

ADAPTATION AND VALIDATION OF THE PSYCHOSOCIAL IMPACT OF DENTAL AESTHETICS QUESTIONNAIRE (PIDAQ) IN A ROMANIAN YOUTH SAMPLE

Beatrice Adriana Balgiu¹, Ruxandra Sfeatcu², Christina Mihai^{3*}
Loredana Dumitraşcu², Mihaela Adina Dumitrache², Andreea Didilescu⁴

¹National University of Science and Technology Politehnica Bucharest, Department of Career and Educational Training;

²Carol Davila University of Medicine and Pharmacy, Faculty of Dentistry, Department of Oral Health and Community Dentistry

³Carol Davila University of Medicine and Pharmacy, Faculty of Dentistry, Department of Preventive Dentistry

⁴Carol Davila University of Medicine and Pharmacy, Faculty of Dentistry, Department of Embriology and Microbiology

Correspondence author: Christina Mihai*, email: christina.mihai@umfcd.ro

ABSTRACT

Background. In recent years, dental aesthetics has been shown to have a significant impact on oral health-related quality of life. A widely used tool to assess the impact of dental aesthetics is the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) which is composed of 4 scales: dental self-confidence, psychological impacts, social impacts, and aesthetic concern. This study aims to validate the PIDAQ-RO and assess its psychometric properties in the case of a sample of young Romanian adults (N=775; 52.78% females; Mean_{age}=21.74). **Methods.** The questionnaire was translated into Romanian and adapted using the forward-backward translation procedure. The factorial validity was checked by using the confirmatory factor analysis (CFA). Multi group-CFA (MG-CFA) was used in order to demonstrate the gender invariance. Convergent validity was evaluated using average variance extracted (AVE) and composite reliability (CR), and, in order to assess reliability, we used McDonald's omega and Cronbach's alfa. The concurrent validity was carried out with scales which assess the perceived impact of oral aesthetics (OASIS), self-esteem (RSES), and life satisfaction (SWLS). **Results.** The results indicated that the fit indices were adequate for the proposed 4-factor model. ($\chi^2/df=2.74$; CFI=0.98; TLI=0.97; RMSEA=0.047, 90%CI-0.043-0.052) and the support of gender invariance ($\Delta CFI < 0.01$). The internal consistency is excellent for all subscales of the questionnaire (α and ω between 0.87 and 0.94). Dental self-confidence scale correlates positively with self-esteem, life satisfaction and the perceived impact of dental aesthetics, while the psychological and social impacts scales demonstrated negative associations with self-esteem and life satisfaction, and positive correlations with the perceived impact of dental aesthetics. The aesthetic concern scale exhibited a minor negative correlation with life satisfaction. **Conclusions.** These results support the validity and reliability of PIDAQ-RO as an instrument for assessing young Romanian adults.

Keywords: dental aesthetics, structural validity, self-esteem, life satisfaction, gender invariance.

INTRODUCTION

Dental aesthetics has been shown to significantly impact the oral health-related quality of life, particularly in recent years. Research highlights that the need for orthodontic treatment is often influenced by psycho-aesthetic factors, which are subjectively determined [1]. Dental aesthetics are closely linked to psychosocial factors,

playing a pivotal role in an individual's self-esteem and overall quality of life. These factors, in turn, affect workplace performance and job satisfaction. For instance, individuals with malocclusions or poor dental aesthetics frequently experience lower self-esteem and elevated levels of social anxiety. These issues can hinder professional interactions and reduce overall workplace satisfaction [2].

Adolescents, in particular, highlight a significant psychosocial impact of malocclusion. As individuals mature, their perceptions of dental aesthetics tend to evolve, often leading to improved self-image and enhanced social interactions [3].

Further studies indicate that better dental aesthetics correlate with higher self-perceived quality of life and overall satisfaction, which are essential for effective workplace functioning [4]. Conversely, malocclusion and poor dental aesthetics, particularly in the context of social desirability among young adults, can lead to social anxiety, diminished self-esteem, and impaired social interactions. Collectively, these factors adversely affect the quality of life [5].

The psychological implications of dental aesthetics extend into professional settings, especially in occupations requiring frequent social interactions or public engagement. Individuals with concerns about their dental appearance often report lower confidence in professional environments, which can negatively influence their career development and job performance [6].

In summary, dental aesthetics play a critical role in shaping an individual's psychosocial well-being, quality of life, and workplace satisfaction. Addressing these concerns through appropriate orthodontic or aesthetic dental interventions can lead to substantial improvements in both personal and professional domains.

One of the instruments widely used in the evaluation of the impact that dental aesthetics has on the psyche is the *Psychosocial Impact of Dental Aesthetics Questionnaire* (PIDAQ) which was translated, adapted, and validated in various cultural models [7-16]. To the best of our knowledge, the questionnaire has not been validated in the Romanian language. It is worth noting that discrepancies exist among the various PIDAQ validation studies.

Although most studies confirm the original 4-factors structure [7,9,17], some studies found different structure. For example, five factors identified in a Nepalese sample [18], three factors in the Chinese version [8], two factors in the case of Swedish teenagers [14], and a first-order unifactorial model in the case of Portuguese adults [19] and a second-order hierarchical model in a large sample of Australian adults [16]. This study aimed to address these aspects by linguistically and culturally adapting the PIDAQ for Romanian speakers and assessing its psychometric properties in a sample of young adults. This age group were chosen as the target group based on existing literature, which identifies them as particularly sensitive to issues related to dental aesthetics [14,20].

