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Original Article

Translation, cultural adaptation, and validation of the AOFAS lesser metatarsophalangeal-interphalangeal scale into Brazilian Portuguese

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Abstract

Objective: Translate, culturally adapt, and evaluate the reproducibility of the American Orthopaedic Foot and Ankle Society (AOFAS) lesser metatarsophalangeal-interphalangeal scale into Brazilian Portuguese.

Methods: The AOFAS and SF-36 questionnaires were applied to 50 patients with lesser toes deformity. The methodology followed the criteria defined by Reichenheim & Moraes for translation and cultural adaptation of questionnaires.

Result: The intraclass correlation coefficient (ICC) across the domains was 0.96, and Cronbach's alpha was 0.80, both indicating excellent reliability. The scores of the first and second evaluations were 70.72 and 72.36, respectively, with high interobserver agreement and overlapping confidence intervals. Spearman's correlation analysis also yielded a correlation coefficient of 96%, indicating strong agreement among the applications of the test.

Conclusion: According to the established criteria, the translation and cultural adaptation of the questionnaire were conducted effectively, with very high interobserver agreement, and can be safely reproduced in Brazilian Portuguese.

Level of evidence IV; Case series.

Keywords: Toes; Questionnaires; Translation; Validation.

Introduction

Lesser toe deformities, including hammer, claw, and overlapping toes, affect more than 50% of patients evaluated in foot and ankle surgery services, resulting in pain, functional limitations, and considerable psychosocial repercussions[1,2].

Although minimally invasive corrective procedures have advanced in the last decade, the heterogeneity of techniques and success criteria makes it difficult to compare studies and clinical-surgical decision-making[3].

Lesser toe deformity, although often perceived as secondary, deserves attention due to its significant impact on the patient's quality of life[4]. Adequate treatment should be recommended in each case, and, for better results, a standardized instrument is essential to evaluate postoperative outcomes and achieve a universal comparison standard[5]. Additionally, a standardized criterion facilitates the development of new treatments within the subspecialty, allowing for a consistent approach among practitioners.

Study performed at the Faculdade de Medicina do ABC, Santo André, SP, Brazil.

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Faced with the demand for a model that helps compare the patient's quality of life, the American Orthopaedic Foot and Ankle Society (AOFAS) published a questionnaire that evaluates pain, function, and specific alignment of the lesser toes on a scale from 1 to 100. This questionnaire aims to quantify the impact of the disease on quality of life, monitor responses to treatment, compare interventions in clinical trials, and support evidence-based health policies[6]. Several cultures are validating this questionnaire to systematize the results of the studies and create better standardization of them[7,8]. Although an excellent questionnaire, it does not have translation and cultural validation into Portuguese for lesser toe deformity.

Foot and ankle pathologies directly influence the patient's quality of life and, in many cases, can generate disability, especially in older people and women. Thus, scoring exactly the benefits of each surgical technique to equalize and rationalize the choice becomes an essential task.

The objective of this study is to translate, culturally adapt, and evaluate the reproducibility of the AOFAS lesser metatarsophalangeal/interphalangeal (MTP/IP) scale questionnaire (Table 1) into Brazilian Portuguese, following the COSMIN protocols[9]. By providing a validated version, the aim is to facilitate multicenter research, assist in the selection of evidence-based surgical techniques, and, above all, improve the postoperative follow-up of patients with lesser toe deformities.

Methods

Study design and ethical approval

This is a study of translation, cross-cultural adaptation, and evaluation of the psychometric properties of the AOFAS lesser MTP/IP scale in Brazilian Portuguese. The study was approved by the Institutional Review Board under the number 285506820.6.0000.5442, following all its requirements. Thus, all participants signed free and informed consent forms.

Sample size

To estimate the test-retest reliability using the intraclass correlation coefficient (ICC), an expected ICC of 0.90, an acceptable minimum of 0.75, α = 0.05, and power of 80% were considered. According to the method of Walter et al.[10], a minimum of 46 subjects is required; we recruited 50 consecutive patients to compensate for potential losses. This number falls under Browne's recommendations for pilot/validation studies[10,11].

