

Validity and Reliability of the Persian Version of the Malocclusion Impact Questionnaire (MIQ) in Shiraz (2024)

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Abstract

Background: The Malocclusion Impact Questionnaire (MIQ) is a condition-specific instrument used to examine how dental occlusion problems relate to health-related quality of life. This study aimed to produce a Persian translation of the MIQ and to examine the psychometric characteristics of this Persian version among adolescents with malocclusion living in Shiraz.

Method: A stepwise cross-cultural adaptation protocol was applied to produce the Persian MIQ, following established guidelines for translating measurement instruments. The finalized questionnaire was then completed by 310 adolescents aged 10 to 14 years. Psychometric evaluation of the Persian MIQ comprised exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and assessment of criterion validity, convergent validity, and construct validity. A calibrated dentist additionally recorded the presence and severity of occlusal problems using the dental aesthetic index.

Results: Both EFA and CFA confirmed a unidimensional structure for the Persian MIQ, with fit indices for the CFA model of $\chi^2=224.108$. Reliability of the Persian MIQ was acceptable, with a Cronbach's α of 0.901 and an ICC of 0.863. A moderate correlation was observed between the Persian MIQ and the CPQ11–14 ($r=0.679$), supporting adequate criterion validity. OHRQoL was inversely related to malocclusion severity ($P=0.03$), and the strong correlations between the Persian MIQ and the two global questions (Q1, $r=0.759$; Q2, $r=0.680$) confirmed adequate convergent validity.

Conclusion: The Persian version of the MIQ showed acceptable psychometric properties, including validity and reliability. Future studies using longitudinal designs and more geographically diverse samples are recommended.

Keywords: Malocclusion, Quality of life, Psychometrics, Orthodontics

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Introduction

Health-Related Quality of Life (HRQoL) is a central concept in pediatric health with a substantial influence on children's daily lives; the World Health Organization (WHO) describes it as a multidimensional construct spanning social, physical, and psychological domains that are shaped by a person's emotions, beliefs, expectations, and lived experience.¹ In practical terms, HRQoL reflects how an individual perceives their own physical and mental wellbeing and how well they can adapt to changing physical and social circumstances,² and it has become an important construct within dental health research.³ As a multidimensional outcome, it captures elements such as comfort during social interaction, eating, and sleeping, along with self-confidence and satisfaction regarding oral health^{4,5}. The WHO has likewise identified Oral Health-Related Quality of Life (OHRQoL) as a core component of global oral health initiatives,⁶ and dental

research increasingly combines efforts to treat oral and dental disease with investigation of how oral health status relates to overall quality of life, to maintain, improve, and monitor wellbeing.⁶ Assessing how well a treatment works from the patient's own perspective is essential, and using OHRQoL as an outcome measure fits naturally within patient-centered care; it also offers valuable insight into how general health and specific health characteristics relate to one another over time.^{7–9}

Multidimensional instruments for assessing oral health-related quality of life generally fall into two broad categories: Generic questionnaires and condition-specific questionnaires. Generic instruments tend to be less sensitive to small differences between individuals.¹⁰ Condition-specific instruments, by contrast, are built around particular conditions and populations and can pick up on clinically meaningful changes that generic tools might miss.^{11,12} A



growing number of such targeted tools have emerged in recent years; because they are narrower in scope and more directly relevant to the population being studied, condition-specific instruments tend to be better accepted by patients and are especially useful in clinical settings.^{13,14}

The Child Perceptions Questionnaire (CPQ11–14) was the earliest instrument built specifically to capture OHRQoL; although it shows that malocclusion influences daily activities and behavior, the strength of this association is only moderate.¹⁵ Most existing pediatric OHRQoL measures, however, are oriented mainly toward dental caries and its consequences, leaving little room to capture the impact of malocclusion specifically — an indication that the tools currently available do not adequately serve children who need orthodontic treatment.¹⁶

More recently, the Malocclusion Impact Questionnaire (MIQ) was introduced specifically to capture the OHRQoL impact of malocclusion in children aged 10 to 16 years,^{17,18} and it was designed with the further aim of gauging how adolescents themselves perceive their oral health and its influence on their quality of life. It comprises 17 items rated on a 3-point intensity scale (“not at all”, “a little”, “a lot”), covering three core areas: Dental appearance, social functioning, and oral health/function.^{17,18} Before an instrument like this can be used in a new country, it needs to go through a translation and standardization process that takes local social and cultural characteristics into account.^{19,20} The MIQ itself has already been translated into several languages, with its validity and reliability confirmed in earlier studies.^{21–26}

Applying the MIQ to Iranian children with a range of occlusal disorders first requires a Persian translation together with a careful evaluation of its cultural validity and relevance. While the Persian CPQ11–14 has already been validated as an OHRQoL measure,²⁷ available evidence indicates that the MIQ offers greater sensitivity and responsiveness for this purpose.

