

## Psychosocial impact of malocclusion in Spanish adolescents

Carlos Bellot-Arcís  
José María Montiel-Company  
José Manuel Almerich-Silla

Department of Stomatology, Faculty of  
Medicine and Dentistry, University of  
Valencia, Valencia, Spain

**Objective:** To evaluate the psychosocial impact of malocclusion, determine its relationship with the severity of malocclusion, and assess the influence of gender and social class on this relationship in adolescents. **Methods:** A random sample of 627 Spanish adolescents aged 12 - 15 years underwent intraoral examinations by 3 calibrated examiners (intraexaminer and interexaminer kappa > 0.85) at their schools. Psychosocial impact was measured through a self-rated Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ). The severity of malocclusion was measured by the Index of Orthodontic Treatment Need (IOTN). Gender and social class were also recorded. **Results:** The total PIDAQ score and those of its 4 subscales, social impact, psychological impact, aesthetic concern, and dental self-confidence, presented significant differences ( $p \leq 0.05$  by analysis of variance) and linear relationships with the IOTN grades ( $p \leq 0.05$  by linear regression). Stepwise linear regression models showed that the IOTN dental health component was a predictive variable of the total and subscale PIDAQ scores. Neither gender nor social class was an independent predictive variable of this relationship, except the linear model for psychological impact, where gender was a predictive variable. The occlusal conditions responsible for higher PIDAQ scores were increased overjet, impeded eruption, tooth displacement, and increased overbite. **Conclusions:** Malocclusion has a psychological impact in adolescents and this impact increases with the severity of malocclusion. Social class may not influence this association, but the psychological impact seems to be greater among girls.

[Korean J Orthod 2013;43(4):193-200]

**Key words:** Public health, Epidemiology

Received March 1, 2013; Revised May 10, 2013; Accepted May 20, 2013.

Corresponding author: José Manuel Almerich-Silla.  
Tenured Lecturer, Department of Stomatology, Faculty of Medicine and Dentistry,  
University of Valencia, C/Gascó Oliag nº 1, CP: 46010, Valencia, Spain  
Tel +34-963864144 e-mail jose.m.almerich@uv.es

The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.

© 2013 The Korean Association of Orthodontists.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

**INTRODUCTION**

Malocclusion affects many people worldwide. Orthodontists traditionally consider restored oral health, function, and aesthetics as the principal therapeutic goals.<sup>1</sup> However, improved aesthetics and its positive psychosocial impact are increasingly being accepted as important benefits of treatment.<sup>1,2</sup>

Occlusal or orthodontic treatment need indices are available to classify the anatomical and aesthetic aspects of malocclusion. The best-known and most-used tools are the Dental Aesthetic Index (DAI) and Index of Orthodontic Treatment Need (IOTN).<sup>3,4</sup> However, they do not account for the influence of malocclusion on the patient's quality of life.<sup>5</sup> Tools that attempt to assess the oral health-related quality of life (OHRQoL) offer information on the patient's perception of their welfare

in relation to a particular oral condition.<sup>6</sup>

Several authors have employed OHRQoL assessment questionnaires together with normative indices to study the impact of malocclusion on the patient's quality of life.<sup>7,8</sup> In the past, OHRQoL research focused on adults with periodontal disease, tooth loss, or inadequate dentures.<sup>9</sup> Recently, however, the OHRQoL of children and adolescents has aroused considerable interest,<sup>10</sup> to some extent because adolescents usually show great concern about their appearance, which plays an important role in their psychosocial welfare.<sup>11,12</sup>

The Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) is a valuable tool that provides information on one aspect of the OHRQoL. This self-rating instrument was designed to assess the psychosocial impact of dental aesthetics in young adults.<sup>6</sup> Brazilian, Chinese, and Spanish versions of the PIDAQ have been

