Original Article

Effect of anterior teeth display during smiling on the self-perceived impacts of malocclusion in adolescents

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ABSTRACT

Objective: To investigate the impact of the anterior teeth display during smiling (ATDDS) on the self-perceived psychosocial impacts of malocclusion in adolescents.

Materials and Methods: This cross-sectional study included a convenience sample of 301 adolescents (mean age 16.1 years, SD 1.8 years; 58.1% female). Two instruments were used for data collection: (1) the Dental Aesthetic Index (DAI) and (2) the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ). In addition, ATDDS was assessed in posing smiling, and adolescents' satisfaction with their dental appearance was investigated. Data analysis included descriptive statistics, Kruskal-Wallis test and Mann-Whitney *U*-test, Spearman correlation, and multiple linear regression analysis.

Results: Significant associations were observed between independent variables (ATDDS, DAI scores, and satisfaction with dental appearance) and total PIDAQ score ($R^2 = 0.37$) and dental self-confidence ($R^2 = 0.37$), psychological impact ($R^2 = 0.30$), esthetic concern ($R^2 = 0.20$), and social impact ($R^2 = 0.15$).

Conclusion: The excessive anterior teeth display during smiling may potentially influence the self-perceived psychosocial impacts of malocclusion in adolescents depending on the severity level of malocclusion and the self-reported satisfaction with dental appearance. (*Angle Orthod.* 2011;81:540–545.)

KEY WORDS: Dental esthetics; Anterior teeth display; Malocclusion; Adolescents

INTRODUCTION

Adolescence is a transitional stage of physical and mental development to new environmental and psychological structures, when some aspects of the facial appearance and dental esthetics have great importance for an adolescent's self-image and self-esteem. Malocclusion significantly affects the esthetic appearance of the smile, which is a part of notable facial attractiveness and an effective way of expressing the emotions.[1] Therefore, the esthetic impacts of malocclusion can affect quality of life; impair social interaction, interpersonal relationships, and psychological well-being; and produce feelings of inferiority.[2–4]

The need for orthodontic treatment is difficult to define and, in most cases, a professional viewpoint is used to describe the need for orthodontic treatment.[5] By contrast, the demand for orthodontic treatment in adolescents is mainly motivated by personal concerns about appearance and other psychosocial factors.[6,7] Normative orthodontic criteria are the key factors for determining the prevalence and severity of malocclusion, whereas the perception of dental esthetics in adolescents is more strongly related to self-concept than the grades of malocclusion.[8]

Increasing attention has been given to dentofacial characteristics such as the smile.[9,10] Lips form the frame of a smile and define the esthetic zone,[11] revealing tooth and tissue asymmetries or defects.[12] Consequently, it could be hypothesized that the

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greater the visual perception of teeth during smiling, the greater the impact of malocclusion of anterior teeth on psychosocial aspects of an adolescent's self-perceived facial esthetics. Thus, the aim of this study was to investigate the impact of anterior teeth display during smiling (ATDDS) on the self-perceived psychosocial impacts of malocclusion in adolescents.

MATERIALS AND METHODS

A cross-sectional study was conducted in Goiânia, midwestern Brazil, on a consecutive sample of adolescents from a public high school. Approval from the State Education Council and Institutional Review Board of the Federal University of Goiás was obtained before data collection. All students and their legal guardians received verbal and written information about the aims and procedures of the research, and were informed that participation was voluntary.

Adolescents were clinically examined for the assessment of malocclusion and determination of orthodontic treatment needs using the Dental Aesthetic Index (DAI).[13] The DAI is a cross-cultural index that has two components, a clinical component and an esthetic component for the assessment of treatment need. The DAI links the clinical and esthetic components mathematically to produce a single score that combines the physical and the esthetic aspects of occlusion. The DAI includes 10 parameters of dentofacial anomalies related to both clinical and esthetic aspects of the anterior teeth. Based on DAI cut-off points, individuals were classified into four grades of malocclusion, with different orthodontic treatment recommendations assigned to each grade: grade 1 indicated normal or minor malocclusion/no treatment need or slight need (DAI $\leq$ 25); grade 2, definite malocclusion/treatment was elective (26 $\leq$ DAI $\leq$ 30); grade 3, severe malocclusion/treatment was highly desirable (31 $\leq$ DAI $\leq$ 35); and grade 4, very severe malocclusion/treatment was mandatory (DAI $\geq$ 36).[13]

