

Psycho-social impact of malocclusion in adolescents in Kosovo

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Objective: To assess the psychosocial impact of malocclusion, establish its association with the severity of malocclusion and determine the effects of gender and age in such association. **Basic research design:** Cross-sectional study. **Methods:** 400 adolescents aged between 12-15 years were randomly selected. Each participant was examined for malocclusion and categorized according to Index of Orthodontic Treatment Need (IOTN) and Dental Aesthetic Index (DAI). The Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) was used to assess the psychosocial impact of malocclusion. **Results:** Significant differences were noted between PIDAQ subscales, and grades of malocclusion assessed by IOTN and DAI ($p < 0.05$). Gender differences were noted in Dental Self Confidence (DSC), Social Impact (SI) and Psychological Impact (PI) for the same severity of malocclusion ($p < 0.05$). IOTN-DHC predicted the total and subscales of PIDAQ scores. Gender and age were the independent predictive variables of the relationship between the PIDAQ scores and the IOTN-DHC grades for the DSC and AC subscales. Gender independently predicted psychological impact. **Conclusion:** Severity of malocclusion, gender and age were related to impacts on the psychosocial wellbeing of participants. Overall, females and older participants experienced worse psychosocial impact.

Keywords: Malocclusion, psychosocial impact, epidemiology

Introduction

The relationship between tooth alignment and facial aesthetics are inseparable. A number of studies have investigated the correlation of physical appearance with social interaction (Marques *et al.*, 2006; Seehra *et al.*, 2011). Teeth, as an important part of the facial aesthetics have a special effect on attractiveness. Good facial proportions tend to be an advantage in professional and private life (Alanko *et al.*, 2010; Vieira-Andrade *et al.*, 2015). While attractive facial lines have been reported as a factor for greater self-confidence and a larger social circle (De Oliveira and Sheiham, 2004; Peres *et al.*, 2008), the presence of malocclusion such as dental protrusion and crowding, apart from predisposing individuals to periodontal disease and dental trauma (Celenk *et al.*, 2002; Dimberg *et al.*, 2015) may negatively impact the quality of life (de Paula *et al.*, 2009; Dimberg *et al.*, 2015; Marques *et al.*, 2006). Aesthetic discomfort is reported as a more common reason for orthodontic treatment than functional problems (Wędrychowska-Szulc and Stryńska, 2010). This issue was reported to be even more pronounced among adolescents, who are more concerned about their appearance. Sommerfeld *et al.* (2017) have shown that the foremost motivation of adolescents to look in a mirror is to obtain the perception of what somebody sees in them. Satisfaction with physical appearance has been described as an essential part of self-esteem in adolescents (Mustapic *et al.*, 2017), with deviation from norms reported to lead to teasing and name-calling, thus directly impacting the adolescent's personality, self-esteem and social circle (De Baets *et*

al., 2012; Sardenberg *et al.*, 2013; Seehra *et al.*, 2011). Improving these personal and social consequences has become an important indicator for orthodontic treatment (De Oliveira and Sheiham, 2004; Seehra *et al.*, 2011).

Oral Health Related Quality of Life (OHRQoL) is defined as the impact of oral diseases and disorders on aspects of everyday life that a patient or person values, that are of sufficient magnitude, in terms of frequency, severity or duration to affect their experience and perception of their life overall (Locker and Allen, 2007). Considering this concept, understanding the psychosocial impact of malocclusion among adolescents is of great importance. Thus, the aim of this paper is to assess the psychosocial impact of malocclusion, establish its association with the severity of malocclusion, and evaluate the effect of gender and age in such association, by using the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) as dependent variable and Index of Orthodontic Treatment Need (IOTN), Dental Aesthetic Index (DAI), gender and age as independent variables.

Materials and Methods

This study included 400 adolescents aged between 12-15 years. To obtain a representative sample, participants were chosen in proportion to the distribution of schools in different cities of Kosovo (Prishtina, Gjilan, Kamenice, Viti, Prizren).

Participants were selected in multi-stage sampling using random numbers from classrooms. Exclusion criteria for the study included: 1) adolescents with an orthodontic appliance or receiving orthodontic treatment, 2) traumatic injuries, 3) frontal teeth with visible lesions related to

dental caries, and 4) teeth development anomalies (i.e. hypoplasia, fluorosis, amelogenesis imperfecta, dentinogenesis imperfecta). The study was conducted in line with recommendations from the Declaration of Helsinki and has been approved by the Ethical Committee of Dental School at the University of Zagreb and the Ministry of Education in each municipality where the study was implemented. Written consent has been received from parents of each adolescent involved.