**Table 1.** Scores of the PIDAQ and IOTN by gender and social class

	Gender			Social class			
	Boy (n = 300)	Girl (n = 327)	Statistics test, <i>p</i> -value	Low (n = 309)	Middle (n = 243)	High (n = 75)	Statistics test, <i>p</i> -value
PIDAQ, mean (95% CI)							
DSC subscale	11.3 (10.7 - 11.9)	11.3 (10.7 - 12.0)	Student t-test, 0.91	11.1 (10.4 - 11.7)	11.6 (10.9 - 12.3)	11.1 (9.84 - 12.4)	ANOVA, 0.48
SI subscale	6.18 (5.47 - 6.88)	6.02 (5.34 - 6.71)	Student t-test, 0.76	6.31 (5.59 - 7.04)	5.84 (5.08 - 6.61)	6.01 (4.57 - 7.45)	ANOVA, 0.67
PI subscale	5.50 (4.99 - 6.00)	6.41 (5.87 - 6.94)	Student t-test, 0.02*	6.04 (5.50 - 6.58)	5.96 (5.39 - 6.54)	5.72 (4.66 - 6.67)	ANOVA, 0.87
AC subscale	7.54 (7.18 - 7.90)	7.35 (7.02 - 7.67)	Student t-test, 0.42	7.34 (6.98 - 7.70)	7.41 (7.03 - 7.79)	7.93 (7.35 - 8.52)	ANOVA, 0.32
PIDAQ total	31.9 (30.4 - 33.5)	32.5 (30.8 - 34.1)	Student t-test, 0.66	32.6 (30.9 - 34.3)	31.6 (29.8 - 33.3)	32.5 (29.4 - 35.7)	ANOVA, 0.69
IOTN-DHC, % (95% CI)							
Grades 1 - 2	51.6 (46.0 - 57.3)	56.8 (51.4 - 62.1)	Chi-square, 0.25	49.5 (43.9 - 55.1)	57.6 (51.3 - 63.6)	64.0 (52.7 - 73.9)	Chi square, 0.12
Grade 3	27.6 (22.9 - 32.9)	27.2 (22.6 - 32.3)		29.7 (24.9 - 35.1)	26.7 (21.5 - 32.6)	20.0 (12.5 - 30.4)	
Grades 4 - 5	20.6 (16.4 - 25.6)	15.9 (12.3 - 20.3)		20.7 (16.5 - 25.5)	15.6 (11.6 - 20.7)	16.0 (9.30 - 25.9)	
IOTN-AC, % (95% CI)							
Grades 1 - 4	92.3 (88.7 - 94.8)	88.3 (84.4 - 91.4)	Chi-square, 0.02*	91.2 (87.5 - 93.9)	88.1 (83.4 - 91.6)	93.3 (85.3 - 97.1)	Chi square, 0.35
Grades 5 - 7	3.66 (2.06 - 6.44)	8.86 (6.24 - 12.4)		6.47 (4.22 - 9.78)	7.40 (4.73 - 11.4)	2.66 (0.73 - 9.21)	
Grades 8 - 10	4.00 (2.30 - 6.86)	2.75 (1.45 - 5.14)		2.26 (1.10 - 4.60)	4.52 (2.54 - 7.92)	4.00 (1.37 - 11.1)	

PIDAQ, Psychosocial Impact of Dental Aesthetics Questionnaire; IOTN, Index of Orthodontic Treatment Need; IOTN-DHC, dental health component of the IOTN; IOTN-AC, aesthetic component of the IOTN; DSC, dental self-confidence; SI, social impact; PI, psychological impact; AC, aesthetic concern; CI, confidence interval; ANOVA, analysis of variance.

\**p* ≤ 0.05.

published recently,<sup>13-15</sup> so its global use is increasing.

The aims of the present study were to evaluate the psychosocial impact of malocclusion, determine its relationship with the severity of malocclusion, and assess the influence of gender and social class on this relationship in adolescents.

## MATERIALS AND METHODS

### Subjects

The study sample was composed of 627 adolescents aged 12 - 15 years in 42 schools chosen randomly from 1,200 subjects of all the schools in Valencia, Spain. The fieldwork was carried out in November and December 2010.

In each of the selected schools, 15 - 20 adolescents underwent intraoral examinations by three examiners,

who were calibrated against a gold standard in the use of the IOTN (intraexaminer and interexaminer kappa > 0.85). Adolescents with visible lesions on their anterior teeth due to caries, traumatic injury, or hypoplasia/fluorosis or those who wore orthodontic appliances were excluded.

The study was approved by the Human Research Ethical Committee of the University of Valencia (approval number H1352114553202) and complied with the recommendations of the Declaration of Helsinki. Written informed consent for the intraoral examinations and survey was obtained from the parents.

