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Translation and validation of the italian version of the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) among adolescents

ABSTRACT

Aim *The Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) is a valid tool aiming to evaluate the self-reported influence of dental aesthetics on quality of life. This questionnaire was developed in English for young adults, and later translated and validated with an Italian population. A new version of the questionnaire was recently introduced to be used in adolescents (11-17 years-old), but it had not been translated in Italian yet. Hence, the purpose of this study was to translate, cross-culturally adapt and validate the PIDAQ for adolescents, for its use among Italian subjects.*

Methods *To develop the Italian PIDAQ, the original version was translated, back-translated, cross-culturally adapted and pre-tested. Afterwards, the Italian PIDAQ was administered to a convenience sample of 677 subjects, aged 11-17 years, together with two other written questionnaires: the Aesthetic Component of the Index of Orthodontic Treatment Need (IOTN-AC) and the Perception of Occlusion Scale (POS), which are instruments dedicated to assess the self-reported degree of malocclusion. A one-way ANOVA was performed to assess the difference between groups, within each PIDAQ factor, according to POS and IOTN-AC scores. The correlation between PIDAQ factors and POS/IOTN-AC scores was measured as Spearman's rank correlation. The internal consistency was assessed as Cronbach's alpha coefficient (α), and the test-retest reproducibility as Intra-Class Correlation Coefficient (ICC).*

Results *The one-way ANOVA showed that all the factors of the self-reported impact of dental aesthetics on quality of life significantly increased as the degree of malocclusion worsened (P<0.001). Furthermore, all the factors showed statistically significant correlations with both IOTN-AC and POS scores. The α ranged between 0.79 and 0.90, and the ICC ranged between 0.93-0.97.*

Conclusion *The Italian adolescent PIDAQ showed good reliability and validity. The psychometric properties of this version of the questionnaire support its use for the assessment of the psychosocial impact of dental aesthetics among Italian adolescents.*

Keywords *Adolescent, Aesthetics, Malocclusion; Quality of Life.*

Introduction

Oral Health Related Quality of Life (OHRQoL) deals with the implications of the dental status on both functional comfort and psychosocial satisfaction [DHHS, 2000]. Dental malocclusion cannot be considered a disease, but rather a set of dental deviations that can influence the Quality of Life (QoL) of an individual [Lee et al., 2010]. Previous studies have found a mild association between malocclusion and QoL, with a decrease in QoL as the severity of the malocclusion increases [Liu et al., 2009; Scapini et al., 2013]. It has been recently claimed that the self-esteem of an individual is more influenced by self-perceived dental aesthetics than by normative level of malocclusion [Gavric et al., 2015]. In addition, the recent increase in the demand for orthodontic treatment can be ascribed to the greater attention on the dental aesthetic and social implications of the malocclusion rather than to the significant worsening of the health status [Bernabe et al., 2006; Gherunpong et al., 2006; van Wezel et al., 2015]. However, the traditional tools adopted by the clinicians to assess orthodontic treatment need (oral examination, dental casts, radiographs, photographs, occlusal indices) are based on ideal concepts of occlusion and aesthetics [Shaw et al., 1991], neglecting the effects of malocclusion on patient's QoL [Sheiham and Tsakos, 2007; Bowling, 1997; Klages et al., 2004]. It has been reported that the expectations and dentofacial perception of the patients highly differ from that of the clinicians, hence being able to assess properly the degree of malocclusion and its psychological impact from the patient's perspective seems to be crucial [Shaw et al., 1991]. The Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) is a valid and reliable multi-item psychometric instrument, originally developed to evaluate the self-reported impact of dental aesthetics on QoL of young-adults, aged 18 to 30 years [Klages et al., 2006]. Due to the ease of use and interpretation, this questionnaire has been translated

and validated among different non-English speaking populations [Lin et al., 2013; Sardenberg et al., 2011; Ngom et al., 2013; Montiel-Company et al., 2013; Spalj et al., 2014; Bucci et al., 2015]. For instance, the same authors of the current manuscript already validated and cross-culturally adapted the adult version of PIDAQ among Italian subjects [Bucci et al., 2015]. Recently, the PIDAQ has been modified to assess the psychosocial impact of dental aesthetics among adolescents aged 11-17 years [Klages et al., 2015]. As the socio-cultural environment of the region in which a questionnaire has been developed influences its interpretation, in order to be used in a different population it has to be translated and adapted to the context of the country where it will be used [Beaton et al., 2000]. Since to the best of our knowledge no Italian version of the adolescent PIDAQ exists, the aim of the present study was to translate the PIDAQ into Italian, and cross-culturally adapt and validate it on an adolescent Italian population with the same protocol already used by the authors to validate the PIDAQ for young adults [Bucci et al., 2015]. The main purpose was to provide a suitable instrument for future applications in specific orthodontic Oral Health-Related Quality of Life (OHRQoL) studies, performed on Italian adolescents.