One examiner, previously trained and calibrated on the use of DAI and IOTN examined and categorized participants for orthodontic treatment need. The PIDAQ was used to evaluate the psychosocial impact of malocclusion. The PIDAQ questionnaire and examination of participants were performed in the dental office of public schools.

PIDAQ is a condition-specific measure with 23 questions, divided into one positive and three negative domains: Dental Self Confidence (DSC) (6 items), Social Impact (SI) (8 items), Psychological Impact (PI) (6 items) and Aesthetic Concern (AC) (3 items). Each response in the questionnaire is based on a five-point Likert scale (from 0= *not at all* to 4= *very strongly*) (Klages *et al.*, 2006). DSC is a positive domain, meaning that a higher score indicates greater confidence, whereas higher scores in SI, PI and AC (negative domains) indicate greater impact or concern. Although PIDAQ was designed to be used in adults, its validity and reliability has been demonstrated in adolescents (Ilijazi-Shahiqi *et al.*, 2020; Montiel-Company *et al.*, 2013; Santos *et al.*, 2016; Wan Hassan *et al.*, 2017).

IOTN is a rating system, originally used to assess need for orthodontic treatment and now increasingly used to determine the severity of malocclusion. IOTN consists of a Dental Health (IOTN-DHC) and an Aesthetic Concern component (IOTN-AC). IOTN-DHC is a 5-point ordinal scale where grade 1 indicates no or minor malocclusion and grade 5 severe malocclusion with significant need for treatment. IOTN-AC uses ten images of smiles of increasing aesthetic concern against which the examiner rated the malocclusion of each participant (Brook & Shaw, 1989).

The Dental Aesthetic Index is based on aesthetic aspects of occlusion that have the potential to cause psychosocial or social dysfunction. It scores the occlusion using specific criteria including: dentition (absence of incisor, canine and premolars), spaces (crowding in the incisor

region, spacing in the region of incisors, diastema, anterior jaw misalignment, anterior mandibular misalignment), occlusion (anterior maxillary overjet, anterior mandibular overjet, vertical anterior open bite) and anteroposterior molar relationship. Participants were categorized into four groups based on their score: ≤ 25 (normal or mild occlusion with little or no need for treatment), 26-30 (malocclusion with elective need for treatment), 31- 35 (severe malocclusion with highly desirable need for treatment) and ≥ 36 (very severe or disabling malocclusion with mandatory treatment) (Cons *et al.*, 1989).

As the sample data had a non-normal distribution, non-parametric tests were used to assess between group differences. To test the construct validity of PIDAQ, we compared the severity of the psychosocial impact of dental aesthetics (PIDAQ subscales) between participants with minor and major malocclusion using the DAI (scores ≤ 25 and ≥ 26 , Mann Whitney test), across three categories using the IOTN-DHC (1-2, 3 and 4-5, Kruskal-Wallis test) and three categories using the IOTN-AC (1-3, 4-7 and 8-10, Kruskal-Wallis test).

As the residuals were normally distributed, linear regression models were employed to study the linear relationship between the PIDAQ data as the dependent variable and the IOTN components, gender, and age as predictive variables. Data analysis was performed using the Statistical Package for Social Sciences (version 20.0, SPSS Inc., Chicago, Illinois, USA).

Results

The sample consisted of 400 participants, with 180 (45%) boys and 220 (55%) girls aged 12-15 years old. For both the IOTN and DAI the prevalence of malocclusion was higher among males than females. The IOTN-AC and DAI found malocclusion to be more common among 14-year olds, whereas it was more common among 12 years old using IOTN-DHC (Table 1).

The Mann-Whitney and Kruskal-Wallis tests revealed significant differences in the dental self-confidence, social impact, psychological impact, and aesthetic concern subscale scores of PIDAQ with increasing severity of malocclusion as indicated by IOTN-DHC, IOTN-AC and DAI (Tables 2-4).

Table 1. Distribution of malocclusion categories by age and gender.