It is also considered easier for younger respondents to complete.^{21,28} The present study was therefore conducted to examine the validity and reliability of the Persian MIQ following its cultural adaptation.

Methods

This study invited 310 adolescents aged 11 to 14 years to participate, and ethical approval was obtained from the Ethics Committee of Azad University (Ethical code: IR.IAU.SHIRAZ.REC.1402.058). Individuals were excluded if they had a disability or a physical/mental health disorder, active dental caries, broken teeth, moderate-to-severe fluorosis with discoloration, a history of orthodontic treatment, or prior cosmetic work (such as laminate veneers or composite bonding) on their front teeth; participants who did not give written informed consent were likewise excluded. The instrument itself is a self-administered questionnaire built to capture OHRQoL among adolescents and young people with malocclusion, containing 17 items grouped into four domains: Feelings about one’s teeth (seven items), the effect of teeth on everyday situations (four items), dental-related

anxiety (four items), and other impacts of teeth on daily life (two items).

Every item offers a 3-point intensity scale as a response option. Negatively worded items are scored 0 (‘not at all’), 1 (‘a little’), and 2 (‘very little’), while positively worded items are scored in reverse: 0 (‘very’), 1 (‘a little’), and 2 (‘not at all’). Summing all item scores yields a total ranging from 0 to 34, with higher totals reflecting worse OHRQoL.^{15,16}

Initial translation

In the first stage, three Persian-native dental students who were fluent in English each produced an independent Persian translation of the original questionnaire.

These translations were then reviewed and discussed jointly to arrive at a single consensus version.

Back translation

Two bilingual translators, each holding a PhD in English and familiar with the quality-of-life concept, then back-translated the Persian consensus version into English. This back-translation was checked against the original instrument, discrepancies were corrected, and Persian version No. 1 was produced. One difficulty arose with item 4, where no Persian equivalent could be found that fully captured the meaning of the adjective “normal”; because this English word is already in common everyday use in Persian, it was ultimately retained as it is in the Persian version.

Checking the quality of the translation

A panel of four experts — two orthodontists, a Persian-language specialist, and a specialist in oral health and community dentistry — evaluated the first Persian version for accuracy, clarity, grammar, wording, and syntax. Their feedback was incorporated to produce the second Persian version.

Cultural Adaptation

Two orthodontic experts subsequently made the cultural adjustments needed for the translated instrument, resulting in the third Persian version.

Preliminary Study

Before the main study began, a pilot test was conducted to identify any remaining problems and refine the clarity and relevance of the items. Twenty students aged 10 to 14 years completed the questionnaire while a trained facilitator, thoroughly familiar with the instrument, was present to note any ambiguity in the responses and gather feedback. The issues raised at this stage were addressed, and the revised questionnaire was then given to a further 20 participants. Once its accuracy and fluency were confirmed, the final Persian version was finalized.

Validity

Convergent validity was examined using two global oral health questions drawn from earlier studies.^{16,22} These two items were included to gauge both the perceived severity of

malocclusion and its effect on OHRQoL among adolescents, and they specifically capture how aware adolescents are of their malocclusion in relation to daily functioning and wellbeing:

1. Generally, to what degree do your teeth trouble you?
2. Comprehensively, how much do your dental problems influence your life?

The global questions were rated on a 5-point scale ranging from 0 ('not at all') to 4 ('very much').

The same five-stage process — forward translation, back-translation, content review, cultural adaptation, and pilot testing — was applied to the Persian versions of these two global questions along with the MIQ items.^{16,22} Construct validity was tested by comparing MIQ scores across participants with various degrees of malocclusion severity, which was determined when a study orthodontist examined each participant's occlusal characteristics using the Dental Aesthetic Index (DAI). This index rates 10 occlusal features linked to dentofacial anomalies, including crowding, overjet, spacing, reverse overjet, anterior open bite, anterior and other diastema, tooth loss, and the extent of anterior irregularity in the upper and lower jaw,^{29,30} while the antero-posterior relationship was additionally assessed through intraoral examination with a periodontal probe (UNC-15). Then, one of the study's orthodontic specialists classified malocclusion severity into five DAI categories: normal occlusion, mild, moderate, severe, and very severe. Criterion validity was assessed by asking participants to complete the Child Perceptions Questionnaire for 11–14 alongside the MIQ. The CPQ11–14 is a 37-item self-report instrument covering four domains: Functional limitations, oral symptoms, social wellbeing, and emotional wellbeing.²⁷

Reliability

Test–retest reliability was evaluated by asking 10% of the sample to complete the questionnaire a second time, 2 to 3 weeks after their first attempt, to gauge how reproducible the instrument's results were.