Materials and methods

All procedures performed in this study involving human participants, were in accordance with the ethical standards of the Institutional Research Committee University of Naples Federico II and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The research was approved by the Ethics Committee of the University of Naples Federico II (Protocol number: 6115). Written parental and patient informed consents were obtained from all the participants included in the study. The validation and the cross-cultural adaptation of the PIDAQ for adolescents followed the same methods already used for the previous validation of the PIDAQ for young adults [Bucci et al., 2015].

Translation AND Back-translation

Three orthodontists, who were proficient in English and Italian and familiar with QoL issues, translated the PIDAQ questionnaire from English to Italian.

An English mother tongue teacher, unaware of the QoL terminology, translated the Italian version of the PIDAQ back into the English language. The English teacher was not informed of the purpose of the study and had no knowledge of the original English questionnaire. This process aimed to guarantee consistency between the two English versions.

Cultural adaptation/Committee review

A committee of three orthodontists and a psychologist was trained to review the questionnaire. All of them were fluent in English and had good knowledge regarding the concept of QoL. The committee compared the original and the back-translated versions of the questionnaire, commenting the Italian questionnaire in order to improve the semantic equivalence of meaning between the two English versions. To determine the conceptual equivalence, another committee of two experts in QoL and oral health evaluated the meaning and the importance of the items in the Italian version, comparing those to the original English language version. This committee assessed the relevancy of the English PIDAQ items as compared to the Italian context. After these phases were concluded, the first version of the Italian PIDAQ was created.

Pre-test

The first version of the Italian PIDAQ was pilot tested on a convenience sample of 20 volunteers (10 males, 10 females, mean age 16.3±1.5 years), recruited from one school in Campania region (Italy). The pilot test was performed to evaluate the effects of the translation on the meaning of the words and to assess misunderstandings in the comprehension of the items. A single investigator (RR) performed a direct interview. At the end of this phase, as no difficulties in understanding were encountered, no changes were applied to the first draft.

Translated version of PIDAQ

The PIDAQ questionnaire is composed of 23 items, divided into four domains, according to the original study by Klages et al. [2006]. The four domains are: Dental Self-Confidence (DSC; 6 items), Social Impact (SI; 8 items), Psychological Impact (PI; 6 items), and Aesthetic Concern (AC; 3 items). The possible responses for each item are based on a five-point Likert scale; the response options are as follows: 0 = not at all; 1 = a little; 2 = somewhat; 3 = strongly; and 4 = very strongly. The items of the DSC show positive meaning and interpretation, while the others domains are all negative. The validity and reliability assessment of the Italian adolescent PIDAQ were carried out on a convenience sample of 677 subjects (328 males, 349 females, mean age 14.2±2.1 years), aged 11-17 years, recruited from schools of the Campania region (Italy). A single investigator (RB), provided clear and standardised instructions prior to questionnaire administration and was present during the compilation to help the participants. The inclusion criteria of the present study were willingness to participate in the study and age between 11 and 17 years. Some psychological and dental characteristics were set as exclusion criteria because they could influence the self-assessment of the malocclusion. The exclusion criteria included intellectual and/or physical inability to answer the questionnaire, presence of carious lesions with cavities on the front teeth, missing or fractured teeth in the anterior region, moderate to severe fluorosis (dark areas) or pigmented spots in the anterior region, and history or current orthodontic treatment. Furthermore, the subjects were asked to assess their dental status with the help

TABLE 1 Descriptive statistics, internal consistency (N=677) and test-retest reliability (N=153) for the PIDAQ domains

TABLE 1A

Domain[1]	Internal consistency (N=677)					
	mean±SD	Range	α	α if item deleted	Range of inter-item correlation	MI
Dental Self-Confidence (6 items)	18.0±5.4	6-30	0.90	0.87 - 0.89	0.49 - 0.75	0%
Psychosocial Impact (13 items)	21.9±8.0	13-60	0.88	0.86 - 0.87	0.14 - 0.52	0%
Aesthetic Concern (4 items)	7.5±3.2	4-20	0.79	0.72 - 0.76	0.42 - 0.51	0%