### Data collection

#### *Psychosocial impact of dental aesthetics*

The Spanish version of the PIDAQ for adolescents was employed. The PIDAQ, a psychometric instrument

**Table 2.** Total and subscale PIDAQ scores in relation to the IOTN-DHC grades

Variable	IOTN-DHC grade 1 - 2 (n = 341)	IOTN-DHC grade 3 (n = 172)	IOTN-DHC grade 4 - 5 (n = 114)	p-value	Post-hoc ANOVA test LSD
DSC subscale	12.4 (11.7 - 12.9)	11.0 (10.2 - 11.8)	8.59 (7.58 - 9.60)	0.00* 0.00 <sup>†</sup>	Grades 1 - 2 vs. 3 <i>p</i> = 0.006 <sup>‡</sup> Grades 3 vs. 4 - 5 <i>p</i> = 0.000 <sup>‡</sup> Grades 1 - 2 vs. 4 - 5 <i>p</i> = 0.000 <sup>‡</sup>
SI subscale	5.71 (5.06 - 6.36)	5.44 (4.59 - 6.29)	8.24 (6.92 - 9.57)	0.00* 0.00 <sup>†</sup>	Grades 1 - 2 vs. 3 <i>p</i> = 0.633 Grades 3 vs. 4 - 5 <i>p</i> = 0.000 <sup>‡</sup> Grades 1 - 2 vs. 4 - 5 <i>p</i> = 0.000 <sup>‡</sup>
PI subscale	5.60 (5.10 - 6.08)	6.10 (5.39 - 6.81)	6.90 (6.02 - 7.78)	0.03* 0.00 <sup>†</sup>	Grades 1 - 2 vs. 3 <i>p</i> = 0.249 Grades 3 vs. 4 - 5 <i>p</i> = 0.154 Grades 1 - 2 vs. 4 - 5 <i>p</i> = 0.010 <sup>‡</sup>
AC subscale	7.16 (6.81 - 7.49)	7.69 (7.25 - 8.13)	7.91 (7.38 - 8.43)	0.04* 0.02 <sup>†</sup>	Grades 1 - 2 vs. 3 <i>p</i> = 0.065 Grades 3 vs. 4 - 5 <i>p</i> = 0.539 Grades 1 - 2 vs. 4 - 5 <i>p</i> = 0.023 <sup>‡</sup>
PIDAQ total	30.09 (28.6 - 31.6)	32.2 (30.3 - 34.2)	38.5 (35.6 - 41.3)	0.00* 0.00 <sup>†</sup>	Grades 1 - 2 vs. 3 <i>p</i> = 0.106 Grades 3 vs. 4 - 5 <i>p</i> = 0.000 <sup>‡</sup> Grades 1 - 2 vs. 4 - 5 <i>p</i> = 0.000 <sup>‡</sup>

Values are presented as mean (95% confidence interval).

PIDAQ, Psychosocial Impact of Dental Aesthetics Questionnaire; IOTN, Index of Orthodontic Treatment Need; IOTN-DHC, dental health component of the IOTN; DSC, dental self-confidence; SI, social impact; PI, psychological impact; AC, aesthetic concern; ANOVA, analysis of variance; LSD, least significant difference.

\**p* < 0.05 by ANOVA; <sup>†</sup>*p* < 0.05 by the polynomial test linear contrast in ANOVA; <sup>‡</sup>Post-hoc ANOVA LSD < 0.05.

containing 23 items, is composed of four subscales, representing four areas, one positive and three negative: aesthetic concern (AC, three items), psychological impact (PI, six items), social impact (SI, eight items), and dental self-confidence (DSC, six items). A five-point Likert scale is used for each item. The response options are as follows: 0 = not at all; 1 = a little; 2 = somewhat; 3 = strongly; and 4 = very strongly.<sup>5</sup> Each subscale score can be calculated separately and is obtained by summing the item scores.<sup>14</sup> To calculate the total PIDAQ score, the DSC items were re-coded to align them with the other subscales.

*Severity of malocclusion*

The IOTN was used to determine the severity of malocclusion. This index is composed of 2 parts: the dental health component (DHC) and the aesthetic component (AC).<sup>3,15</sup>

The IOTN-DHC is assessed by the examiner and classified into five grades according to the therapeutic need: grade 1 = none (normal occlusion); grade 2 = little (minor malocclusion); grade 3 = borderline (moderate malocclusion); grade 4 = great (severe malocclusion); and grade 5 = very great (very severe malocclusion).

