



# Portuguese translation, cultural adaptation and psychometric properties of the temporomandibular joint scale: a cross-sectional study

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## Abstract

**Background** The temporomandibular joint (TMJ) scale assesses the severity of temporomandibular joint disorders (TMD), yet a European Portuguese translation is lacking.

**Objectives** To translate, cross-culturally adapt and to examine the psychometric properties (construct validity and reliability) of the TMJ scale.

**Methods** Translation and cultural adaptation were carried out according to international recommendations, including initial translation, evaluation of this translation and cultural adaptation by a panel of experts, and back translation. The final Portuguese version was used to examine the reliability and validity, and participants with TMD were recruited from a Portuguese outpatient clinic. Reliability measures included internal consistency with Cronbach's alpha and test-retest reliability with the intraclass correlation coefficient (ICC<sub>2,1</sub>). The Spearman correlation comparing the TMJ scale with the Fonseca and Helkimo indexes was used to assess the construct validity.

**Results** A total of 63 participants ( $23 \pm 2$  years; 61,9% female) were included. Similar internal consistency was observed between the two moments of application (0.921 and 0.918), and test-retest reliability was excellent, with an ICC<sub>2,1</sub> = 0.998 (95%CI: 0.988–0.999). Robust positive correlations ( $\rho$  0.554–0.611,  $p < 0.001$ ) were found between the TMJ scale and Fonseca and Helkimo indexes.

**Conclusion** The European Portuguese version of TMJ scale is now available to improve the assessment of severity of TMD in routine clinical practice. This version is also reliable and valid.

**Keywords** Temporomandibular joint Scale · translation · cultural adaptation · reliability · validity

## Introduction

The temporomandibular joint (TMJ) has a crucial role in several physiological functions, including chewing, speech, breathing and facial expression [1–3]. The intricate structure TMJ involves the articulation of the temporal bone and the mandible, encompassing a complex interplay of muscles, ligaments, and a fibrocartilaginous disc [4]. Its unique biomechanics, which includes both hinge and glide movements, allow for a wide range of jaw motions [5]. However, this finely tuned system is susceptible to malfunctions that leads to temporomandibular disorders (TMD). These disorders are defined as a collection of signs and symptoms affecting the masticatory system, characterised by pain, limited jaw movement, and dysfunction of the TMJ [6].

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Epidemiologic data indicates that the prevalence of TMD symptoms is approximately 30% in adults and 5–15% in children, with a potential increase during adolescence [2, 7]. Women are two to three times more susceptible to TMD than men [7].

The aetiology of TMD is complex and multifactorial, and while internal derangements within the joint, including disc displacement and osteoarthritis, have been implicated in the past [8], muscular factors such as myofascial pain and masticatory dysfunction may play an important role [7]. Other factors such as stress [9], genetic predisposition [10] hormonal fluctuations [11] can act as potential triggers or aggravate existing conditions. Patient reported outcome measures (e.g., scales and questionnaires) are important in the assessment of TMD [12]. Typically, these instruments offer insight into the subjective experiences that include pain intensity, functional limitations, psychosocial impact and quality of life [13, 14]. The TMJ scale, developed by the Pain Resource Center in the United States of America (USA) [15], has been used to assess the presence and severity of TMD symptoms [16–18]. This scale consists of 97 items, using a diagram and a four-point rating scale [17]. The TMJ Scale is not available in Portuguese, which limits its use in Portugal. Therefore, this study aimed to translate, cross-culturally adapt the European Portuguese version of the TMJ scale. Another aim was to examine the reliability and construct validity of the European version of the scale.

## Methodology

The TMJ Scale was translated from English and culturally adapted for the Portuguese population after written consent from the authors of the original scale [15]. The cross-cultural adaptation process was carried out according to the current guidelines and divided in 5 stages [19]. For Stage 1 - translation, a bilingual healthcare professional and a bilingual translator independently performed a forward translation of the TMJ Scale from English to Portuguese. When translators experienced difficulty to reach consensus, the English version was used to assist [20]. The 2 Portuguese versions were then synthesised into 1 version in a consensus meeting (Stage 2 - synthesis). The discrepancies between versions were resolved by a third party [21] who performed a written report detailing the difficulties encountered and how they were resolved.

Two different bilingual translators, non-health professionals whose native language is English and who are fluent in Portuguese, performed two backward translations of the Portuguese TMJ Scale synthesis version, back into English (Stage 3 - back translation). Both translators were unaware of the original version of the TMJ [21]. Three specialists

from the temporomandibular rehabilitation field, together with the four translators and the third party, involved in the project, reviewed all translated and back-translated versions to reach consensus on possible discrepancies. Then, a pre-final version of the TMJ Scale was produced (Stage 4 - expert committee review). The pre-final version of the TMJ Scale was applied to a panel of 63 individuals (Stage V - pretesting) whose sociodemographic and academic data was collected to characterise the sample [22, 23]. Each individual who completed the questionnaire was interviewed to assess the layout of the instrument, as well as the comprehension of the instructions and the different items, the receptiveness and adherence to its contents. For each participant, the total score (dependent variable) in the TMJ questionnaire was obtained.