[1]Confirmatory Factor Analysis: Comparative Fit Index (CFI)=0.88; Root Mean Square Residual (RMSR)=0.07; Standardized RMSR (SRMSR)=0.06; Root Mean Square Error of Approximation (RMSEA)=0.07 α Cronbach's alpha MI Percentage of missing items

TABLE 1B

Domain	Test-retest reliability (N=153)						
	ICC (95 % CI)	SME	SDC	Paired difference mean	95%CI	MI	LOA
Dental Self-Confidence (6 items)	0.96 (0.95 - 0.97)	1.06	2.94	0.20	-0.05 - 0.44	0%	-2.83 - 3.23 (92%)
Psychosocial Impact (13 items)	0.97 (0.93 - 0.99)	1.30	3.59	-1.07	-1.34 - -0.80	0%	-4.37 - 2.23 (94%)
Aesthetic Concern (4 items)	0.93 (0.90 - 0.95)	0.85	2.35	-0.35	-0.51 - -0.18	0%	-2.37 - 1.67 (93%)

ICC Intraclass correlation coefficient SME Standard measurement error was calculated as SD√((1-ICC))
SDC Smallest detectable change was calculated as 1.96ME√2
LOA Limits of agreement were calculated as paired difference mean ± 1.96 standard deviation (percentage within LOA)

of a small mirror, by means of two standardised tools that evaluate the self-reported degree of malocclusion: the Aesthetic Component of the Index of Orthodontic Treatment Need (IOTN-AC) [Brook and Shaw, 1989] and the Perception of Occlusion Scale (POS) [Espeland and Stenvik, 1991]. The IOTN-AC is composed of ten black and white photographs of frontal teeth, each identified by a number, displaying different rates of severity. The subjects were asked to indicate which photograph best represented their own teeth. The POS is a self-reported scale based evaluating the aesthetic features of the front teeth. It is composed of six statements based on a five-point Likert scale. Finally, to assess the reproducibility of the questionnaire, 153 subjects were randomly selected to fill to the questionnaire a second time, at least 10 days after the first questionnaire administration.

Power analysis

Considering the hypothesis that the factors of the Italian PIDAQ had Cronbach's alpha (α) coefficient for the subscales $\alpha \geq 0.79$, to achieves the 99% power to detect the difference between the null hypothesis of $\alpha=0.7$ and the alternative hypothesis of $\alpha=0.79$ with $P<0.05$, a sample of 437 subjects was calculated.

Statistical analysis

The Statistical Package for the Social Sciences (ver. 22.0, SPSS Inc., Chicago, IL, USA) and the Statistical Analysis Software (ver. 9.3, SAS Inc., Cary, NC, USA) were used for data analysis. The criterion validity was assessed, by means of one-way analysis of variance (ANOVA, $P<0.05$), evaluating whether adolescents with different self-perceived degrees of malocclusion, reported as IOTN-AC and POS scores, performed differently on the Italian PIDAQ. The convergent validity between PIDAQ factors and IOTN-AC or POS scores was measured with the Spearman's rank coefficient (ρ). The internal consistency of the PIDAQ factors was measured as Cronbach's alpha coefficient for the subscales (α). The reproducibility was calculated in the test-retest by means of Intraclass Correlation Coefficient (ICC) with 95% confidence intervals, Standard Measurement Error (SME) and Limits of Agreement (LOA). A sample of 150 subjects with 2 observations per subject achieve 99% power to detect the difference between the null hypothesis of ICC=0.6 and the alternative hypothesis of ICC=0.8, with $P<0.05$.

Results

Cross-cultural adaptation, construct validity

During the cross-cultural adaptation process, semantic and conceptual equivalence were reached. Moreover, the pre-test analysis demonstrated that Italian adolescents could easily understand the first draft of the questionnaire. Therefore, the cross-cultural adaptation resulted in a questionnaire which was ready to be administered. Nevertheless, the explanatory factor analysis detected only three factors: Dental Self-Confidence (DSC): 6 items; Psychosocial Impact (PSI): 13 items; Aesthetic Concern (AC): 4 items. The confirmatory factor analysis proved that the tested model had high model fit indices (Comparative Fit Index=0.88, Table 1).