The IOTN-AC is assessed by the patient using 10 photographs that show the degrees of malocclusion ranging

from the least severe to the most severe. The patient has to identify with one of the photographs. The 10 IOTN-AC grades are combined into three groups: grades 1 - 4, grades 5 - 7, and grades 8 - 10.<sup>3</sup>

*Social class*

The UK Registrar-General's Social Class scale was employed. This scale groups the population into the following five categories: I = professionals and higher managerial and technical occupations; II = lower managerial and technical occupations, trade; III = intermediate supervisory and clerical occupations; IVa = skilled manual workers; IVb = partly skilled manual workers; and V = unskilled workers.<sup>16</sup> In this study, categories I and II were considered the high social class, category III was considered the middle social class, and the remaining categories were considered the low social class.

**Statistical analysis**

PASW Statistics version 18.0 (IBM Inc., Armonk, NY, USA) was used for the data analysis. Univariate descriptive statistics were used to calculate the means of the quantitative variables, proportions of the categorical variables, and confidence intervals of both. The means were compared by using Student's t-test and analysis of

**Table 3.** Linear regression models of PIDAQ with IOTN-DHC as predictive variable

Dependant variable	R	Predictive variables	Equation of the model
DSC subscale	0.248	IOTN-DHC: Beta coeff. = -1.81, <i>p</i> = 0.00* Excluded of the model: Gender, <i>p</i> = 0.76 Social class, <i>p</i> = 0.98	DSC = 14.2 - (1.81 × IOTN-DHC)
SI subscale	0.124	IOTN-DHC: Beta coeff. = 1.01, <i>p</i> = 0.02* Excluded of the model: Gender, <i>p</i> = 0.92 Social class, <i>p</i> = 0.69	SI = 4.44 + (1.01 × IOTN-DHC)
PI subscale	0.147	IOTN-DHC: Beta coeff. = 0.67, <i>p</i> = 0.01* Gender: Beta coeff. = 0.97, <i>p</i> = 0.01 Excluded of the model: Social class, <i>p</i> = 0.86	PI = 3.38 + (0.67 × IOTN-DHC) + (0.97 × Gender)
AC subscale	0.101	IOTN-DHC: Beta coeff. = 0.40, <i>p</i> = 0.01* Excluded of the model: Gender, <i>p</i> = 0.52 Social class, <i>p</i> = 0.13	AC = 6.78 + (0.40 × IOTN-DHC)
PIDAQ total	0.204	IOTN-DHC: Beta coeff. = 3.84, <i>p</i> = 0.00* Excluded of the model: Gender, <i>p</i> = 0.43 Social class, <i>p</i> = 0.78	PIDAQ = 25.9 + (3.84 × IOTN-DHC)

PIDAQ, Psychosocial Impact of Dental Aesthetics Questionnaire; IOTN, Index of Orthodontic Treatment Need; IOTN-DHC, dental health component of the IOTN; DSC, dental self-confidence; SI, social impact; PI, psychological impact; AC, aesthetic concern; Beta coeff., beta coefficient.

\**p* ≤ 0.05.

variance ( $p < 0.05$ ). Stepwise linear regression models were employed to study the linear relationship between the PIDAQ data as the dependant variable and the IOTN components, gender, and social class as the independent predictive variables.

### RESULTS

By gender, 47.8% and 52.2% of the sample were boys and girls, respectively. In terms of social class, 49.3%, 38.7%, and 12.0% belonged to the low, middle, and high social classes, respectively.

The mean total PIDAQ score was 32.2 (95% confidence interval = 31.1 to 33.3). The mean DSC score was 11.3 (10.8 to 11.7), SI score was 6.1 (5.6 to 6.5), PI score was 5.9 (5.6 to 6.3), and AC score was 7.44 (7.2 to 7.7).

In the IOTN-DHC, 54.4% of the adolescents had grades 1 and 2, 27.4% had grade 3, and 18.2% had grades 4 and 5. The IOTN-AC distribution was 90.3% for grades 1 - 4, 6.4% for grades 5 - 7, and 3.3% for grades 8 - 10.

Table 1 shows the relationships of the PIDAQ and IOTN data with gender and social class. The total and subscale PIDAQ scores showed no significant differences by gender, except the PI subscale, where girls had higher scores ( $p = 0.02$ ). No significant differences by social class were noted. The IOTN-AC presented significant differences by gender, with a greater number of girls having grades between 5 and 10 ( $p = 0.02$ ).

The total PIDAQ score and the SI, PI, and AC scores presented a significant positive linear relationship and the DSC score presented a significant negative linear relationship with the IOTN-DHC grades (Table 2).