The final version was then produced and distributed to the same panel. All questionnaire versions were printed and distributed for self-completion.

**Clinical trial number** not applicable.

## Study sample

The patient panel (for stage 5 - pretesting and final version testing) comprised individuals experiencing TMJ pain recruited in April 2019 from the outpatient clinic of Fernando Pessoa University (UFP). Participants were adults aged 18 years and older, excluding those with a history of significant craniofacial trauma, prior surgical TMJ interventions, or orofacial tumours.

## Reliability

Participants were asked to complete the TMJ scale twice in-person, 7 days apart. A well-trained physiotherapist conducted the in-person interviews. Participants and the physiotherapist were blinded to the answers/scores of the instrument on the first administration.

## Validity

The construct validity was performed correlating the two TMJ assessments with two other instruments, the Fonseca [24] and Helkimo [25] indexes (independent variables). Fonseca index [26] has a sensitivity of 94.23–98.21% and a specificity of 87.72%, whilst Helkimo index [27] shows a sensitivity of 86.67%, a specificity of 68.09% [27] predicting TMD.

## Statistical analysis

Continuous variables were characterised by their mean, minimum, and maximum values, while categorical variables were presented as absolute frequencies. The internal consistency was assessed using Cronbach's alpha and a value higher than 0.70 was considered an acceptable level of consistency [28]. Relative reliability in test-retest was explored with the Intraclass Correlation Coefficient (ICC) Eqs. (1, 2) and the respective 95% confidence intervals (95%CI). The ICC was interpreted as excellent ( $>0.75$ ), moderate to good (0.4–0.75) or poor ( $<0.4$ ). The construct validity of the TMJ scale was assessed using the Spearman correlation coefficient ( $\rho$ ), comparing it to the Fonseca and Helkimo indexes. This coefficient was interpreted as strong ( $\geq 0.70$ ), moderate (0.30–0.70) or weak ( $\leq 0.30$ ) [29]. According to Consensus-based Standards for the selection of health Measurement Instruments (COSMIN) guidelines, a sample size of at least 50 participants are needed to test the psychometric properties of PROMs. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS), version 25.0 for Windows, with a significance level set at 5%.

## Results

The initial translation and synthesis, as well as the back-translation and synthesis, included statements from the translators and back-translators, respectively. The panel of experts' modifications to the semantic, idiomatic, experiential, and conceptual aspects resulted in the final version of the scale. The reliability and validity sample consisted of 63 participants, with a mean age of  $23 \pm 2$  years, ranging from 18 to 26 years. Most of the participants were female ( $n=39$ ), with a mean body mass index (BMI) of  $23.7 \pm 1.7$  kg/m<sup>2</sup>. Following pre-testing of the final version, it became evident that the items in the translated and adapted version were universally comprehensible and interpretable by all participants.

## Reliability

The Cronbach's alpha test indicated strong and similar internal consistency at both time points, 0.921 at the first assessment and 0.918 at the second assessment. Item-by-item analysis showed consistent Cronbach's alpha values, ranging from 0.917 to 0.924 in the first assessment and from

0.915 to 0.922 in the second assessment. Excellent test-retest reliability was found with an ICC of 0.998 (95% CI: 0.988–0.999). Total scores at both assessments of TMJ are reported in Table 1.

## Construct validity

The construct validity of the TMJ Scale was demonstrated by moderate correlations with the Fonseca Index at both the first ( $r=0.554$ ,  $p<0.001$ ) and second ( $r=0.585$ ,  $p<0.001$ ) assessment moments, and with the Helkimo Index at both the first ( $r=0.611$ ,  $p<0.001$ ) and second ( $r=0.606$ ,  $p<0.001$ ) assessment moments.

## Discussion

Our study shows that the European version of the TMJ scale is reliable and valid in people with TMD. The adaptation of an instrument is necessary when there are cultural differences between the instrument's origin and the target population [30]. This process should involve a rigorous evaluation of both the cultural adaptation itself and the instrument's psychometric properties [30]. In the literature, there are several TMD assessment instruments available [31, 32]. The Helkimo and Fonseca indexes are two of the most widely used assessment tools, especially in Portuguese countries [33, 34]. The Helkimo index has been widely used instrument in studies for symptom-based classification of TMD, mainly due to its ease of use in large-scale population research. Nevertheless, it has certain limitations, such as the potential to classify a person with mild TMD based only on three criteria for evaluating facial pain [31].