METHODS

Description of PIDAQ

PIDAQ is an instrument devised by Klages, et al. (2006) used in order to assess the need for orthodontic treatment and the perception of the changes brought about the latter on the oral health related quality of life. Initially developed for teenagers [20] the instrument was validated in the case of adult samples as well [9, 10, 19]. The questionnaire has 23 items included in four factors: *dental self-confidence* - it refers to the significant impact of dental aesthetics on an individual's emotional state (6 items), *social impacts* - they refer to the social issues caused by a negative assessment of the aspect of one's teeth (8 items), *psychological impacts* - they refer to the feelings of inferiority and unhappiness which appear when the person whose teeth have been affected is compared to somebody with better dental aesthetics (6 items), and *aesthetic concern*, which is about the discontent regarding one's own dental aspect when the individual looks at himself/herself in the mirror, in photos, or videos (3 items). The

first scale is inverted [9, 14, 20], and, in order to obtain a total PIDAQ score, one needs to add the scores of all scales. The questionnaire showed a good internal consistency for various samples of subjects from various cultures, such as groups of Italian young people (α between 0.79 and 0.92) [9]), Spanish teenagers ($\alpha \geq 0.92$ for all the subscales [7]) and Swedish teenagers (α between 0.94-0.97 [14]), Moroccan adults (α between 0.78-0.87 [10]), Nepalese students ($\alpha \geq 0.94$ [18]), children (α ranged from 0.90 to 0.93 [15]), and so on. The test-retest reliability was good, as well: ICC varying between 0.75 and 0.97 [7, 9, 14, 18]. In order to demonstrate the concurrent validity, Campos, et al. (2021) [17] find divergent relations between PIDAQ and scales that measure an important indicator of optimal individual functioning as it is life satisfaction (assessed with Satisfaction with Life Scale - SWLS) in the case of a large sample of 3636 Finnish, thus demonstrating that the lower the level of well-being, the bigger the psychosocial impact of dental aesthetics and the concern about dental aesthetics. In the correlations of PIDAQ with the Rosenberg Scale of Self-esteem it was demonstrated that self-esteem is influenced by the perceived psychosocial impact of dental aesthetics [3, 21].

The translation and the adaptation of the scale

After obtaining the agreement to use the questionnaire (License number 5882530944169) the authors proceeded to its translation and adaptation. This was translated in accordance with the recommendations made by World Health Organization (2000) regarding the adaptation of the instruments [22]. The translation from Romanian into English was made by two dentists. After the formulations in the Romanian language were refined, the new version was translated into English by two other bilingual people who

speak Romanian and English fluently. The two versions were compared and some minor changes were made with a view to fitting the conceptual clarity of the original items. The translation and the adaptation of items into Romanian were carried out so as to make sure the items keep their content validity and their apparent validity. The Romanian version was tested on a convenience sample made of 20 master students who were asked to give information on the clarity and the comprehension of the items. The test demonstrated that the analyzed version has adequate semantic and conceptual equivalence (Supplemental material S1).

Ethical considerations

The study has been conducted in full accordance with ethical principles, including the World Medical Association Declaration of Helsinki from 1975 as revised in 2013. The informed consent was obtained from all participants involved in study. This study acquired ethical approval from the Ethical Commission of the “Carol Davila” University of Medicine and Pharmacy, Bucharest (Protocol No. 1141/13.01.2023).

Study design and procedure

The data used in the psychometric study were carried out come from processing the answers that 775 young Romanian adults in a convenience sample have given to the items. The protocol was administered in the context of an extensive study focused on the aesthetics perception on teeth. The participants, recruited with the help of social media platforms (e.g. Facebook and WhatsApp) received a link created in Google Forms on which an online survey with a set of instruments was posted. The eligibility conditions consisted in: being in the 18 - 36 age bracket, being a Romanian native speaker and having visited the dentist at least once at the time when the instruments

were completed. The total non-completion of the survey was the exclusion criterion from the sample. When the respondents were instructed with regard to how to fill in the questionnaires they also found out about informed consent. The time allotted for the answers was of 8-9 minutes.

Instruments:

1. *Psychosocial impact of dental aesthetics questionnaire* (PIDAQ) [20] with 23 items assessed on a scale from 0 – *not at all*, to 4 – *very strongly*: dental self-confidence (items 1-6; e.g.: Proud of teeth), social impacts (items 7-14; e.g.: Hold back when I smile), psychological impacts (items 15-20; e.g.: Somewhat distressed), and aesthetic concern (items 21-23; e.g.: Don't like teeth in mirror).

2. *Oral aesthetic subjective impact scale* (OASIS) [23] assesses the perceived impact of the appearance of the teeth and it is made of 5 questions assessed on a scale from 1- *not at all*, to 7 - *all the time* (for item 1:1 - *not concerned at all*, to 7 - *very concerned*). A higher OASIS score shows a bigger concern regarding dental aesthetics. Example of question: *Have you found that other people have commented on the appearance of your teeth?* The scale was developed for children (14-15 years old), but it was also used in order to analyse the impact of dental aesthetics for 19-year-old and 21 year-old students, respectively [24]. In the present study we obtained an acceptable internal consistency $\alpha=0.70$ ($95\%CI=0.66-0.73$); $\omega=0.72$ ($95\%CI=0.70-0.76$) while CFA shows the following coefficients: $\chi^2/df=1.30$; CFI=0.99; RMSEA=0.020; SRMR=0.005.

3. *Rosenberg Self-esteem Scale* (RSES) [25] assess self-esteem for various ages and it is a set of 10 items assessed on a scale from 1 - *strongly disagree* to 4 - *strongly agree*, out of which 5 items have negative scores (e.g: I wish I had more respect for myself). The total score

is obtained by summing up the scores of all items. A high score shows a high level of global self-esteem. For the present study we used the version validated on a Romanian population [26]. The data show very good internal consistency of the scale: $\alpha=0.86$ ($95\%CI=0.85-0.87$); $\omega=0.87$ ($95\%CI=0.85-0.88$) and the CFA coefficients are: $\chi^2/df=2.96$; CFI=0.98; RMSEA=0.050; SRMR=0.037.