**Table 4.** Total and subscale PIDAQ scores in relation to the IOTN-AC grades

Variable	IOTN-AC grades 1 - 4	IOTN-AC grades 5 - 7	IOTN-AC grades 8 - 10	p-value	Post-hoc ANOVA test LSD
DSC subscale	11.6 (11.2 - 12.1)	9.35 (7.41 - 11.3)	5.57 (3.41 - 7.72)	0.00*, 0.00 <sup>†</sup>	Grades 1 - 4 vs. 5 - 7 $p = 0.011^{\ddagger}$ Grades 5 - 7 vs. 8 - 10 $p = 0.011^{\ddagger}$ Grades 1 - 4 vs. 8 - 10 $p = 0.000^{\ddagger}$
SI subscale	5.82 (5.35 - 6.32)	6.25 (4.33 - 8.16)	12.1 (8.07 - 16.2)	0.00*, 0.00 <sup>†</sup>	Grades 1 - 4 vs. 5 - 7 $p = 0.701$ Grades 5 - 7 vs. 8 - 10 $p = 0.000^{\ddagger}$ Grades 1 - 4 vs. 8 - 10 $p = 0.000^{\ddagger}$
PI subscale	5.77 (5.39 - 6.15)	7.47 (6.03 - 8.91)	8.14 (5.48 - 10.8)	0.01*, 0.00 <sup>†</sup>	Grades 1 - 4 vs. 5 - 7 $p = 0.027^{\ddagger}$ Grades 5 - 7 vs. 8 - 10 $p = 0.595$ Grades 1 - 4 vs. 8 - 10 $p = 0.023^{\ddagger}$
AC subscale	7.35 (7.09 - 7.59)	8.17 (7.15 - 9.19)	7.95 (6.34 - 9.56)	0.20, 0.12	Grades 1 - 4 vs. 5 - 7 $p = 0.108$ Grades 5 - 7 vs. 8 - 10 $p = 0.787$ Grades 1 - 4 vs. 8 - 10 $p = 0.391$
PIDAQ total	31.3 (30.1 - 32.5)	36.5 (31.8 - 41.3)	46.6 (39.1 - 54.2)	0.00*, 0.00 <sup>†</sup>	Grades 1 - 4 vs. 5 - 7 $p = 0.026^{\ddagger}$ Grades 5 - 7 vs. 8 - 10 $p = 0.009^{\ddagger}$ Grades 1 - 4 vs. 8 - 10 $p = 0.000^{\ddagger}$

Values are presented as mean (95% confidence interval).

PIDAQ, Psychosocial Impact of Dental Aesthetics Questionnaire; IOTN, Index of Orthodontic Treatment Need; IOTN-AC, aesthetic component of the IOTN; DSC, dental self-confidence; SI, social impact; PI, psychological impact; AC, aesthetic concern; ANOVA, analysis of variance; LSD, least significant difference.

\* $p < 0.05$  by ANOVA; <sup>†</sup> $p < 0.05$  by the polynomial test linear contrast in ANOVA; <sup>‡</sup>Post-hoc ANOVA LSD  $< 0.05$ .

Table 3 shows that the IOTN-DHC was a predictive variable of the total and subscale PIDAQ scores. Neither gender nor social class was an independent predictive variable of the relationship between the PIDAQ scores and the IOTN-DHC grades, except the PI subscale, where gender was a predictive variable in the linear model.

The total PIDAQ and SI and PI scores showed a significant positive linear relationship and the DSC score presented a significant negative linear relationship with the IOTN-AC grades. The PIDAQ-AC scores did not exhibit significant differences in the IOTN-AC grades (Table 4).

**Table 5.** Linear regression models of PIDAQ with IOTN-AC as predictive variable

Variable	R	Predictive variables	Equation of the model
DSC subscale	0.213	IOTN-AC: Beta coeff. = -2.81, <i>p</i> = 0.00* Excluded of the model: Gender, <i>p</i> = 0.77 Social class, <i>p</i> = 0.47	DSC = 14.4 - (2.81 × IOTN-AC)
SI subscale	0.156	IOTN-AC: Beta coeff. = 2.29, <i>p</i> = 0.00* Excluded of the model: Gender, <i>p</i> = 0.67 Social class, <i>p</i> = 0.43	SI = 3.50 + (2.29 × IOTN-AC)
PI subscale	0.153	IOTN-AC: Beta coeff. = 1.30, <i>p</i> = 0.00* Gender: Beta coeff. = 0.88, <i>p</i> = 0.01* Excluded of the model: Social class, <i>p</i> = 0.61	PI = 3.17 + (1.30 × IOTN-AC) + (0.88 × gender)
PIDAQ total	0.202	IOTN-AC: Beta coeff. = 6.89, <i>p</i> = 0.00* Excluded of the model: Gender, <i>p</i> = 0.78 Social class, <i>p</i> = 0.58	PIDAQ = 24.4 + (6.89 × IOTN-AC)