Statistical analysis

All statistical analyses were conducted in SPSS version 23.0 (SPSS Inc., Chicago, IL, USA). Variable normality was checked using the Kolmogorov–Smirnov test, and the required sample size was calculated using Bonnett's formula. Structural validity was examined first through exploratory factor analysis (EFA) and then through confirmatory factor analysis (CFA), with model fit judged from the Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA); CFI and TLI values at or above 0.90 were taken as acceptable.³¹ Convergent validity was tested by correlating (Spearman's) the instrument's total score with the two global questions, with correlation strength classified as strong ($r > 0.80$), strong-to-moderate (0.60–0.80), moderate (0.40–0.60), weak (0.20–0.40), or negligible (below 0.20). Criterion validity relied on Spearman's correlation between the Persian MIQ and CPQ11–14 total scores, while construct validity was

examined by comparing MIQ scores across DAI-based malocclusion-severity groups using the Kruskal–Wallis test.

Reliability was assessed using Cronbach's alpha and test–retest reproducibility, the latter measured through the intraclass correlation coefficient (ICC) among 10% of participants who repeated the questionnaire 2 to 3 weeks after the first completion. Cronbach's alpha values between 0.70 and 0.95 were considered acceptable.

Results

Participant characteristics

Participants had a mean age of 12.34 ± 1.23 years (demographic details in Table 1), and Pearson's correlations indicated that neither age ($r = 0.01$; $P = 0.873$) nor gender ($r = -0.386$; $P = 0.061$) was significantly associated with participants' responses to the questionnaire.

Validity

The data were suitable for factor analysis, as indicated by the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (KMO = 0.924) and Bartlett's test of sphericity ($P < 0.05$). Together, the two extracted factors accounted for 53.145% of the total variance (29.873% and 23.272% individually). As shown in Table 2, the rotated factor loading of every item exceeded 0.30, while all loadings were above 0.40.

CFA confirmed an acceptable fit for the two-factor model (Table 3). Figure 1 presents the resulting multifactor structure for the Persian MIQ.

The CPQ score was correlated with the total MIQ score of 0.679 (Spearman), indicating a strong relationship and confirming adequate criterion validity for the Persian version of MIQ. The MIQ total score likewise was correlated at 0.759 with global question 1 and 0.680 with global question 2, supporting adequate convergent validity for the Persian version of the MIQ (Table 4).

Construct validity, tested with the Kruskal–Wallis test, is summarized in Table 5: children with more severe malocclusion and those more troubled by their dental condition and its effect on daily life obtained higher MIQ scores.

Reliability

Item-level correlation coefficients were first computed to evaluate the reliability of the MIQ scale, after which overall reliability was estimated via Cronbach's alpha, yielding a

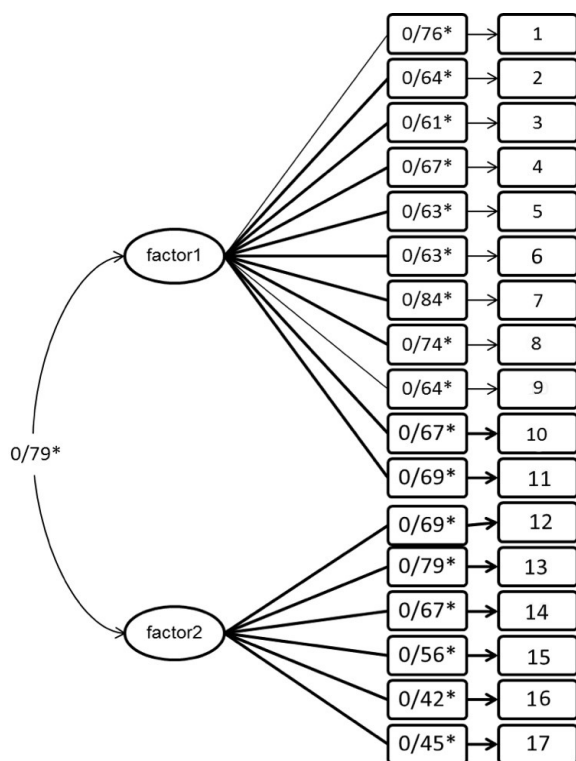
Table 1. Demographic characteristics of participants