4. *Satisfaction with Life Scale* (SWLS) [27] is one of the most often used instruments for the assessment of life satisfaction and, implicitly, of subjective well-being determined by the assessment of the latter's cognitive component [27]. The instrument included five items assessed on a scale of 1 - *strongly disagree* to 4 - *strongly agree*. The version used in the study was validated on various samples of Romanian students ($\alpha \geq 0.80$) from the dental domain included [28]. In the present study we found again high coefficient values for the internal consistency: $\alpha=0.86$ ($95\%CI=0.84-0.87$); $\omega=0.86$ ($95\%CI=0.85-0.88$) and good factorial validity: $\chi^2/df=1.18$; CFI=0.99; RMSEA=0.016; SRMR=0.026.

Hypotheses:

1. PIDAQ-RO will show four factors, just like the original version of the instruments.

2. PIDAQ-RO will correlate significantly with the instruments that measure the perceived impact of oral aesthetics (OASIS) [17], life satisfaction (SWLS) [21], and self-esteem (RSES) [3].

Sociodemographic data

The information we gathered is data about (i) self-identified gender, (ii) age, (iii) studies (primary, secondary, university and post-university), (iv) area of residence (urban vs. rural), and (v) work sector (public, private, other).

Data analysis

The descriptive statistics of the items included averages, standard deviations, skewness, and kurtosis. The reliability was examined by using Cronbach's α and McDonald's ω . The value over 0.80 is considered to be good for internal consistency [29]. For the construct validity we used CFA, the Diagonally Weighted Least Squares (DWLS) estimator method recommendable for ordinal data and whenever there is no multivariate normality assumption [30]. To this purpose, we used various fit indices: χ^2 (chi-square test), which needs to be statistically insignificant [31] and χ^2/df (relative/normed chi-square test), which has an acceptable value if it is <3.00 [32]. Since χ^2 is sensitive to the size of the sample we used a combination of indices: CFI (Comparative fit index), TLI (Tucker-Lewis index), NFI (Bentler-Bonned Normed fit index), GFI (Goodness of Fit) recommendable to be ≥ 0.95 [31]. The RMSEA value (Root mean squared error of approximation) and the SRMR value (Standardized root mean square residual) are good if they are <0.08 [31]. Rutkowschi and Svetina (2017) recommended that the ΔCFI and the $\Delta RMSEA$ values for the measurement of gender invariance should be <0.010 [33]. In addition, we used factor loading to calculate the Composite Reliability (CR) of the scale and the convergent validity through Average Variance Extracted (AVE). The minimal level for AVE is 0.50 [31], and for CR it is 0.70 [29]. The discriminatory validity was calculated by comparing the square root of AVE from every construct with its inter-construct correlation. The concurrent validity of the instrument PIDAQ-RO was calculated through the correlations with the scores for instruments OASIS, RSES, and SWLS. The data were analysed with the SPSS Version 22.0. (Armonk, NY: IBM Corp.) and JASP 0.19.1.0

(Amsterdam University, Netherlands) programs.

RESULTS*Sociodemographic characteristics of the sample*

Given the number of latent and observed variables (9), the anticipated effect size (0.30), desired probability (0.95), and statistical power level (0.05), an a-priori sample size computation for structural equation models was carried out. The minimum sample size is 264. In the present study, the resulting convenience sample was made of 775 participants in the 18–36 age bracket ($Mean_{age}=21.74$; $SD=3.40$), with a relatively equal ratio of males ($N=365$; 47.21%; $Mean_{age}=3.18/0.19$) to females ($N=410$; 52.78%; $Mean_{age}=3.46/0.15$). Among them, 82.79% (640) of the participants live in the urban area and 17.25 % (133) in the country. 52.4% have secondary education, 44% have university studies and 3.60% have post-university studies such as master and PhD degrees. 22.76% (176) work in the public domain, 20.69% (160) work for private companies, 12.03% (93) are freelancers and 44.50% (344) are not employed yet.

The descriptive analysis

In the analysis of the descriptive statistics of items (the average, standard deviations, skewness, kurtosis, the univariate normality of the instrument) we took into consideration the recommendation made by Kim (2013) according to whom, for the samples which are bigger than 300, an absolute value of skewness > 2 and an absolute value of kurtosis > 7 can be used as reference values in order to determine data normality [34]. For the items of the version in the Romanian language of the instrument PIDAQ-RO, the absolute value of the skewness indicator was between -0.06 and 2.63, while the absolute values of the kurtosis were between 0.19 and 6.49. In the

case of the analysed items, we obtained the univariate quasi-normality, except for item 10, which is positively skewed, but does not have a normal deviation from normality (Table 1). The average scores of the items varied

between 2.38 ± 1.62 (item 21: Don't like teeth in mirror) to 0.37 ± 0.89 (item 10: Inhibited in social contacts).