Dental evaluation was performed by an experienced orthodontist who was trained and calibrated for the measurement of dental parameters for the DAI score. Dental examination and diagnostic criteria for the DAI followed the World Health Organization recommendations for oral health surveys.[14]

In addition, the ATDDS was assessed in posing smiling, ie, a voluntary and sustained smile not elicited by an emotion.[15] The subjects were asked to smile and the two examiners independently recorded, by clinical observation, the amount of exposure of the maxillary incisors during the smile (ATDDS). The smile line was classified into three types: (1) a low smile, revealing less than 75% of the maxillary incisors; (2) an average smile, revealing 75%–100% of the maxillary incisors with up to 3 mm of marginal gingiva; and (3) a high smile, revealing the complete maxillary incisors and a continuous band with more than 3 mm of gingiva.[16,17] Divergences in scoring were solved by consensus during clinical evaluation.

Data on the demographic characteristics of adolescents and psychosocial impact of dental esthetics were collected through a self-completed questionnaire. For this investigation, the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) was used to measure oral health–related quality of life impacts associated with dental esthetics.

The PIDAQ[18] is a 23-item psychometric instrument for assessing orthodontic-specific aspects of quality of life, expressed in four domains: dental self-confidence (six items), social impact (eight items), psychologic impact (six items), and esthetic concern (three items). This instrument had been previously tested for its validity, reliability, and factorial stability across samples.[18] The subjects were asked to rate how much dental esthetics exerted a positive or negative impact using a five-point Likert scale ranging from 0 to 4 (0 indicates not at all; 1, a little; 2, somewhat; 3, strongly; and 4, very strongly). An overall PIDAQ score was obtained by summing all item scores, and the sum of the items in each domain produced subdomain scores. Possible range of scores was 0–92 for the overall PIDAQ. To ensure the same direction of scoring for all items of the questionnaire, some domains had scores reversed to produce a consistent measure of the impacts, with greater scores meaning greater impacts of dental esthetics.

The self-completed questionnaire also included an item about adolescents' satisfaction with their dental appearance, not included as part of PIDAQ: ''Are you satisfied with the esthetics of your teeth?'' This question was coded into yes, no, or don't know.

Descriptive statistics of clinical characteristics and self-perception of adolescents were obtained. Bivariate analysis was performed using the chi-square, Kruskal-Wallis, and Mann-Whitney *U*-tests, and Spearman correlation coefficient. Nonparametric tests were used because the hypothesis of normal distribution was rejected by the Kolmogorov-Smirnov test. Multiple linear regression analysis was used to test PIDAQ association with significant variables in a bivariate analysis. Independent variables were coded as dichotomous, considering the grouped category ''yes/don't know'' as a reference category for satisfaction with dental appearance, and ''low/average'' as a reference category for ATDDS (reference category = 0). Significance level was set at $P < .05$. SPSS Statistics 17.0 software (SPSS Inc, Chicago, Ill) was used for statistical analysis.