The Fonseca index is based on Helkimo and assesses the severity of the TMD based on its signs and symptoms [24]. This instrument is particularly useful for early stage TMD [35]. Both the Fonseca and Helkimo Indexes [24, 25] classify individuals with common symptoms like headaches or palpation tenderness as having TMD, regardless of the absence of definitive clinical signs. However, these symptoms can occur independently of TMD [33]. This binary approach might limit the accuracy of diagnoses, particularly when assessing individuals without obvious symptoms. The TMJ Scale facilitates a nuanced assessment by integrating symptomatic presentation with objective clinical indicators, thereby it may improve the diagnostic precision and ensure comprehensive evaluation across diverse patient demographics. Our research findings affirm the robustness of the

**Table 1** Descriptive analysis of the total score at both moments

$n=63$	Mean	Standard deviation	Minimum	Maximum
<b>Total Score at 1° moment</b>	105,37	36,291	49	217
<b>Total Score at 2° moment</b>	107,48	35,701	54	218

adapted TMJ Scale, showcasing strong reliability, internal consistency, and construct validity for evaluating TMD among the Portuguese population.

This study assessed the reliability of the Portuguese TMJ Scale through test-retest reliability and internal consistency analysis. Test-retest reliability indicates the scale's ability to produce consistent scores when administered to the same individuals on multiple occasions [36]. Internal consistency assesses how well items within the scale measure the same underlying construct [37]. Our data indicates a strong association between repeated administrations of the Portuguese TMJ Scale, supported by a very high ICC (0.998, 95% CI). To our knowledge, the TMJ Scale hasn't been translated and culturally adapted to any other language. The original authors reported that the instrument was reasonably reliable and accurately screened for disorders in both patients and non-patients [16]. Regarding the other instruments, the Fonseca index has shown a high reliability and good correlation with Helkimo index [32, 34]. The reliability data available for the Helkimo Index is limited in terms of quality. Despite this, the Helkimo Index is valued in clinical settings for its simplicity in evaluating TMD [27, 36]. Using the Cronbach's alpha coefficient, we observed excellent internal consistency across all domains, supported by a strong correlation among all scale items, which affirms its reliability. According to Maroco [36], decreased variability among items across subjects correlates with reduced measurement error, thus reinforcing the scale's reliability. However, the inclusion of 97 questions in TMJ questionnaire may introduce potential biases, as lengthy questionnaires can inflate alpha values without necessarily enhancing internal consistency. The construct validity was assessed correlating the TMJ Scale with both the Fonseca and Helkimo Indexes. Construct validity is a measure of the extent of which scores on a particular instrument relate to other measures in a manner that is consistent with theoretically derived hypotheses concerning the concepts that are being measured [38, 39]. Our results revealed a moderate to strong association between all measures.

### Limitations

The present study has limitations that should be considered. Despite the consent to culturally adapt the "Temporomandibular Joint Scale", our request to access the domains inherent in each question was denied by both the scale's author and the Pain Resource Centre. Therefore, only the total/general scores were obtained, and not the domain-specific scores. Another limitation, similarly, to other studies, was the higher proportion of female individuals, possibly related to a higher prevalence of TMDs in the female population. Moreover, to our knowledge, the TMJ hasn't been translated

and culturally adapted to any other language, which limited the results comparison. In addition, we also recommend in further studies the comparison of the TMJ scale with the DC/TMD, as the gold standard measure to assess the TMD.

### Conclusion

The European Portuguese version of the TMJ scale is now available to improve the assessment of the severity of TMD in routine clinical practice. The results of this study also confirm that the TMJ is a reliable and valid PROMs. Furthermore, these results underline the potential of this scale for both clinical diagnosis and symptoms identification on TMD in the Portuguese population.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s10006-024-01300-8>.

**Author contributions** Conceptualized and designed the study: M.C.; L.A.; J.P. Supervised the project and ensured its overall direction and integrity: M.C.; L.A.; J.P. Coordinated data collection and managed the logistics of participant recruitment: J.P.; L.A., M.C. Ensured compliance with ethical standards and obtained necessary approvals: M.E.; R.V. Contributed to the data collection and data entry process: J.P. Drafted the initial manuscript and critically revised it for important intellectual content. Assisted in drafting the methods and results sections of the manuscript. M.E.; V.A. Developed the methodology for the scale adaptation and validation process: R.V.; A.M. Managed references and citations: V.A.; A.M. All authors reviewed and provided feedback on all sections and approved the final manuscript.

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**Data availability** No datasets were generated or analysed during the current study.

### Declarations

**Ethical approval** The current study was reviewed and approved by the University of Fernando Pessoa's Ethics Committee in April 2019.

**Competing interests** The authors declare no competing interests.

**Statements on consent** Informed written consents to participate and to publish were obtained from all participants.

**Conflict of interest** The authors declare that no conflict of interest was present.

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