Study population (inclusion criteria)

Adults over 18 years with outpatient follow-up and clinical-radiographic diagnosis of symptomatic lesser toes deformity (hammer, claw, or overlap) under treatment in a tertiary hospital between 2023 and 2024 were included. Patients who did not have any impairment to answer the questionnaire and those who were using immobilizers or victims of acute trauma were excluded from the study (Figure 1). During the study, there were no exclusions or loss of follow-up in the reapplication of the questionnaires.

Table 1. AOFAS Lesser Metatarsophalangeal-Interphalangeal Scale

None	40
Mild, occasional	30
Moderate, daily	20
Severe, almost always present	0
Function (45 points)	
Activity limitations	
No limitations	10
No limitation of daily activities, limitation of recreation activities	7
Limited daily and recreational activities	4
Severe limitation of daily and recreational activities	0
Footwear requirements	
Fashionable, conventional shoes, no insert required	10
Comfort footwear, shoe insert	5
Modified shoes or brace	0
MTP joint motion (dorsiflexion plus plantarflexion)	
Normal or mild restriction (75° or more)	10
Moderate restriction (30° - 74°)	5
Severe restriction (less than 30°)	0
IP joint motion (plantarflexion)	
No restriction	5
Severe restriction (less than 10°)	0
MTP-IP stability (all directions)	
Stable	5
Definitely unstable or able to dislocate	0
Callus related to lesser MTP-IP	
No callus or asymptomatic callus	5
Callus, symptomatic	0
Alignment (15 points)	
Good, lesser toes well aligned	15
Fair, some degree of lesser toe malalignment observed, no symptoms	8
Poor, severe malalignment, symptoms	0
Total	100

Grading: Excellent=90-100points, Good = 75-89 points; Fair= 60-74 points; Poor =<60 points. AOFAS: American Orthopaedic Foot and Ankle Society.

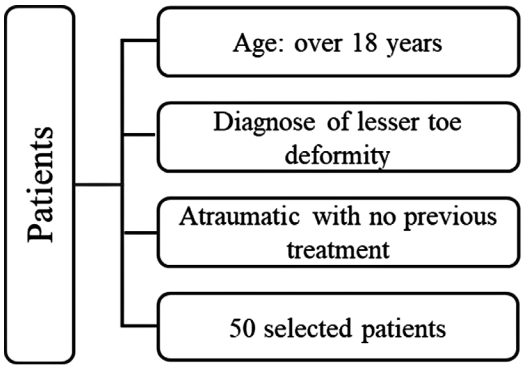

Figure 1. Patient selection.

Questionnaire translation and adaptation process

The process followed the COSMIN protocol, as described by Reichenheim and Moraes[9].

Direct translation: The questionnaire was translated by two independent Brazilian translators, who were aware of the objective of the study, ensuring that the translation was not only literal but also considered the context in which it would be applied. The disagreements would be resolved by a third translator-moderator, producing a consensual version. However, we did not observe significant divergences in translations.

Back-translation: After this step, two independent American translators were hired to perform the back-translation of the questionnaire, blind to the objective of the study, to minimize any tendency to accept an inadequate translation.

Expert committee: A team formed by for foot and ankle specialists, two physiotherapists, and an independent translator evaluated the patients' understanding of the questions and answers, to validate the translation processes (semantic, idiomatic, conceptual, and cultural equivalence) and the application of the questionnaire among Brazilian patients. This committee reached the final version of the translation (Table 2).

Instruments

Lesser MTP/IP scale, which consists of nine domains totaling 100 points: pain (40), function (10), footwear requirements (10), MTP amplitude (dorsiflexion and plantar flexion) (10), IP amplitude (plantar flexion) (5), MTP/IP amplitude (all directions) (5), calluses associated with hallux MTP/IP (5) and alignment (15).

Score interpretation is as follows: poor (< 60 points), fair (60-74 points), good (75-89 points), and excellent (90-100 points).

Application

The test was applied to 50 patients by two orthopedic examiners, specialized in foot and ankle, and submitted again 14 days later by one of the same examiners; thus, it was possible to obtain the interobserver and ICC.

These steps are illustrated in a flowchart for better understanding (Figure 2).