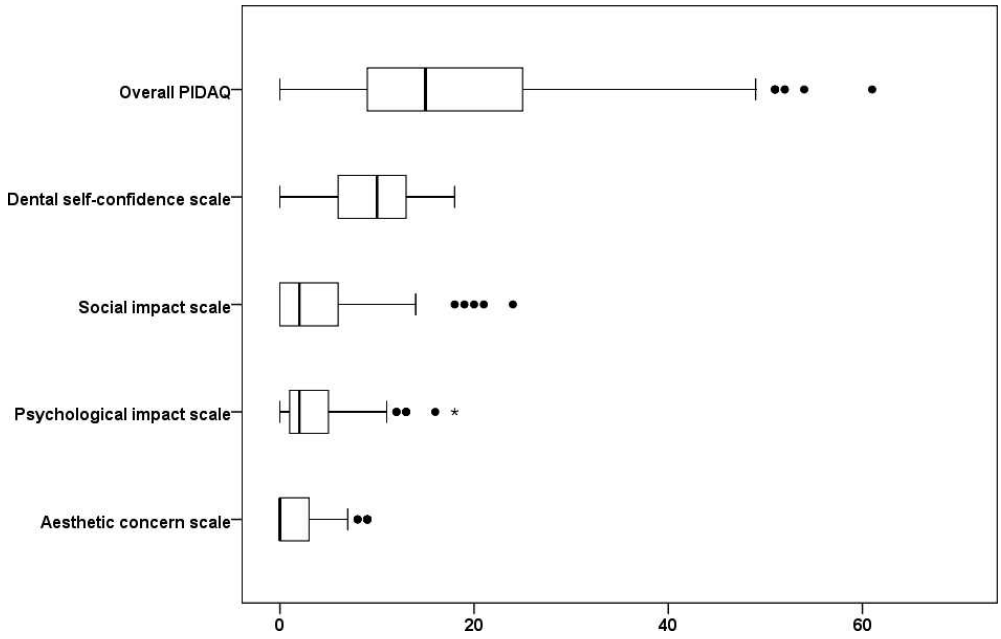

Figure 1. Distributions of scores for the PIDAQ scales.

RESULTS

The study sample included 301 volunteers, 58.1% female and 41.9% male, with ages ranging from 13 years to 20 years (mean 16.1; SD 1.8). Almost half of those studied (49.8%) had no treatment need or only a slight need (grade 1) and had an average smile line (60.5%). Dissatisfaction with dental appearance was revealed by 34.6% of the sample, and 98.3% of adolescents showed some level of psychosocial impact of dental esthetics. For these variables, gender was significantly different only for ATDDS (chi-square test $P = .037$). The frequency of the smile line height cases showed the following distribution for male and female subjects, respectively: average smile line in 55.6% and 64.0%, low smile line in 25.4% and 13.7%, and high smile line in 19.0% and 22.3%.

Reliability of the PIDAQ scale and subscales for the study sample was satisfactory—Cronbach alpha was 0.93 for PIDAQ (subscale alphas ranged from 0.82 to 0.92), as reported in a previous study with the same sample.[4] The mean overall PIDAQ score was 18.1 (SD 12.3), ranging from 0 to 61. Raw distributions of scores according to PIDAQ scales are shown in Figure 1. Floor effect was observed in three scales: social impact, psychological impact, and esthetic concern.

Scores on the PIDAQ scale were higher with greater DAI scores, high smile line, and dissatisfaction with dental appearance (Table 1). Between-group comparison among DAI grades showed that grade 1 was statistically different from grades 2, 3, and 4. No significant differences were found regarding the psychosocial impacts of dental esthetics according to gender ($P = .738$). The PIDAQ scale was not correlated with age (Spearman correlation coefficient, $r = -.097$; $P = .122$).

Significant differences in all PIDAQ subscales were also observed for both DAI scores and satisfaction with dental appearance ($P < .001$). For the ATDDS variable, only the psychologic impact ($P = .013$) and esthetic concern ($P = .005$) subscales were found to be greater for adolescents with a gingival smile.

Table 2 shows the multiple linear regression analysis of the influence of significant variables in the bivariate analysis of the PIDAQ scale and subscales. The overall results revealed that ATDDS, DAI scores, and satisfaction with dental appearance were positively associated with psychosocial impacts. The predictive ability of the regression models ranged from 15% to 37% (R^2 values), indicating the proportion of the variability in PIDAQ scores that can be explained by the variability of ATDDS, DAI score, and the self-reported satisfaction with appearance in the regression model. Overall PIDAQ scale was positively associated with all independent variables, which means that self-reported dissatisfaction with appearance, higher levels of malocclusion, and gingival smile are associated with higher psychosocial impacts of dental esthetics. Satisfaction with appearance showed the greatest regression coefficients and most significant P values ($P < .001$).