Table 1. The descriptive statistics of the items

Items	Mean	SD	Skewness	Kurtosis	α if item deleted
1. I am proud of my teeth.	1.16	0.91	-0.64	0.32	0.88
2. I like to show my teeth when I smile.	1.25	1.22	-0.77	-0.32	0.88
3. I am pleased when I see my teeth in the mirror.	1.20	0.99	-0.75	0.38	0.88
4. My teeth are attractive to others.	1.36	1.06	-0.47	-0.34	0.88
5. I am satisfied with the appearance of my teeth.	1.20	0.97	-0.70	0.30	0.88
6. I find my tooth position to be very nice.	1.25	1.12	-0.59	-0.47	0.88
7. I hold myself back when I smile so my teeth don't show so much.	0.98	1.22	0.99	-0.21	0.88
8. If I don't know people well I am sometimes concerned what they might think about my teeth.	0.70	1.12	1.51	1.20	0.88
9. I'm afraid other people could make offensive remarks about my teeth.	0.60	1.08	1.80	2.21	0.88
10. I am somewhat inhibited in social contacts because of my teeth.	0.37	0.89	2.63	6.49	0.89
11. I sometimes catch myself holding my hand in front of my mouth to hide my teeth.	0.58	1.08	1.86	2.42	0.88
12. Sometimes I think people are staring at my teeth.	0.62	1.04	1.64	1.76	0.89
13. Remarks about my teeth irritate me even when they are meant jokingly.	0.62	1.09	1.77	2.14	0.88
14. I sometimes worry about what members of the opposite sex think about my teeth.	0.58	1.05	1.80	2.30	0.88
15. I envy the nice teeth of other people.	1.44	1.38	0.48	-1.06	0.88
16. I am somewhat distressed when I see other people's teeth.	0.56	1.00	1.82	2.56	0.88
17. Sometimes I am somewhat unhappy about the appearance of my teeth.	1.23	1.13	0.63	-0.42	0.88
18. I think most people I know have nicer teeth than I do.	1.03	1.13	0.86	-0.19	0.88
19. I feel bad when I think about what my teeth look like.	0.70	1.05	1.46	1.33	0.88
20. I wish my teeth looked better.	2.13	1.34	-0.06	-1.18	0.88
21. I don't like to see my teeth in the mirror.	2.38	1.62	-0.35	-1.49	0.90
22. I don't like to see my teeth in photographs.	2.33	1.59	-0.32	-1.46	0.90

23. I don't like to see my teeth when I look at a video of myself.	2.36	1.61	-0.36	-1.46	0.90
--	------	------	-------	-------	------

Reliability

For all the four scales of questionnaire, the internal consistency is high (α Cronbach and ω McDonald are between 0.87 and 0.94). Similarly, for the total score of PIDAQ-RO, α and ω have equal values of 0.89 (95%CI: .88-0.90). Compatible values of internal consistency for the total score of PIDAQ-RO were also obtained for the subsamples made of

males ($\alpha = 0.88$ [95%CI: 0.86-0.90]; $\omega=0.88$ [95%CI:0.85-0.90], and females, respectively ($\alpha = 0.89$ [95%CI: 0.88-0.91]; $\omega=0.90$ [95%CI: 0.89-0.91]). The values of the coefficient ω if item dropped were between 0.83 and 0.94 (Table 2). The corrected values of the correlations between the items scores and the total score for PIDAQ-RO were between 0.42 and 0.75.

Table 2. Averages, standard deviations and internal consistency for the PIDAQ-RO

Factors	Mean*	SD	α [95%CI]	ω [95%CI]	ω if item dropped	Range of interitem correlation
DSC	7.44	5.32	0.91 [0.90-0.92]	0.91 [0.91-0.92]	0.89-0.91	0.51-0.81
SI	5.08	6.69	0.90 [0.89-0.91]	0.90 [0.89-0.91]	0.88-0.90	0.30-0.79
PS	7.13	5.58	0.87 [0.86-0.88]	0.87 [0.86-0.88]	0.83-0.87	0.35-0.71
AE	7.07	4.60	0.94 [0.94-0.95]	0.94 [0.94-0.95]	0.91-0.95	0.83-0.90
PIDAQ total score	6.68	3.72	0.89 [0.88-0.90]	0.89 [0.88-0.90]	0.87-0.90	

*The total score obtained for every scale was divided to the number of scale items

Note: DSC-Dental self-confidence; SI-Social impacts; PI-Psychological impacts; AC-Aesthetic concern

Factorial structure

Since the assumptions of multivariate normality are not valid (Mardia coefficient = 260.270; c.r.=106.694) we used the bootstrapping method (5000 resamplings). The 4-factor model shows adequate goodness-of-fit coefficients, which are superior to model

1, with a single factor: $\chi^2=613.965$; $df = 224$; $\chi^2/df = 2.74$; CFI = 0.98; TLI=0.97; NFI=0.97; GFI=0.98; RMSEA = 0.047 (90%CI: 0.043-0.052); SRMR=0.067 (Table 3). The standardized factor loading ranged between 0.50 and 0.95, above the cut-off point of 0.50 [31].

Table 3. Goodness-of-fit indices of the CFAs

Models	χ^2	df	χ^2/df	CFI	NFI	TLI	RMSEA (90%CI)	SRMR	GFI
M1: one factor	4612.740	230	20.05	0.78	0.77	0.76	0.157 [0.153-0.161]	0.158	0.85
M2: four-factors	613.965	224	2.740	0.98	0.97	0.97	0.047 [0.043-0.052]	0.067	0.98

Note: χ^2 - chi-square test; df - degrees of freedom; χ^2/df - relative/normed chi-square test CFI - Comparative fit index; TLI - Tucker-Lewis index; NFI - Bentler-Bonned Normed fit index; GFI - Goodness of Fit; RMSEA - Root mean squared error of approximation; SRMR - Standardized root mean square residual.

The measurement invariance across gender

The results of the gender invariance showed that the questionnaire measures the same concept in the groups of males and females. The values ΔCFI (0.005) and ΔRMSEA

(between -0.007 and -0.006), which are lower than the recommended limits, support the invariance specific to the gender. The PIDAQ-RO is invariant between male and female samples based on these cutoffs (Table 4).