The 36-Item Short Form (SF-36) questionnaire (Quality of life), a validated Brazilian version, was used to obtain a correlation and measurement, which evaluates eight categories based on physical and emotional characteristics. This questionnaire consists of 36 items that evaluate functional capacity, physical aspects, pain, general health, vitality, social, emotional, and mental health[12].

Assessment of psychometric properties

The data obtained after the interviews were entered into Microsoft Excel software and subjected to statistical analysis to determine reliable correlation parameters. The significance level was set at 5%. For the statistical analysis, the R software (version 4.3.2, with the IRR and cart packages) was used.

Initially, a descriptive analysis was performed on all study variables. Qualitative variables were presented in terms of both their absolute and relative values, while quantitative variables were presented in terms of their central tendency and dispersion values. To guide the choice of sample similarity test, the Shapiro-Wilk test was used, which yielded values below 0.00001 for all variables, suggesting that the differences in the variables do not follow a normal distribution. Therefore, the Wilcoxon test was applied to compare the first

Table 2. Final questionnaire in Brazilian Portuguese - AOFAS Lesser Metatarsophalangeal-Interphalangeal Scale

Dor (40 pontos)	
Ausente	40
Leve, ocasional	30
Moderada, diária	20
Intensa, quase sempre presente	0
Função (45 pontos)	
Limitação das atividades	
Sem limitação	10
Sem limitação das atividades da vida diária, limitação das atividades do laser	7
Limitação das atividades da vida diária e do laser	4
Limitação grave das atividades da vida diária e do laser	0
Requisitos para calçados	
Calçados da moda, convencionais, sem palmilha	10
Calçados confortáveis, com palmilha 5	5
Calçados adaptados ou órtese 0	0
Amplitude da MTF (dorsiflexão e flexão plantar)	
Normal ou com restrição leve (75° ou mais)	10
Restrição moderada (30°–74°)	5
Restrição grave (menos de 30°)	0
Amplitude da IF (flexão plantar)	
Sem restrição	5
Restrição grave (menos de 10°)	0
Estabilidade da MTF/IF (todas as direções)	
Estável	5
Definitivamente instável ou passível de deslocar	0
Calos associados à MTF-IF do hálux	
Sem calos ou calo assintomático	5
Calo, sintomático	0
Alinhamento (15 pontos)	
Bom, dedos menores alinhados	15
Regular, observa-se certo grau de desalinhamento dos dedos menores, assintomático	8
Ruim, desalinhamento grave, sintomático	0
Total	100

Resultado: Excelente =90-100pontos; Bom= 75-89 pontos; Razoável:60-74 pontos; Ruim= ou < que 60 pontos. MTF:metatarsofalangeana/ IF: interfalangeana. MTF-IF: Metatarso-falangeana.

