M, Escalera Alonso J, Varas Navas J. A randomised clinical trial comparing screws and the TighRope® Knotless system in the treatment of acute injuries of syndesmosis. Article in Spanish. *Rev Esp Cir Ortop Traumatol*. 2022;66(6):T73-T81. doi:10.1016/j.recot.2022.07.020
19. Morelli F, Princi G, Caperna L, et al. Are rush nails still a good choice for fibula fixation in ankle fractures? A retrospective study with five years follow-up. *Arch Bone Joint Surg*. 2023;11(5):337-341. doi:10.22038/ABJS.2023.64745.314
20. Navarro-Flores E, Losa-Iglesias ME, Becerro-de-Bengoa-Vallejo R, et al. Cross-cultural adaptation, translation, and validation of the Spanish Foot and Ankle Outcome Score questionnaire. *Int Wound J*. 2020;17(5):1384-1390. doi:10.1111/iwj.13400
21. Nilsson GM, Eneroth M, Ekdahl CS. The Swedish version of OMAS is a reliable and valid outcome measure for patients with ankle fractures. *BMC Musculoskelet Disord*. 2013;14(1):109. doi:10.1186/1471-2474-14-109
22. Olerud C, Molander H. A scoring scale for symptom evaluation after ankle fracture. *Arch Orth Traum Surg*. 1984;103(3):190-194. doi:10.1007/BF00435553
23. Peng H, Guo XB, Zhao JM. Influence of patient-reported outcome measures by surgical versus conservative management in adult ankle fractures: a systematic review and meta-analysis. *Medicina (Kaunas)*. 2023;59(6):1152. doi:10.3390/medicina59061152
24. Penning D, Kleipool S, van Dieren S, Dingemans SM, RODEO Collaborator Group; Schepers T. The minimal clinically important difference (MCID) of the Olerud Molander Ankle Score (OMAS) in patients with unstable ankle fracture. *Arch Orthop Trauma Surg*. 2023;143(6):3103-3110. doi:10.1007/s00402-022-04533-y
25. Portney LG, Watkins MP. *Foundations of Clinical Research: Applications to Practice*. 3rd ed. Pearson/Prentice Hall; 2009.
26. Roos EM, Brandsson S, Karlsson J. Validation of the Foot and Ankle Outcome Score for ankle ligament reconstruction. *Foot Ankle Int*. 2001;22(10):788-794. doi:10.1177/107110070102201004
27. Sierra-Martínez O, Saucedo-Valencia J, Saldívar-Moreno A. Functionality and stability of the treatment of Weber B ankle fractures with syndesmotic injury depending on the placement level of the screw (2.0 versus 3.5 cm). Article in Spanish. *Acta Ortop Mex*. 2017;31(6):264-268.
28. Terwee CB, Bot SDM, De Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol*. 2007;60(1):34-42. doi:10.1016/j.jclinepi.2006.03.012
29. Turhan E, Demirel M, Daylak A, Huri G, Doral MN, Çelik D. Translation, cross-cultural adaptation, reliability and validity of the Turkish version of the Olerud-Molander Ankle Score (OMAS). *Acta Orthop Traumatol Turc*. 2017;51(1):60-64. doi:10.1016/j.aott.2016.06.012
30. Vetter TR. Fundamentals of research data and variables: the devil is in the details. *Anesth Analg*. 2017;125(4):1375-1380. doi:10.1213/ANE.0000000000002370
31. Xu B, Wang S, Tan J, Chen W, Tang KL. Comparison of suture button and syndesmotic screw for ankle syndesmotic injuries: a meta-analysis of randomized controlled trials. *Orthop J Sports Med*. 2023;11(1):23259671221127665. doi:10.1177/23259671221127665