PIDAQ, Psychosocial Impact of Dental Aesthetics Questionnaire; IOTN, Index of Orthodontic Treatment Need; IOTN-AC, aesthetic component of the IOTN; DSC, dental self-confidence; SI, social impact; PI, psychological impact; Beta coeff., beta coefficient.

\**p* ≤ 0.05.

**Table 6.** Total and subscale PIDAQ scores in relation to the occlusal conditions (IOTN-DHC grades 3 to 5)

Variable	DSC	SI	PI	AC	PIDAQ
Increased overjet (>9 mm; n = 7)	5.75 (0.00 - 11.8)	7.50 (0.81 - 14.1)	7.50 (2.44 - 10.5)	8.75 (6.03 - 11.4)	42.0 (24.31 - 54.6)
Increased overjet (>6 mm, ≤9 mm; n = 19)	7.89 (5.46 - 10.3)	8.73 (4.72 - 12.7)	7.26 (4.41 - 10.1)	8.94 (7.60 - 10.3)	41.05 (32.7 - 49.4)
Impeded eruption of teeth or submerged deciduous teeth (n = 8)	8.93 (5.75 - 12.1)	9.33 (5.14 - 13.5)	8.66 (5.36 - 11.9)	7.33 (5.67 - 8.99)	40.4 (31.9 - 48.8)
Severe displacement of teeth (>4 mm; n = 52)	8.61 (7.02 - 10.2)	8.17 (6.22 - 10.1)	6.52 (5.27 - 7.76)	7.80 (7.01 - 8.60)	37.88 (33.76 - 42.0)
Posterior or anterior crossbite (n = 27)	9.37 (6.99 - 11.7)	4.66 (2.78 - 6.54)	7.03 (5.23 - 8.83)	8.96 (7.93 - 9.99)	35.3 (30.2 - 40.4)
Increased overbite (gingival contact, no traumatic injuries; n = 34)	10.4 (8.77 - 11.9)	6.94 (4.90 - 8.97)	6.85 (5.08 - 8.62)	7.61 (6.63 - 8.60)	35.1 (30.3 - 39.8)
Moderate displacement of teeth (>2 mm, ≤4 mm; n = 120)	11.0 (10.1 - 12.0)	5.84 (4.73 - 6.95)	6.01 (5.12 - 6.89)	7.55 (7.06 - 8.05)	32.4 (29.9 - 34.8)
Increased overjet (>3.5 mm, ≤6 mm) with incompetent lips at rest (n = 22)	10.4 (8.24 - 12.6)	4.59 (2.96 - 6.21)	5.00 (3.49 - 6.50)	7.31 (6.02 - 8.61)	30.5 (25.6 - 35.4)

Values are presented as mean (95% confidence interval).

PIDAQ, Psychosocial Impact of Dental Aesthetics Questionnaire; IOTN, Index of Orthodontic Treatment Need; IOTN-DHC, dental health component of the IOTN; DSC, dental self-confidence; SI, social impact; PI, psychological impact; AC, aesthetic concern.

The IOTN-AC was a predictive variable of the total PIDAQ and DSC, SI, and PI scores. Gender appeared as a predictive variable only of the PI scores. A linear relationship between the PIDAQ-AC scores and the IOTN-AC grades could not be established (Table 5).

Table 6 shows a descriptive analysis of the main occlusal conditions requiring orthodontic treatment (IOTN-DHC grades 3 - 5) and increasing the PIDAQ scores: increased overjet, impeded tooth eruption or submerged deciduous teeth, tooth displacement, and increased overbite.

## DISCUSSION

The present study included a randomized and representative sample, good reliability of the examiners, and a validated questionnaire to measure the psychosocial impact of malocclusion in adolescents. However, considering the age of the subjects, comparisons with other studies should be made cautiously.

Many authors consider it more advisable to analyze the psychosocial impact of dental aesthetics in adults, who are emotionally stable and have a realistic view of dentofacial aesthetics, than in adolescents.<sup>17,18</sup> Cooper et al.<sup>19</sup> observed that the perception of dental aesthetics changes and even improves with age. Tuominen et al.<sup>20</sup> also concluded that the perceived orthodontic treatment need seems to lessen with age even if the patient does not undergo orthodontic treatment.