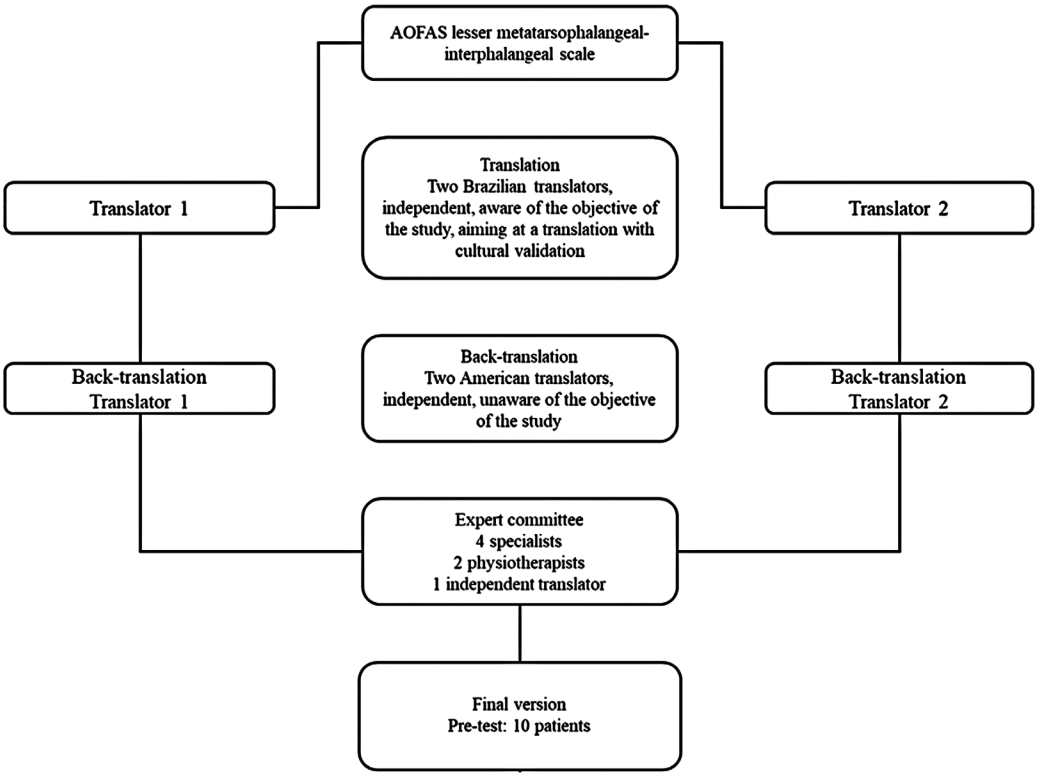

Figure 2. Questionnaire application flow chart.

and second values of each AOFAS domain, as it is a non-parametric test more suitable for our data.

To evaluate the correlation between the SF-36 and AOFAS domains, Spearman's correlation coefficient was used in both the first and second evaluations.

The ICC was used to evaluate the first and second AOFAS agreements for each domain, with their respective 95% confidence interval.

Results

The questionnaire was applied to 50 patients. Table 3 shows the descriptive analysis of the variables: age, sex, and diagnosis. The results show that most patients were women over 50 years with a diagnosis of lesser toe deformity associated with hallux valgus.

Table 4 shows the mean with standard deviation, the ICC coefficient with a 95% confidence interval, and the significance level. An excellent ICC was observed in all domains, with a total ICC of 0.96 (95% CI, 0.93-0.98). It is worth noting that the ICC is widely recognized as one of the most reliable metrics to assess the consistency and homogeneity of repeated measurements, as it encompasses both aspects. Regarding internal consistency, Cronbach's alpha for the total score was 0.80 (95% CI, 0.74-0.85), classified as "good," indicating adequate homogeneity among the domains. Values above 0.70 are generally considered acceptable for group-level comparisons, thereby reinforcing the instrument's reliability.

Table 3. Descriptive analysis

Variables	Total
Age (Years)	
Mean (SD)	66.5 (16.587)
Minimum-Maximum	18 - 85
Sex (N (%))	
Female	46 (92)
Male	4 (8)
Diagnosis (N (%))	
Hallux valgus	43 (86)
Others	7 (14)

SD: Standard deviation.

Table 5 shows the comparison of the first and second AOFAS results for each domain. The results showed no significant differences between the first and second evaluations, as determined by the Wilcoxon test, in each domain ($p > 0.05$). The variable "alignment" did not show any difference between the first and second evaluations, indicating high agreement between the samples in this domain. Therefore, we did not present the Wilcoxon test for this variable.

Table 4. Intraclass correlation coefficient analysis – AOFAS questionnaire

Domain	Pre Mean (SD)	Post Mean (SD)	ICC (95%CI)	p-value
Pain	28.2 (9.83)	29.2 (9)	0.93 (0.87; 0.96)	< 0.0001
Function	8.66 (2.27)	8.6 (2.28)	0.98 (0.97 – 0.99)	< 0.0001
Footwear requirements	6.3 (2.43)	6.5 (2.53)	0.92 (0.86 – 0.95)	< 0.0001
MTP amplitude	7.9 (3.36)	8.1 (3.18)	0.95 (0.92-0.97)	< 0.0001
IP amplitude	3.9 (2.09)	3.9 (2.09)	0.88 (0.8 – 0.93)	< 0.0001
MTP/IP amplitude	4.3 (1.75)	4.4 (1.93)	0.93 (0.87; 0.96)	< 0.0001
Calluses	2.9 (2.49)	3.1 (2.45)	0.92 (0.86 – 0.95)	< 0.0001
Alignment	8.56 (4.56)	8.56 (4.56)	1	
Total	70.72 (20.56)	72.36 (18.42)	0.96 (0.93-0.98)	< 0.0001

MTP: Metatarsophalangeal; IP: Interphalangeal; MTP/IP: Metatarsophalangeal-interphalangeal; 95%CI: 95% confidence interval; SD: Standard deviation; ICC: Intraclass correlation coefficient.