Table 4. The gender invariance for PIDAQ-RO

Model Invariance	Overall Fit Indices					Comparative Fit Indices			
	χ^2	df	χ^2/df	CFI	RMSEA	$\Delta\chi^2$	Δdf	ΔCFI	ΔRMSEA
Configural	663.225	448	1.48	0.989	0.035 [0.029-0.041]	—	—	—	—
Metric	784.078	467	1.67	0.984	0.042 [0.037-0.047]	-120.853	-19	0.005	-0.007
Scalar	817.324	486	1.68	0.984	0.042 [0.037-0.047]	-154.099	-38	0.005	-0.007
Strict	832.529	509	1.63	0.984	0.041 [0.036-0.048]	-169.304	-61	0.005	-0.006

Convergent validity and discriminant validity

AVE (Average variance extracted) and CR (composite reliability) were estimated based on factor loading (λ) and standard error of measurement (ϵ) acquired in CFA. Table 5 highlights that both CR (0.88-0.94) and AVE (0.53-0.86) are over the respective minimum cutoff levels of 0.70 and, respectively, 0.50

[31]. The Fornell-Larcker (1981) criterion, which compares the square root of the AVE of each construct with its inter-construct correlation, was also applied to determine the discriminant validity of the scale [35]. Table 5 provides evidence that the instrument meets the discriminant validity requirement.

Table 5. Convergent and Discriminant validity

Factors	CR	AVE	1	2	3	4
DSC	0.92	0.65	0.80*			
SI	0.89	0.53	0.35	0.72*		
PS	0.88	0.56	0.53	0.74	0.74*	
AC	0.94	0.86	-0.14	-0.09	-0.07	0.92*

Note: DSC - Dental self-confidence; SI - Social impacts; PI - Psychological impacts; AC - Aesthetic concern; CR Composite reliability; AVE-Average variance extracted; *Square root of AVE value for each factor

Concurrent validity

The concurrent validity is certified by the fact that three of the dimensions PIDAQ-RO, Dental self-confidence, Social Impacts and

Psychological Impacts correlate significantly and positively with the perceived impact of oral aesthetic (OASIS) (r between 0.21 and 0.68). Self-esteem (RSES) has negative

correlations with scales Psychological Impacts and Social Impacts (r between -0.35 and -0.36) and positive correlations with Dental self-confidence ($r=0.29$) (all at the $p < 0.001$). The

Aesthetic concern scale has only one weak negative correlation with life satisfaction ($r=-0.114$; $p<0.01$) (Table 6).

Table 6. Intercorrelations between PIDAQ and the other tools

Measures	Variables	1	2	3	4	5	6
PIDAQ	1. DSC	—					
	2. SI	0.35***	—				
	3. PI	0.53***	0.74***	—			
	4. AC	-0.14***	-0.09*	-0.07*	—		
OASIS	5. POAI	0.21***	0.68***	0.57***	0.00	—	
RSES	6. SE	0.29***	-0.35***	-0.36***	0.04	-0.29***	—
SWLS	7. LS	0.34***	-0.22***	-0.26***	-0.11**	-0.10**	0.57***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Note: DSC - Dental self-confidence; SI - Social impacts; PI - Psychological impacts; AC - Aesthetic concern; POAI - perceived oral aesthetic impact; SE - Self-esteem; LS - Life satisfaction

DISCUSSION

The main objective of the study was to assess the validity and the reliability of PIDAQ with regard to the Romanian population. The construct validity highlights the presence of the four factors for the sample on which the questionnaire was applied, in a way similar to the version devised by Klages, et al. [20]. We imposed no restriction with regard to the intercorrelation of errors (residues) corresponding to the items. The calculation of the gender invariance shows that PIDAQ-RO measures the same constructs for both gender groups. The models of configural, metric, scalar and strict invariance showed very good coefficients, which demonstrates that the males and the females in the sample interpret the content of the questionnaire in a similar way.

The convergent validity was confirmed through AVE and CR. In addition, the values of coefficients α and ω is between 0.87 and 0.94 for the four scale, which suggests the high homogeneity of the items, and an adequate correlation between the items of the questionnaire for the current study. The internal consistency is comparable with the

original version of the questionnaire ($\alpha_s=0.91, 0.86, 0.87, 0.87$) [20].

The concurrent validity, carried out through correlations between PIDAQ-RO and the other scales we applied, emphasize positive relations between the first three scales of PIDAQ and OASIS, an instrument that assesses the perceived impact of dental aesthetics. Other correlations with scales which measure life satisfaction (SWLS) and self-esteem (RSES) certify the importance of dental aesthetics for one's individual well-being. The majority of the correlational patterns agreed with theoretical assumptions. As expected, the variable self-esteem makes positive correlations with the scale Dental self-confidence (DSC) and negative correlations with the scales Psychological Impacts (PI) and Social Impacts (SI). In other words, the satisfaction regarding dental aesthetics has a positive impact on individual self-esteem, and the individuals with dental problems (and who feel inferior due to the latter) have low self-esteem. Therefore, the lower the self-esteem, the bigger the psychosocial impact. The result corroborates other pieces of research [3, 21]. For instance, a recent study on the Romanian population found that people who feel

dissatisfied with their dental appearance tend to experience a decrease in self-esteem, which can lead to psychological problems such as anxiety and depression [36].

However, other authors report the fact that there is no relation between the self-esteem measured with the Scale Rosenberg and the scales of PIDAQ in the case of a group of Italian patients selected on the basis of their oral interventions [37].

At the same time, life satisfaction makes positive correlations with Dental self-confidence (DSC) and Aesthetic concern (AC) and negative correlations with Psychological impacts (PI) and Social Impacts (SI). Thus, we demonstrated that individuals happy with their physical appearance enjoy a high level of well-being. The result is consistent with studies which highlighted the relation between PIDAQ and well-being, either measured with established instruments such as SWLS [17], or assessed with regard to income [38]. The impact of the dental-facial aesthetics on life satisfaction was highlighted in prior research [13], which found positive correlations between life satisfaction (SWLS) and *dental self-confidence*, and negative correlations with all the other scales, Social impacts, Psychological impacts, and Aesthetic concern. In fact, studies demonstrated the big impact of the dental aspect on self-esteem and on positive feelings [3, 17]. Moreover, in studies on Romanian patients, it has been shown that patients with high self-esteem have good oral health habits [39] and it is strongly correlated with the quality of life in oral health and satisfaction regarding dental aesthetics [40,41]. The impact of one's physical appearance on life satisfaction is high both for men and women. The bigger the satisfaction regarding the oro-facial appearance and the lower the psycho-social impacts of dental aesthetics, the more satisfied the individual [21]. In fact, the alignment, the dimension, the

form, and the colour of one's teeth, as well as an attractive smile influence personality development, social interactions, and career success.