DISCUSSION

ATDDS with large gingival display has been considered esthetically undesirable for clinicians and

Table 1. Overall PIDAQ Scores According to ATDDS, DAI Score, and Satisfaction With Teeth[a]

		n (%)	Mean (SD) Overall PIDAQ Scale	*P* Value[b]
ATDDS	Low/average	238 (79.1)	17.2 (11.8)	.021
	High	63 (20.9)	21.4 (13.2)	
DAI score	Grade 1	150 (49.8)	14.1 (10.2)	<.001*
	Grade 2	75 (24.9)	21.1 (13.7)	
	Grade 3	45 (15.0)	21.2 (12.0)	
	Grade 4	31 (10.3)	24.9 (12.0)	
Satisfaction with dental appearance	Yes/don't know	189 (62.8)	13.0 (8.5)	<.001
	No	104 (34.6)	27.7 (12.7)	

[a] PIDAQ indicates Psychosocial Impact of Dental Aesthetics Questionnaire; ATDDS, anterior teeth display during smiling; and DAI, Dental Aesthetic Index.

[b] Mann-Whitney *U*-test and Kruskal-Wallis test.

* Grade 1 was statistically different from grades 2, 3, and 4.

researchers.[1,19,20] In spite of the relevance of this esthetic zone in orthodontic treatment planning, there is little knowledge about the layperson's perception of gingival display during smiling.[21] The uniqueness of our study in the orthodontic/psychologic field is the focus on the impact of ATDDS on self-perception of malocclusion in adolescents. By contrast, the specific sociodemographic characteristics of this convenience sample might have resulted in potential bias when epidemiologic and clinical inferences are considered.

Our results confirm the view that adolescents attribute a high importance to dental appearance.[6,18,22] Most adolescents (98.3%) had some level of psychosocial impact of dental esthetics, and a significant percentage of the sample (34.6%) revealed dissatisfaction with their dental appearance. Although it is true that increased teeth display has more chance for an increased perception of malocclusion (because teeth in malocclusion are more visible), teeth or gingival display itself is an esthetic problem that can cause psychosocial effects.

The appearance of the face plays an important psychosocial role in human life and interpersonal relationships.[3] In this context, our findings revealed that the psychosocial impact of dental esthetics was influenced by the severity of malocclusion and satisfaction with dental appearance (Tables 1 and 2). Mandall et al.[23] and Al-Sarheed et al.[24] also found that children with higher orthodontic treatment need had more negative psychosocial impacts and a worse quality of life compared with children with no treatment need.[18,23,24] The impact of oral health conditions on a person's satisfaction with their appearance might result in shame in social contacts and psychosocial disadvantage.[18,23,24] In a previous study, de Paula-Junior et al.[4] showed that adolescents' self-perceived impact of dental esthetics is influenced by the severity of malocclusion, oral health–related quality of life, and body satisfaction. Multiple regression analysis revealed significant associations of independent variables (DAI, short form of the Oral Health Impact Profile, and body satisfaction scale) with the PIDAQ scale and subscales.[4]

Excessive gingival display is a common feature, particularly among women.[16,20] Tjan et al.,[16] Geron and Atalia,[19] and Peck et al.[25] found that a low smile line is a predominantly male characteristic, whereas a high smile line is predominantly female, in concordance with our findings. Despite the sexual dimorphism, gender was not associated with satisfaction and psychosocial impacts of dental esthetics ($P > .05$), as also shown by Mugonzibwa et al.[26] By contrast, Geron and Atalia[19] reported that female evaluators gave higher scores than male evaluators to upper gingival exposure images at smile and speech,

Table 2. Multiple Linear Regression Analysis for PIDAQ Scale and Subscales as Dependent Variables[a]