Table 5. Comparison between the first and second AOFAS questionnaire

	1st	2nd	p-value
Pain			0.08
Mean	28.2 (25.41-30.99)	29.2 (26.64-31.76)	
Standard deviation	9.83	9	
Minimum-maximum	0-40	0-40	
Function			1
Mean	8.66 (8.01-9.31)	8.6 (7.95-9.25)	
Standard deviation	2.27	2.28	
Minimum-maximum	0-10	0-10	
Footwear requirements			0.345
Mean	6.3 (5.61-6.99)	6.5 (2.53-5.78)	
Standard deviation	2.43	2.53	
Minimum-maximum	0-10	0-10	
MTP amplitude			0.345
Mean	7.9 (6.94-8.86)	8.1 (7.2-9)	
Standard deviation	3.36	3.18	
Minimum-maximum	0-10	0-10	
IP amplitude			1
Mean	3.9 (3.31-4.49)	3.9 (3.31-4.49)	
Standard deviation	2.09	2.09	
Minimum-maximum	0-5	0-5	
MTP/IP amplitude			1
Mean	4.3 (3.8-4.8)	4.4(3.85-4.95)	
Standard deviation	1.75	1.93	
Minimum-maximum	0-5	0-10	
Calluses			0.345
Mean	2.9 (2.19-3.61)	3.1(2.4-3.8)	
Standard deviation	2.49	2.45	
Minimum-maximum	0-5	0-5	
Alignment			
Mean	8.56 (7.26-9.86)	8.56(7.26-4.56)	
Standard deviation	4.56	4.56	
Minimum-maximum	0-15	0-15	
Total			0.031
Mean	70.72 (64.88-76.56)	72.36 (67.13-77.59)	
Standard deviation	20.56	18.42	
Minimum-maximum	9-100	9-100	

MTP: Metatarsophalangeal; IP: Interphalangeal; MTP/IP: Metatarsophalangeal-interphalangeal; 95%CI: 95% confidence interval; ICC: Intraclass correlation coefficient; p-value referent to Wilcoxon test

Table 6 shows the Spearman correlation analysis of the first and second AOFAS for each domain. A direct proportional correlation was observed between the first and second evaluations in each AOFAS domain.

Discussion

Injuries to the lesser toes often receive less attention in clinical research, yet they are of fundamental importance due to their significant impact on patients' lives[13]. Although the hallux is mainly responsible for support, the lesser toes are fundamental for distributing the load and total accommodation of the feet[14]. Treatments with limited results can lead to changes in the quality of life for patients and those with disabilities.

The definition of the best approach for each patient depends on instruments that assess progress and results over time, considering the patient's perspective, specifically, in foot pathologies, which have a significant impact on the patient's activities of daily living. With the numerous new techniques available, having a reliable comparison system allows for better choices and results[15].

The AOFAS scale is widely used to evaluate outcomes after treatment of ankle and foot injuries. Considering that the patient's perspective is essential for this evaluation, translation and cultural adequacy become crucial to maintaining the reliability of the results[16].

Literal translation is a possibility, but cross-cultural adaptation is crucial to ensure and facilitate accurate understanding and more reliable results.

It is important to mention that the AOFAS consists of an instrument that is subdivided into hindfoot and ankle, midfoot, hallux, and smaller toes. Translations and cultural adaptations into other languages are still lacking; however, the AOFAS hindfoot and ankle and AOFAS hallux are already available in Portuguese[5,17].

Our study had a predominantly female population (92%), with a mean age of 66.5 years, and 86% of the cases were related to hallux valgus. The data obtained agrees with the literature. Most atraumatic deformities of the lesser toes are related to hallux valgus, a pathology that is 2.3 times more common in women. In addition, since the lesser toe deformity is a pathology often secondary to hallux valgus, the mean age of the study may be higher than the age of diagnosis of hallux valgus[18].