Total	Gender		Age (years)
	Female	Male	
66 (21.3%)	30	36	11
45 (14.6%)	22	23	12
85 (27.4%)	54	31	13
114 (36.7%)	66	48	14
310	172 (53.3%)	138 (46.7%)	Total

Table 2. Rotated Component Matrix and total variance explained

	Component	
	1	2
m1	0.820*	0.142
m2	0.764*	0.030
m3	0.753*	-0.009
m4	0.684*	0.213
m5	0.653*	0.231
m6	0.647*	0.345
m7	0.482*	0.456
m8	0.695*	0.414
m9	0.561*	0.506
m10	0.506*	0.486
m11	0.590*	0.468
m12	0.470	0.528*
m13	0.279	0.629*
m14	0.064	0.704*
m15	-0.074	0.740*
m16	0.428	0.593*
m17	0.135	0.597*
Variance Explained (Initial solution)	7.288	1.746
Percentage of Variance Explained (Initial solution)	42.873	10.273
Percentage of Variance Explained (Rotation solution)	29.873	23.272

CFA confirmed an acceptable fit for the two-factor model (Table 3). Figure 1 presents the resulting multifactor structure for the Persian MIQ

**Figure 1.** A two-factor model for the Persian version of MIQ from CFA

high value of 0.901 (Table 6). Also, Table 7 shows ICC values between 0.863 and 0.915, and Cronbach's alpha values between 0.881 and 0.905.

Table 3. Presentation of the fit indices for the two-factor model in CFA

RMSEA	CFI	TLI	χ^2/df	df	χ^2
0.070	0.930	0.910	2.001	112	224.108

Table 4. Convergent validity of the Persian version of the MIQ (n=310): correlations between the total scores of the MIQ for two global oral health questions

	Global question 1	Global question 2
MIQ	0.759	0.680
Spearman's correlation	0.00**	0.00**
Coefficient Sig. (2-tailed)		

Table 5. Construct validity of Persian version of MIQ (n=310): Comparison of MIQ scores at different levels of malocclusion based on DAI

	N	Mean $\pm$ Σ	P-value
DAI			
Normal Occlusion	71	4.18 $\pm$ 3.49	
Mild malocclusion	114	10.15 $\pm$ 4.83	
Moderate malocclusion	87	10.16 $\pm$ 4.33	0.04*
Severe malocclusion	38	13.8 $\pm$ 3.7	

Discussion

Assessment of oral health-related quality of life (OHRQoL) is commonly performed using either generic or condition-specific instruments.¹ Condition-specific questionnaires are generally considered more appropriate for clinical applications because they are better able to detect the impact of a particular disorder on patients' daily lives.^{11,12} Although the CPQ11-14 represented the first validated instrument specifically designed to evaluate OHRQoL in children and adolescents, its ability to reflect the impact of malocclusion has been reported to be only moderate. Consequently, the Malocclusion Impact Questionnaire (MIQ) was specifically developed to provide a more sensitive assessment of the influence of malocclusion on the quality of life of individuals aged 10–16 years.^{18,19} The purpose of this process was to preserve equivalence between the translated and original versions across conceptual, semantic, technical, and psychometric dimensions. Achieving such equivalence can be challenging because linguistic characteristics, cultural background, and social perceptions often differ substantially between populations.

The systematic adaptation strategy adopted in the present study enabled adolescents to complete the Persian version of the MIQ without assistance, suggesting that the translated instrument was readily understandable and culturally appropriate. Furthermore, the absence of a ceiling effect, consistent with the findings from the original English version of the questionnaire, indicates that the questionnaire adequately covers the intended construct and retains satisfactory conceptual equivalence with the original instrument.

Overall, the findings demonstrate that the Persian version of the MIQ possesses satisfactory psychometric performance, effectively discriminates between different levels of malocclusion severity, and provides results consistent with those reported for the original questionnaire.

Internal consistency was likewise acceptable: Reported

Table 6. Mean scores, corrected item-total correlations, and Cronbach's alpha if the item deleted results for the Persian version of the MIQ

	Pearson's correlation	P-value	Cronbach's Alpha if Item Deleted	Corrected-item total correlation
m1	0.741**	0.000	0.908	0.685
m2	0.636**	0.000	0.911	0.570
m3	0.6**	0.000	0.913	0.529
m4	0.674**	0.000	0.910	0.614
m5	0.642**	0.000	0.911	0.583
m6	0.67**	0.000	0.910	0.617
m7	0.658**	0.000	0.910	0.601
m8	0.798**	0.000	0.905	0.759
m9	0.751**	0.000	0.907	0.708
m10	0.699**	0.000	0.909	0.646
m11	0.723**	0.000	0.908	0.682
m12	0.711**	0.000	0.909	0.657
m13	0.612**	0.000	0.911	0.557
m14	0.494**	0.000	0.914	0.447
m15	0.42**	0.000	0.916	0.359
m16	0.722**	0.000	0.908	0.672
m17	0.475**	0.000	0.915	0.412