Criterion validity and convergent validity

According to the IOTN-AC scores, the participants were divided into four groups. In our population 29.4% of the respondents evaluated their dental appearance as grade 1; 36.2% as grade 2; 18.7% as grade 3; and 16.2% as grade 4 or higher. The mean scores of each PIDAQ factor showed a statistically significant difference (DSC $P<0.001$; PSI $P<0.001$; AC $P<0.001$) with respect

IOTN-AC			
Score	Dental Self-Confidence***	Psychosocial Impact***	Aesthetic Concern***
1 (n=199)	20.9±5.3[a]	19.1±6.7[a]	6.3±2.6[a]
2 (n=245)	17.7±4.8[b]	21.5±7.5[b]	7.5±3.0[b]
3 (n=123)	17.1±4.8[b]	23.3±7.8[b]	8.1±3.3[b]
≥ 4 (n=110)	14.4±5.2[c]	26.3±9.5[c]	9.2±3.8[c]
Spearman's correlation	ρ = -0.39 ***	ρ = 0.32 ***	ρ = 0.30 ***
***P<0.001. Bonferroni post hoc test, [a,b,c] intra-domain indicate statistically significant differences among scores.			

TABLE 2 Results of ANOVA of the PIDAQ scores according to the IOTN-AC groups, and Spearman's rank coefficients between the PIDAQ domains and IOTN-AC.

POS			
Score	Dental Self-Confidence***	Psychosocial Impact***	Aesthetic Concern***
0-1 (n=226)	21.1±4.6[a]	18.0±5.0[a]	6.1±2.3[a]
2-4 (n=325)	17.4±4.8[b]	22.2±7.2[b]	7.6±3.0[b]
5-8 (n=105)	14.2±5.5[c]	27.2±9.7[c]	9.6±3.7[c]
≥9 (n=21)	12.8±3.7[c]	33.1±11.5[d]	10.8±3.7[c]
Spearman's correlation	ρ = -0.46 ***	ρ = 0.45 ***	ρ = 0.38 ***
***P<0.001. Bonferroni post hoc test, [a,b,c] intra-domain indicate statistically significant differences among scores.			

TABLE 3 Results of ANOVA of the PIDAQ scores according to the IOTN-AC groups, and Spearman's rank coefficients between the PIDAQ domains and POS.

to the IOTN-AC scores (Table 2). Similarly, the subjects were divided into four groups according to the POS scores. 33.4% of the subjects of our sample obtained a POS score of 0 or 1; 48% between 2 and 4; 15.5% between 5 and 8, and 3% higher than 9. Again, the four PIDAQ factors displayed significant differences (DSC P<0.001; PSI P<0.001; AC P<0.001) when divided by the POS scores (Table 3). Statistically significant Spearman's rank coefficients were found between the three PIDAQ factors and IOTN-AC and POS (Tables 2, 3).

Reliability

The results of the internal consistency and the test-retest reliability are reported in Table 1.

The internal consistency of the PIDAQ Italian version, calculated by means of Cronbach's alpha coefficient (α) for subscales, measured between good (0.79; AC) and excellent (0.90; DSC). Test-retest reliability, measured with ICC, was excellent, ranging from 0.93 (AC) to 0.97 (PSI). The results of the internal consistency and the test-retest reliability are reported in Table 1 a, b.

Discussion

The use of questionnaires to measure the impact of health condition and intervention on QoL is widely spread [Fitzpatrick et al., 1992]. When a valid questionnaire is not available in the desired language, the possible choices are to develop a new instrument or to translate and adapt an existent, already validated questionnaire into a different language [Beaton et al., 2000]. Furthermore, to consider a questionnaire an applicable tool, it is expected to show good psychometric proprieties, similar to those of the original one. The PIDAQ questionnaire was considered a valid instrument to assess the OHRQoL among adolescents [Klages et al., 2015], but it has not yet been translated into Italian. To cross-culturally adapt the English version of PIDAQ into Italian, the guidelines proposed by Beaton and co-workers [2000] and the COSMIN checklist were followed [Mokkink et al., 2010].