The ICC evaluation showed extremely close agreement and a high reliability coefficient in the demonstrated tests. The high agreement between the examiners indicates that the questionnaire is prepared in a clear, objective, and easy-to-understand manner, both among researchers and patients.

The validation and cultural adaptation protocol follows a well-defined flowchart to ensure the quality and applicability of the translation process. These sequential steps ensure that different researchers found similar results when interviewing the same participant, which was achieved in our study.

When applying the questionnaire for the second time, the same researcher obtains results comparable to those from the first application for the same patient under the same evaluation conditions. According to the ICC criterion, all evaluated domains exhibit extreme agreement. In the Wilcoxon criterion, we observed a slight change in the evaluation of the pain domain, which is known to be a more subjective criterion.

The Persian language study published in 2018 for hindfoot and ankle is a good example showing reliability in the test-retest measured by the ICC of 0.853 ($p < 0.001$) and Pearson's correlation coefficient between AOFAS and SF-36, which validates and provides reliability to the translation process and cultural validation of the questionnaire in the studied population[19].

Conclusion

Our data contribute to demonstrating the importance of an evaluation instrument that allows comparisons to be made regarding the indicated treatments, thereby standardizing the evaluation and facilitating the development

Table 6. Spearman correlation of the first and second AOFAS for each domain

	Pain	Function	Footwear requirements	MTP amplitude	IP amplitude	MTP/IP amplitude	Calluses	Alingnment	Total
Pain	0.95**	0.5**	0	0.45**	0.12	0.34*	0.42**	0.14	0.78**
Function	0.55**	0.97**	-0.07	0.48**	0.25	0.64**	0.1	0.21	0.61**
Footwear requirements	-0.01	0.01	0.92**	0.11	0.3*	0.27	0.35*	-0.04	0.23
MTP amplitude	0.41**	0.54**	0.25	0.96**	0.51**	0.6**	0.47**	0.25	0.69**
IP amplitude	0.03	0.35*	0.33*	0.55**	0.88**	0.6**	0.38**	0.4**	0.47**
MTP/IP amplitude	0.37**	0.63**	0.34*	0.5**	0.48**	0.94**	0.4**	0.34*	0.59**
Calluses	0.36**	0.12	0.51**	0.44**	0.33*	0.38**	0.92**	0.32*	0.68**
Alignment	0.02	0.22	0.09	0.23	0.24	0.24	0.25	1**	0.4**
Total	0.71**	0.54**	0.29*	0.61**	0.42**	0.5**	0.65**	0.45**	0.96**

MTP: Metatarsophalangeal; IP: Interphalangeal; MTP/IP: Metatarsophalangeal-interphalangeal.

of new therapeutic approaches. Our study found very high interobserver agreement, demonstrating that the translation of the AOFAS lesser metatarsophalangeal-interphalangeal scale into Brazilian Portuguese can be used for clinical evaluations and studies aimed at comparing the quality of life of patients during treatment.

Authors' contributions: Each author contributed individually and significantly to the development of this article: TAA *(https://orcid.org/0000-0002-3008-7069) Interpreted the results of the study, formatting of the article, and wrote the article; BRM *(https://orcid.org/0000-0002-5306-2972) Conceived and planned the activities that led to the study, and bibliographic review; HCC *(https://orcid.org/0009-0000-6104-4064) Bibliographic review and performed data collection; AMS *(https://orcid.org/0000-0002-3067-3279) Performed data collection; FCLS *(https://orcid.org/0000-0003-4925-8101) Performed data collection; ADPF *(https://orcid.org/0000-0001-5808-1788) Performed data collection; FCPFF *(https://orcid.org/0000-0002-8907-0472) Participated in the review process; DRCN *(https://orcid.org/0000-0003-0227-2440) Participated in the review process; TRN *(https://orcid.org/0009-0001-0282-5001) Statistical analysis; RSB *(https://orcid.org/0000-0002-2870-2261) Participated in the review process. All authors read and approved the final manuscript. *ORCID (Open Researcher and Contributor ID).

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