Limitations of the study

In the present study we admit to certain limitations. Firstly, the nature of the self-reporting scales we used cannot exclude the possibility that the participants' answers may have been influenced by factors related to social desirability. Secondly, the convenience sample does not allow for the generalization of the results. Despite these limitations, on the one hand, the results show good psychometric properties of PIDAQ-RO and the fact that it is a valid instrument with high reliability; on the other hand, it also shows how important dental aesthetics is in young adults' lives.

CONCLUSION

This study's strengths cover a range of topics. This is the first PIDAQ validation study carried out in Romanian culture. Multiple types of validity were incorporated in the validation: construct, convergent, concurrent, and discriminant. The findings support earlier research that demonstrated the connection between PIDAQ use and well-being as measured by life satisfaction. In subsequent studies we propose to produce further proof about the (predictive) criterion validity and the (test-retest) reliability for the PIDAQ-RO instrument. In summary, the results make us consider that PIDAQ-RO is an adequate instrument for the population of Romanian young people, and therefore it becomes useful in clinics and research. Romanian researchers can thus utilize this tool to evaluate the impact of dental aesthetics and to observe which are its predictors and moderators. Oral health is an important part of general health, and well-being and a determinant of quality of life. Since the oral cavity is one of the primary

concerns for people due to its role in interpersonal communication, the results of the study show evidence regarding the applicability of the PIDAQ-RO as a measure of quality of life to assess the psychosocial impact of dental esthetics among young adults. At the same time, it provides a holistic image regarding the young patient's motivation for esthetic treatment and pattern of dental visits. Applying the PIDAQ among young people can provide valuable data for improving their mental health and quality of life. This helps to identify individual needs, but also to develop intervention strategies that support the general well-being of young people. In fact, a questionnaire like PIDAQ helps the dentist to better understand the dental problems of young people and to help them prioritize their aesthetic or functional treatments. Also, it can help identify young people who have social anxiety or low self-esteem due to problematic dental aesthetics. The results of the PIDAQ application can facilitate collaboration between dentists, educators and other professionals to offer a holistic approach to the well-being of young people.

Supplementary Materials: The following are available online: Supplemental material S1.

Funding: This research received no external funding.

Institutional Review Board Statement: The study has been conducted in full accordance with ethical principles, including the World Medical Association Declaration of Helsinki from 1975 as revised in 2013. The informed consent was obtained from all participants involved in study. All experimental protocols were approved by the Ethical Commission of the “CAROL DAVILA” UNIVERSITY OF MEDICINE AND PHARMACY in Bucharest (Protocol No. 1141/13.01.2023).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Declaration of Interest: The authors declare no conflict of interest.

Author contribution statement: Study concept and design: BAB, RS, MAD and AD; Data collection: BAB, RS, LD, CM; Drafting of the manuscript: BAB, RS, and LD; Statistical analysis: BAB and AD; Interpretation of data: BAB, RS. Revision and editing of the manuscript: MAD, AD, CM, and LD. Supervision: BAB, RS, AD, and MAD.

Declaration on the use of AI: none.

Supplementary material S1

English version	Romanian version
I am proud of my teeth.	Sunt mândru/mândră de dinții mei.
I like to show my teeth when I smile.	Îmi place să îmi arăt dinții când zâmbesc.
I am pleased when I see my teeth in the mirror.	Sunt mulțumit/ă când îmi văd dinții în oglindă.
My teeth are attractive to others.	Dinții mei sunt atrăgători pentru alții.
I am satisfied with the appearance of my teeth.	Sunt mulțumit/ă de aspectul dinților mei.
I find my tooth position to be very nice.	Mi se pare că dinții mei sunt într-o poziție bună.
I hold myself back when I smile so my teeth don't show so much.	Mă rețin când zâmbesc, astfel încât dinții să nu mi se vadă atât de mult.

If I don't know people well I am sometimes concerned what they might think about my teeth.	Dacă nu cunosc bine oamenii, uneori sunt îngrijorat/ă referitor la ce ar putea crede despre dinții mei.
I'm afraid other people could make offensive remarks about my teeth.	Mi-e teamă că alți oameni ar putea face remarcii jignitoare despre dinții mei.
I am somewhat inhibited in social contacts because of my teeth.	Viața socială îmi este afectată de starea dinților mei.
I sometimes catch myself holding my hand in front of my mouth to hide my teeth.	Uneori mă surprind că îmi ascund dinții ținând mâna în dreptul feței.
Sometimes I think people are staring at my teeth.	Uneori cred că oamenii se uită cu insistență la dinții mei.
Remarks about my teeth irritate me even when they are meant jokingly.	Remarcile despre dinții mei mă irită chiar și atunci când sunt spuse în glumă.
I sometimes worry about what members of the opposite sex think about my teeth.	Uneori îmi fac griji pentru ce gândesc oamenii de sex opus despre dinții mei.
I envy the nice teeth of other people.	Invidiez dinții frumoși ai altor oameni.
I am somewhat distressed when I see other people's teeth.	Sunt oarecum supărat când mă uit la dinții altora.
Sometimes I am somewhat unhappy about the appearance of my teeth.	Uneori sunt oarecum nemulțumit de aspectul dinților mei.
I think most people I know have nicer teeth than I do.	Cred că majoritatea oamenilor pe care îi cunosc au dinți mai frumoși decât ai mei.
I feel bad when I think about what my teeth look like.	Nu mă simt bine când mă gândesc cum arată dinții mei.
I wish my teeth looked better.	Mi-aș dori ca dinții mei să arate mai bine.
I don't like to see my teeth in the mirror.	Nu-mi place să-mi văd dinții în oglindă.
I don't like to see my teeth in photographs.	Nu-mi place să-mi văd dinții în fotografii.
I don't like to see my teeth when I look at a video of myself.	Nu-mi place să-mi văd dinții în clipuri video.