Differently from other tools used in the dental field, the PIDAQ has been developed to specifically measure the impact of the aesthetic orthodontic-related dental characteristics, neglecting oral functions and pain. In the phases of cross-cultural adaptation (Translation, Back-translation, Committee review and pilot test), there was no need to apply any modifications to the first structured version of the Italian PIDAQ, probably due to a substantial affinity between the socio-cultural contexts where the questionnaires were tested. In the construct validity assessment, the Italian PIDAQ provided only three factors extracted from 23 items. Factor 1 (DSC) was consistent with the items of the corresponding domain of the original PIDAQ. Instead, Factor 2 (PSI) included the entries of two domains of the original English version ("Psychological Impact" and "Social Impact"), except for one item. The word 'psychosocial' was used as this factor embedded all items that refer to the psychological effects produced by the self-judgment and the judgment of people. Factor 3 (AC) resembled the items of the original domain, with the addition of a forth entry ("Hold back teeth when smile"). This is probably due to the fact that in the Italian adolescent population this item better explains a behaviour commonly adopted to avoid seeing one's own smile at the mirror, in a picture or in a video. The subdivision of the Italian adolescent questionnaire into three factors was different from that of the Italian adult version of PIDAQ, which showed four domains as the English tool [Bucci et al., 2015]. According to the standard interpretation [Bland and Altman, 1997] the α of the Italian adolescent PIDAQ showed between good and excellent internal consistency. Similarly to the original version, lower values were reported for the AC factor. Furthermore, all α were higher than the threshold (α=0.70) indicated by Klages and colleagues [2006] to consider a questionnaire as a reliable instrument. The test-retest reproducibility pointed out satisfactory results, between 0.93 (AC) and 0.97 (PSI). Generally, an ICC greater than 0.74 is considered acceptable, and the

higher the score the better the reproducibility [Nunnally and Bernstein, 1994]. Overall, the results of internal consistency and reproducibility of the Italian adolescent PIDAQ replicate those of the original adolescent version, even though Klages and co-workers [2015] maintained the four factors structure of the young adult PIDAQ and tested its psychometric characteristics dividing their sample into three subgroups according to the age.

In order to assess if the Italian PIDAQ could establish the impact of dental aesthetics due to different grades of malocclusion, it was necessary to administer the questionnaire together with two standardised tools (POS and IOTN-AC) able to determine the self-reported grade of malocclusion, as previously done in other studies [Lin et al., 2013; Bucci et al., 2015]. Therefore, the criterion validity was calculated comparing the mean PIDAQ score for each factor, associated with the different grades of self-rated malocclusion. The statistically significant differences between the PIDAQ scores among the POS groups and the PIDAQ scores among the IOTN-AC groups demonstrate the ability of the Italian questionnaire to discriminate among different levels of self-reported malocclusion. As shown in Tables 2 and 3, the PIDAQ values varied together with the increasing of the reported grade of malocclusion, demonstrating favourable results on the ability of the PIDAQ to evaluate the impact of the dental aesthetics. This Italian adolescent PIDAQ showed a good criterion validity, similar to that of the Italian PIDAQ for adults [Bucci et al., 2015]. However, interestingly the adolescents seemed to have a higher Aesthetic Concern of the malocclusion, as compared to the behaviour of the young adults. Furthermore, all the Spearman's rank coefficients were statistically significant, and for each PIDAQ factor high scores corresponded to increased IOTN-AC and POS scores, except for the DSC due to the opposite interpretation of the items. The findings of the present study are also consistent with the Brazilian PIDAQ translation [Santos et al., 2016], in which the authors adopted the Dental Aesthetic Index (DAI) to evaluate the degree of malocclusion in the criterion validity.

Finally, the Italian version of PIDAQ seemed to be able to identify correctly the impact of dental aesthetics on the psychological QoL of the Italian young adult population, even when changes in the QoL level are small. One potential limit of the present study was the lack of evaluation of subjects' self-esteem. It was demonstrated that an association between the self-esteem and the malocclusion effects on the OHRQoL exists, above all on the social and emotional sphere [Agou et al., 2008]. Another possible limitation was the inclusion of subjects from only one Italian region. Hence, for future studies, the self-reported level of malocclusion should be integrated with an evaluation of self-esteem and self-concept.

Conclusions

The Italian version of the PIDAQ demonstrated satisfactory reliability supported by a good to excellent internal consistency and a high level of reproducibility for the three factors. The criterion validity of the questionnaire was demonstrated, due to the statistically significant increase of the PIDAQ scores according to the worsening of the self-reported levels of malocclusion (IOTN-AC and POS). The good psychometric properties of the Italian PIDAQ, similar to the original ones, make it a suitable tool for assessment of the psychosocial impact of dental aesthetics among Italian young adults.

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