Several authors agree that the IOTN-DHC measures the severity of malocclusion,<sup>21</sup> but the reliability of the IOTN-AC has been questioned.<sup>22,23</sup> Indeed, many studies have shown that results differ considerably according to whether the treatment need is measured objectively with the IOTN-DHC or subjectively with the IOTN-AC.<sup>22,24,25</sup> Nevertheless, the present study showed a significant linear association between the PIDAQ scores and the grades of both the IOTN components. The PIDAQ-AC was the only subscale that did not show a linear correlation with the IOTN-AC. Although the PIDAQ-DSC showed a linear relationship with the IOTN-DHC, this association was not much stronger than that of the other subscales.

In agreement with other studies,<sup>8,17,26</sup> this study showed that the psychosocial impact of dental aesthetics increased with the severity of malocclusion, so the PIDAQ has considerable validity. This finding confirms that malocclusion has a psychosocial impact in adolescents, which can considerably influence their self-confidence and social life.<sup>6,27</sup>

Increased overjet, tooth displacement, and increased overbite were the occlusal conditions that had a higher psychosocial impact. Dahong et al.<sup>28</sup> obtained similar results; they considered that the overjet might induce a protrusive or retrusive profile and further influence the psychology of patients. In this study, only Angle's

classification or the incisor classification was used.

Only Sardenberg et al.<sup>13</sup> and Lin et al.<sup>14</sup> have analyzed the psychosocial impact of malocclusion, but neither study was conducted in adolescents using the PIDAQ. We related the PIDAQ with a normative index (IOTN) that has been used by many authors. Sardenberg et al.<sup>13</sup> used the DAI as a normative index, but Lin et al.<sup>14</sup> did not use any objective index.

Although some studies have shown a relationship between the aesthetic impact of malocclusion and social class,<sup>8</sup> the present study showed no such association, as previously reported.<sup>29</sup> Noteworthy, the methods employed to obtain socioeconomic information differ among the relevant studies, so more research should be conducted with this aspect in mind. Other authors such as Doğan et al.<sup>30</sup> also concluded that socioeconomic factors are unrelated to the perception of malocclusion.

Gender, however, did affect the psychosocial impact of malocclusion in adolescents. Although it did not influence three PIDAQ subscales (DSC, SI, and AC), it affected the PI subscale. de Oliveira and Sheiham<sup>31</sup> also found that the psychosocial impact of malocclusion is significantly greater in women than in men and affects their quality of life. Similarly, the present study showed that the girls' perception of their dental aesthetics was worse than that of the boys. Other studies have also indicated that men tend to be more satisfied with their dental aesthetics.<sup>22</sup>

We have observed lower punctuation than the Brazilian version on the PIDAQ DSC subscale. The younger sample may explain this difference.

## CONCLUSION

Malocclusion has a psychological impact in adolescents and this impact increases with the severity of malocclusion. Social class may not influence this association, but gender has some effect, because the psychological impact is greater in girls.

## REFERENCES

1. Hunt O, Hepper P, Johnston C, Stevenson M, Burden D. Professional perceptions of the benefits of orthodontic treatment. *Eur J Orthod* 2001;23:315-23.
2. Cunningham SJ, Hunt NP. Quality of life and its importance in orthodontics. *J Orthod* 2001;28:152-8.
3. Brook PH, Shaw WC. The development of an index of orthodontic treatment priority. *Eur J Orthod* 1989;11:309-20.
4. Bellot-Arcís C, Montiel-Company JM, Almerich-Silla JM, Paredes-Gallardo V, Gandía-Franco JL. The use of occlusal indices in high-impact literature. *Community Dent Health* 2012;29:45-8.