Cronbach's alpha values elsewhere include 0.893 in China, 0.924 in New Zealand, 0.952 in the Malayalam-language sample (consistent with the results of the present study), and 0.85 in Spain,^{6,22,24,27} indicating that the internal consistency of the Persian version of the MIQ is comparably strong. Its coefficient of 0.915 is also slightly higher than the value (0.906) reported for the original questionnaire,¹⁷ further supporting the strength of the reliability of the Persian version. The Spearman's correlations confirmed that every item correlated strongly and significantly with the total score.

Varimax rotation yielded a two-factor structure for the Persian version of the MIQ that together explained 53.145% of the total variance, pointing to an appropriate scale structure, and the CFA results corroborated the factor structure identified by the EFA with an acceptable model fit. This two-factor solution diverges from the studies by Li et al. and Telatar and Bayrak, who each reported a three-factor structure for the Chinese and Turkish versions of the questionnaire, respectively; Hope et al, meanwhile, favored a one-factor model, whereas Telatar and Bayrak found neither the one- nor two-factor solutions acceptable.²⁶

Both global questions correlated with the Persian MIQ, though question 1 showed a stronger relationship than question 2 — a pattern that supports acceptable validity for the Persian version and mirrors what was found for question 1 in the Spanish adaptation.²⁴

Criterion validity was examined next by relating the MIQ total score to the Persian CPQ.

The observed correlation of 0.679 reflects a moderate relationship between the CPQ and the MIQ, somewhat lower than the $r=0.751$ reported in the original MIQ study.¹⁸ A New Zealand sample similarly assessed construct validity via the MIQ–CPQ11-14 correlation and obtained a

Table 7. Internal consistency and test-retest reliability of the Persian version of the MIQ

	Number of items	Internal consistency (Cronbach alpha) N=310	Test-retest reliability: Intraclass correlation coefficient (95% CI) N=31
Total score	17	0.901	0.863 (0.772–0.969)
Subscale Factor 1	11	0.881	0.884 (0.781–0.961)
Factor 2	6	0.905	0.915 (0.817–0.956)

Pearson's coefficient of 0.523,²⁸ and a comparably moderate correlation ($r=0.58$) between these two instruments was reported for the Spanish adaptation,²¹ which in a separate analysis also used the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) to gauge construct validity.²¹ That the MIQ–CPQ11-14 correlation is only moderate suggests the MIQ captures information that general OHRQoL instruments do not, and that the CPQ11-14 on its own may not fully represent the impact of malocclusion on OHRQoL, since children's perceptions of oral health are likely to be shaped by additional factors.²⁵ It is also worth noting that although spoken Persian varies by region and dialect nationally, its written form remains standardized throughout the country. The present findings offer baseline data to support future MIQ research in the Persian-speaking regions and contribute to the broader development of culturally adapted OHRQoL instruments.

Limitations

In this study, all participants were recruited from Shiraz in southern Iran; therefore, the findings cannot be generalized to adolescents elsewhere in the country, and future work would benefit from longitudinal designs using more regionally varied samples. Socioeconomic status, a factor known to influence OHRQoL, was also not assessed, since cultural norms in Iran make people hesitant to disclose this kind of personal information.

Conclusion

Overall, the Persian version of the MIQ demonstrates good reliability and validity for assessing OHRQoL among children and adolescents with malocclusion, offering clinicians and researchers a useful tool for capturing the social impact of malocclusion and informing treatment and public health decisions. Its validity and reliability findings closely resemble those reported for the original instrument, supporting the equivalence and cross-cultural adaptability of this Persian adaptation.

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Authors' Contribution

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Competing Interests

The authors declare that they have no competing interests.

Data Availability Statement

The datasets used and/or analyzed during the present study are available from the corresponding author upon request.

Ethical Approval

Ethical approval to conduct the study was granted by the Medical Ethics Committee, Shiraz branch, Islamic Azad University, Iran (Ethical code: IR.IAU.SHIRAZ.REC.1402.148). This study was conducted according to the ethical standards in the 1964 Declaration of Helsinki and its later amendments. Written informed consent was obtained from all participants included in the study. Participation was voluntary, and no remuneration was involved.

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