REFERENCES

1. Carbajal C, Rodríguez T, Falconí D. The psychosocial impact of dental aesthetics and experiencing discrimination at a peruvian public hospital among outpatients. Plos One 2022; 17(8): e0272553. <https://doi.org/10.1371/journal.pone.0272553>.
2. Bellot-Arcís C, Montiel-Company J, Pinho T, Almerich-Silla J. Relationship between perception of malocclusion and the psychological impact of dental aesthetics in university students. J Clin Exp Dent 2015; e18-e22. <https://doi.org/10.4317/jced.52157>.
3. Venete A, Trillo-Lumbreras E, Prado-Gascó V, Bellot-Arcís C, Almerich-Silla J, Montiel-Company J. Relationship between the psychosocial impact of dental aesthetics and perfectionism and self-esteem. J Clin Exp Dent 2017; 0-0. <https://doi.org/10.4317/jced.54481>
4. Närhi L, Mattila M, Tolvanen M, Pirttiniemi P, Silvola A. The associations of dental aesthetics, oral health-related quality of life and satisfaction with aesthetics in an adult population. Eur J Orthod 2023; 45(3): 287-294. <https://doi.org/10.1093/ejo/cjac075>.
5. Ulloa M, Domínguez C, Crespo C, Vallejo R. Impact of dental self-perception on the quality of life of students at the Catholic University of Cuenca, Azogues in 2018. IJMSS 2018; 5(2): 63-66. <https://doi.org/10.32457/ijmss.2018.016>.

6. Khalaf K, Seraj Z, Hussein H. Perception of smile aesthetics of patients with anterior malocclusions and lips influence: a comparison of dental professionals', dental students,' and laypersons' opinions. *Int J Dent* 2020; 1-9. <https://doi.org/10.1155/2020/8870270>
7. Montiel-Company JM, Bellot-Arcís C, Almerich-Silla JM. Validation of the psychosocial impact of dental aesthetics questionnaire (PIDAQ) in Spanish adolescents. *Med Oral Patol Oral Cir Bucal* 2013; 18(1): e168-73. 10.4317/medoral.18324.
8. Lin H, Quan C, Guo C, Zhou C, Wang Y, Bao B. Translation and validation of the Chinese version of the psychosocial impact of dental aesthetics questionnaire. *Eur J Orthod* 2013; 35(3): 354-60. 10.1093/ejo/cjr136.
9. Bucci R, Rongo R, Zito E, Galeotti A, Valletta R, D'Antò V. Cross-cultural adaptation and validation of the Italian Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ). *Qual Life Res* 2015; 24(3): 747-52. 10.1007/s11136-014-0807-4.
10. Bourzgui F, Serhier Z, Sebbar M, Diouny S, Bennani Othmani M, Ngom PI. Adaptation and validation of the Moroccan Arabic version of the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ). *Saudi Dent J* 2015; 27(4): 180-6. 10.1016/j.sdentj.2014.11.016.
11. Dos Santos PR, Meneghim MC, Ambrosano GM, Filho MV, Vedovello SA. Influence of quality of life, self-perception, and self-esteem on orthodontic treatment need. *Am J Orthod Dentofacial Orthop* 2017; 151(1): 143-147. 10.1016/j.ajodo.2016.06.028.
12. Garg K, Tripathi T, Rai P, Sharma N, Kanase A. Prospective Evaluation of Psychosocial Impact after One Year of Orthodontic Treatment Using PIDAQ Adapted for Indian Population. *J Clin Diagn Res* 2017; 11(8): ZC44-ZC48. 10.7860/JCDR/2017/28720.10376.
13. Naseri N, Baherimoghadam T, Rasooli R, Hamzeh M, Merikh F. Validity and reliability of the Persian version of the psychosocial impact of dental aesthetics questionnaire. *Health Qual Life Outcomes* 2019; 17(1): 126. 10.1186/s12955-019-1188-8.
14. Göranson E, Norevall LI, Bågesund M, Dimberg L. Translation and validation of the Swedish version of the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) for adolescents. *Acta Odontol Scand* 2021; 79(4): 241-247. 10.1080/00016357.2020.1823014.
15. Alsanabani AAM, Yusof ZYM, Wan Hassan WN, Aldhorae K, Alyamani HA. Validity and Reliability of the Arabic Version of the Psychosocial Impact of Dental Aesthetics Questionnaire for Yemeni Adolescents. *Children (Basel)* 2021; 8(6): 448. 10.3390/children8060448.
16. Wahab A, Ju X, Jamieson L, Dreyer C. Validation of the Psychosocial Impact of Dental Aesthetics Questionnaire in the Australian population. *Am J Orthod Dentofacial Orthop* 2022; 161(3): 416-422. e1. 10.1016/j.ajodo.2020.09.033.
17. Campos LA, Kämäräinen M, Silvola AS, Marôco J, Peltomäki T, Campos JADB. Orofacial Esthetic Scale and Psychosocial Impact of Dental Aesthetics Questionnaire: development and psychometric properties of the Finnish version. *Acta Odontol Scand* 2021; 79(5): 335-343. 10.1080/00016357.2020.1857435.
18. Singh VP, Singh R. Translation and validation of a Nepalese version of the Psychosocial Impact of Dental Aesthetic Questionnaire (PIDAQ). *J Orthod* 2014; 41(1): 6-12. 10.1179/1465313313Y.0000000079.
19. Fidalgo J, Botelho J, Proença L, Mendes JJ, Machado V, Delgado AS. Cross-Cultural Adaptation and Validation of the Portuguese Version of the Psychosocial Impact of Dental Aesthetics Questionnaire. *Int J Environ Res Public Health* 2022; 19(16): 9931. 10.3390/ijerph19169931.
20. Klages U, Claus N, Wehrbein H, Zentner A. Development of a questionnaire for assessment of the psychosocial impact of dental aesthetics in young adults. *Eur J Orthod* 2006; 28(2): 103-11. 10.1093/ejo/cji083.
21. Campos LA, Campos JADB, Silva WRD, Peltomäki T, Pinto ADS, Marôco J. Impact of body and orofacial appearance on life satisfaction among Brazilian adults. *PLoS One* 2022; 17(11): e0275728. 10.1371/journal.pone.0275728.
22. World Health Organization. Process of Translation and Adaptation of Instruments. (2020). Available on line at: http://www.who.int/substance_abuse/research_tools/translation/en/ (last accessed 29-08-2022).