5. de Oliveira CM, Sheiham A, Tsakos G, O'Brien KD. Oral health-related quality of life and the IOTN index as predictors of children's perceived needs and acceptance for orthodontic treatment. *Br Dent J* 2008;204:1-5.
6. 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;28:103-11.
7. de Oliveira CM, Sheiham A. The relationship between normative orthodontic treatment need and oral health-related quality of life. *Community Dent Oral Epidemiol* 2003;31:426-36.
8. Sardenberg F, Martins MT, Bendo CB, Pordeus IA, Paiva SM, Auad SM, et al. Malocclusion and oral health-related quality of life in Brazilian school children. *Angle Orthod* 2013;83:83-9.
9. Locker D, Jokovic A. Using subjective oral health status indicators to screen for dental care needs in older adults. *Community Dent Oral Epidemiol* 1996; 24:398-402.
10. Jokovic A, Locker D, Stephens M, Kenny D, Tompson B, Guyatt G. Validity and reliability of a questionnaire for measuring child oral-health-related quality of life. *J Dent Res* 2002;81:459-63.
11. DiBiase AT, Sandler PJ. Malocclusion, orthodontics and bullying. *Dent Update* 2001;28:464-6.
12. Onyeaso CO, Sanu OO. Perception of personal dental appearance in Nigerian adolescents. *Am J Orthod Dentofacial Orthop* 2005;127:700-6.
13. Sardenberg F, Oliveira AC, Paiva SM, Auad SM, Vale MP. Validity and reliability of the Brazilian version of the psychosocial impact of dental aesthetics questionnaire. *Eur J Orthod* 2011;33:270-5.
14. 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;35:354-60.
15. 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:e168-73.
16. Alonso J, Pérez P, Sáez M, Murillo C. Validity of the occupation as an indicator of social class, according to the British Registrar General classification. *Gac Sanit* 1997;11:205-13.
17. Hassan AH, Amin Hel-S. Association of orthodontic treatment needs and oral health-related quality of life in young adults. *Am J Orthod Dentofacial Orthop* 2010;137:42-7.
18. Klages U, Bruckner A, Guld Y, Zentner A. Dental esthetics, orthodontic treatment, and oral-health attitudes in young adults. *Am J Orthod Dentofacial Orthop* 2005;128:442-9.
19. Cooper S, Mandall NA, DiBiase D, Shaw WC. The reliability of the Index of Orthodontic Treatment Need over time. *J Orthod* 2000;27:47-53.
20. Tuominen ML, Tuominen RJ, Nyström ME. Subjective orthodontic treatment need and perceived dental appearance among young Finnish adults with and without previous orthodontic treatment. *Community Dent Health* 1994;11:29-33.
21. Bellot-Arcís C, Montiel-Company JM, Manzanera-Pastor D, Almerich-Silla JM. Orthodontic treatment need in a Spanish young adult population. *Med Oral Patol Oral Cir Bucal* 2012;17:e638-43.
22. Svedström-Oristo AL, Pietilä T, Pietilä I, Vahlberg T, Alanen P, Varrelä J. Acceptability of dental appearance in a group of Finnish 16- to 25-year-olds. *Angle Orthod* 2009;79:479-83.
23. Flores-Mir C, Major PW, Salazar FR. Self-perceived orthodontic treatment need evaluated through 3 scales in a university population. *J Orthod* 2004; 31:329-34.
24. Hunt O, Hepper P, Johnston C, Stevenson M, Burden D. The Aesthetic Component of the Index of Orthodontic Treatment Need validated against lay opinion. *Eur J Orthod* 2002;24:53-9.
25. Soh J, Sandham A. Orthodontic treatment need in Asian adult males. *Angle Orthod* 2004;74:769-73.
26. Manjith CM, Karnam SK, Manglam S, Praveen MN, Mathur A. Oral Health-Related Quality of Life (OHQoL) among adolescents seeking orthodontic treatment. *J Contemp Dent Pract* 2012;13:294-8.
27. Klages U, Bruckner A, Zentner A. Dental aesthetics, self-awareness, and oral health-related quality of life in young adults. *Eur J Orthod* 2004;26:507-14.
28. Dahong X, Xiangrong C, Ying L, Yusong L, Ying G, Yan S. Effect of incisor position on the self-perceived psychosocial impacts of malocclusion among Chinese young adults. *Angle Orthod* 2013;83:617-22.
29. Bernabé E, Tsakos G, Messias de Oliveira C, Sheiham A. Impacts on daily performances attributed to malocclusions using the condition-specific feature of the Oral Impacts on Daily Performances Index. *Angle Orthod* 2008;78:241-7.
30. Doğan AA, Sari E, Uskun E, Sağlam AM. Comparison of orthodontic treatment need by professionals and parents with different socio-demographic characteristics. *Eur J Orthod* 2010;32:672-6.
31. de Oliveira CM, Sheiham A. Orthodontic treatment and its impact on oral health-related quality of life in Brazilian adolescents. *J Orthod* 2004;31:20-7.