	Standardized Regression Coefficients (*P* Value)			
PIDAQ	ATDDS[b]	DAI score	Satisfaction With Dental Appearance[c]	R^2
Overall scale	0.157 (.002)	0.158 (.003)	0.531 (<.001)	0.372
Dental self-confidence scale	0.080 (.094)	0.174 (<.001)	0.539 (<.001)	0.371
Psychological impact scale	0.132 (.009)	0.146 (.006)	0.471 (<.001)	0.296
Esthetic concern scale	0.192 (<.001)	0.109 (.050)	0.367 (<.001)	0.202
Social impact scale	0.112 (.043)	0.101 (.078)	0.337 (<.001)	0.151

[a] PIDAQ indicates Psychosocial Impact of Dental Aesthetics Questionnaire; ATDDS, anterior teeth display during smiling; and DAI, Dental Aesthetic Index.

[b] Low/average = 0.

[c] Yes/don't know = 0.

suggesting that women are more tolerant to upper gingival exposure.

Literature is focused on creating standards for smile analysis, but the influence of ATDDS in the perception of oral esthetics has not been studied, particularly in relation to a possible difference between genders.[19] Furthermore, most studies about the impact of smile line on dental attractiveness have used the judgment of clinicians and laypersons in relation to the photographs of unknown individuals smiling, with self-assessment studies carried out to a lesser degree.[19,21,27]

Our study reveals that a higher psychosocial impact of dental esthetics was also associated with gingival smile, revealing a continuous band with more than 3 mm of gingiva. Excessive ATDDS and gingival smile can potentially impact the self-perceived dental esthetics in adolescents, especially in cases with great levels of malocclusion. Hunt et al.[21] investigated the level of gingival display considered most attractive by laypersons. In total, 120 university students evaluated seven photographs of a male subject and seven photographs of a female subject, with levels of gingival display ranging from −2 mm to +4 mm. More attractive ratings were awarded to smiles with gingival exposure ranging from 0–2 mm. Kokich et al.[27] evaluated female smiles and found that laypersons were unable to detect an incisal plane inclination of less than 3 mm, and gingival display exceeding 4 mm was classified as unattractive. Geron and Atalia[19] showed that images were scored as less attractive when the amount of upper and lower gingival display was increased during smile and speech. The amount of gingival exposure graded in the esthetic range was up to 1 mm for the upper incisors and 0 mm for the lower incisors.

Multiple linear regression analysis (Table 2) showed that ATDDS, DAI scores, and satisfaction with dental appearance were associated with psychosocial impacts, confirming our initial hypothesis that a high smile line increases the psychosocial impact of the malocclusion of anterior teeth on self-perceived dental esthetics. In a self-perception study, Van der Geld et al.[1] reinforced this importance of psychosocial and clinical factors for the awareness of smile attractiveness. Size and visibility of teeth and upper lip position influenced satisfaction with smile appearance in the social dimension, whereas the color of teeth and gingival display were crucial factors for the individual dimension.

The R^2 values used to summarize the measure of the global fit of the regression models represent the proportion of variability in PIDAQ scales that may be attributed to some linear combination of the selected explanatory variables. Approximately 37% of the variation in the overall PIDAQ scale can be explained by the explanatory variables. A caution that applies to the R^2 values is that a great part of the variability can be explained by unknown variables or inherent data variability. This means that the clinical significance of the independent variables as predictors of the self-perceived psychosocial impacts in adolescents, specially the ATDDS, must be considered with caution and taken into account together with other clinical and psychological characteristics of the individual patient.

General dentists and orthodontists should pay attention to a patient's understanding of their malocclusion, satisfaction with dental appearance and ATDDS, as well as evaluating subjective aspects such as the psychosocial impact of dental esthetics. The results of our study reveal that a gingival smile is a critical clinical condition for the psychosocial impact of dental esthetics in adolescents with dissatisfaction with esthetics and great levels of malocclusion. Additional studies are needed to assess the predictive value of other clinical and sociodental variables on self-perceived esthetic impacts in adolescents, focusing on representative samples of normal populations.

CONCLUSION

- The excessive anterior teeth display during smiling may potentially influence the self-perceived psychosocial impacts of malocclusion in adolescents, depending on the severity levels of malocclusion and self-reported satisfaction with dental appearance.

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