23. Mandall NA, McCord JF, Blinkhorn AS, Worthington HV, O'Brien KD. Perceived aesthetic impact of malocclusion and oral self-perceptions in 14-15-year-old Asian and Caucasian children in greater Manchester. *Eur J Orthod* 2000; 22(2): 175-83. 10.1093/ejo/22.2.175.
24. Claudino D, Traebert J. Malocclusion, dental aesthetic self-perception and quality of life in a 18 to 21 year-old population: a cross section study. *BMC Oral Health* 2013; 13: 3. 10.1186/1472-6831-13-3.
25. Rosenberg M. Society and the adolescent self-image. (Rev. ed.) Middletown (CT): Wesleyan University Press, 1989.
26. Robu V, Sandovici A, Pruteanu LM. The Rosenberg Self-Esteem Scale: Uni- or multidimensional? Results of a psychometric study in the adolescent population. *J Psychol* 2015; 61(3): 203-210.
27. Diener E, Emmons RA, Larsen RJ, Griffin S. The Satisfaction with Life Scale. *J Pers Assess* 1985; 49(1): 71-5. 10.1207/s15327752jpa4901_13.
28. Balgiu BA, Sfeatcu R, Ilinca R, Bucur V. Investigating construct validity of the Satisfaction with Life Scale in a sample of Romanian dental students. *Rom J Oral Rehabil* 2021; 13: 7-12.
29. Chin WW. How to write up and report PLS analyses. In Esposito Vinzi V, Chin W, Henseler J and Wang H (eds): *Handbook of partial least squares*. Berlin: Springer, 2010.
30. DiStefano C, Morgan GA. Comparison of Diagonal Weighted Least Squares Robust Estimation Techniques for Ordinal Data. *Structural Equation Modeling. Multidiscip J* 2014; 21: 425-438. 10.1080/10705511.2014.915373.
31. Hooper D, Coughlan J, Mullen M. Structural Equation Modeling: Guidelines for Determining Model Fit. *Electron. J. Bus. Res. Methods* 2008; 6(1): 53-60.
32. Schermelleh-Engel K, Moosbrugger H, Müller H. Evaluating the Fit of Structural Equation Models: Tests of Significance and Descriptive Goodness-of-Fit Measures. *MPR Online*. 2003;8(8):23-74.
33. Rutkowski L, Svetina D. Measurement invariance in international surveys: categorical indicators and fit measure performance. *Appl Meas Educ* 2107; 30(1): 39-51. 10.1080/08957347.2016.1243540
34. Kim HY. Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis. *Restor Dent Endod*. 2013; 38(1): 52-4. 10.5395/rde.2013.38.1.52.
35. Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. *J Mark Res* 1981; 18(1): 39-50. 10.2307/3151312
36. Moraru M, Spinei A. Impact of dental caries on daily performance of children. *Journal of Stomatological Medicine*. 2023; 1(61): 32-40. <https://doi.org/10.53530/1857-1328.22.61.04>
37. Militi A, Sicari F, Portelli M et. al. Psychological and Social Effects of Oral Health and Dental Aesthetic in Adolescence and Early Adulthood: An Observational Study. *Int J Environ Res Public Health* 2021; 18(17): 9022. 10.3390/ijerph18179022.
38. AlSagob EI, Alkeait F, Alhaimy L, Alqahtani M, Hebbal M, Ben Gassem AA. Impact of Self-Perceived Dental Esthetic on Psycho-Social Well-Being and Dental Self Confidence: A Cross-Sectional Study Among Female Students in Riyadh City. *Patient Prefer Adherence* 2021; 15: 919-926. 10.2147/PPA.S308141.
39. Oancea R, Timar B, Papava I, Bredicean AC, Ilie AC, Dehelean L., Influence of depression and self-esteem on oral health-related quality of life in students. *J Int Med Res* 2020; 48(2): 300060520902615. 10.1177/0300060520902615.
40. Grecu AG, Balazsi R, Dudea D, Mesaroş AŞ, Strîmbu M, Dumitraşcu DL. Oral health related quality of life and self-esteem in a general population. *Med Pharm Rep* 2019; 92(Suppl No 3): S65-S72. 10.15386/mpr-1520.
41. Ba A, Koita H, Kassambara A, Sogodogo M, Kouyate V, Thiam A, Bamba A, Keita M, Forna NC. The aesthetic needs of patients in the department of removable prosthesis from the Chu-Cnos of Bamako. *Rom J Oral Rehabil* 2024; 16(3): 326-335. DOI : 10.6261/RJOR.2024.3.16.34.