	IOTN-DHC			IOTN-AC			DAI			
	1-2 %	3 %	4-5 %	1-3 %	4-7 %	8-10 %	≤ 25 %	26-30 %	31-35 %	$36 \leq$ %
Gender ^a (%)										
Male (45)	16.7*	14.5*	13.7*	31.5	11.5	2	25.7*	7.5*	6.5*	5.2*
Female (55)	25.5	18.5	11	42	11.7	1.2	34.5	11.2	4.25	5
Age (%)										
12y (26.2)	9.7	9.7	36.7	19.7	6	0.5	15.5	5.5	3	2.2
13y (23.2)	12.2	6	5	17.7	4.7	0.7	16.2	3	2.2	1.7
14y (29.7)	12	10.5	7.2	22.2	5.7	1.7	17.7	4	3.7	4.2
15y (20.7)	8.2	6.7	5.7	13.7	6.7	0.2	10.7	6.2	1.7	2

^a = $p < 0.05$, Mann-Whitney test for gender differences

IOTN-DHC Index of orthodontic treatment need - Dental health component; IOTN-AC Index of orthodontic treatment need - Aesthetic Component; DAI - Dental Aesthetic Index

In general, females had worse PIDAQ scores within malocclusion categories (Tables 2 and 3) For example, females scored worse for the DSC and PI domains within Grade 3 of DHC-IOTN and worse in the PIDAQ AC domain in the Grade 1, 2, and 3 categories of IOTN-AC.

Table 4 summarises the results of multiple regression models to identify predictors of the total PIDAQ and the subscale scores. It should be noted that the DSC is a positive domain meaning that a higher score indicates greater confidence. IOTN-DHC consistently predicted the total and subscale PIDAQ scores. Gender predicted the total and all PIDAQ subscale scores, except for the SI subscale. Age predicted the DSC and AC subscale scores. That is, the impact of malocclusion as measured by PIDAQ tended to be worse in female and older participants

Discussion

To our knowledge this study is the first of its kind conducted in Kosovo adolescents. We studied the impact of malocclusion and associations between its severity with

age and gender on the psychosocial status of adolescents aged between 12-15 years. Malocclusion was associated with worse impacts on the physical and psychosocial status of adolescents. Even though malocclusion was more common in male participants, the psychosocial impact was worse in females of the same severity.

These results are supported by previously published data (Bellot-Arcís *et al.*, 2013; Svedström-Oristo *et al.*, 2009) which might lead to the conclusion that males are less impacted from dental appearance compared to females.

Using the IOTN-DHC index for grades 1 and 2 of malocclusion, a significant difference between genders was noted for the SI and AC of PIDAQ subscales, with females recording higher scores (greater impact). The same result was recorded for the DSC and PI of PIDAQ subscales among grade 3 of IOTN-DHC. These data are similar those of Bellot-Arcis *et al.* (2013) who found gender-based differences in psychosocial impact of malocclusion among adolescents in Spain. These results show that, minor irregularities (IOTN-DHC: grade 1 and

Table 2. PIDAQ and subscale scores by IOTN-DHC category and gender

PIDAQ Domain	IOTN DHC					
	Grade 1 and 2 (n=169)		Grade 3 (n=132)		Grade 4 and 5 (n=99)	
	F Median, IR	M Median, IR	F Median, IR	M Median, IR	F Median, IR	M Median, IR
Dental self-confidence	2.2, 1.6	2.5, 1.3	1.1, 1.5	1.8, 1.1*	0.6, 1.5	1.1, 1.6
Social Impact	0.3, 0.7	0.2, 0.6*	0.8, 1.3	0.6, 0.9	1.3, 1.7	1.3, 1.6
Psychological Impact	1.1, 1.3	0.8, 0.9	2, 1.3	1.5, 1.3*	2.2, 1.6	2.0, 1.6
Aesthetic Concern	1, 1.5	0.3, 0.8*	4.4, 0.2	4.4, 0.2	2, 1.6	2, 2
PIDAQ Total Score	1.1, 0.3	1, 0.3*	1.2, 0.7	1.2, 0.6	1.5, 0.8	1.5, 0.9

* = $p < 0.05$, Mann-Whitney test for gender scores in PIDAQ domains across IOTN-DHC categories

Table 3. PIDAQ and subscale scores by IOTN-AC category and gender

PIDAQ Domain	IOTN AC					
	Grade 1, 2 & 3 (n=294)		Grade 4, 5, 6 & 7 (n=93)		Grade 8, 9 & 10 (n=13)	
	F Median, IR	M Median, IR	F Median, IR	M Median, IR	F Median, IR	M Median, IR
Dental self-confidence	1.8, 1.5	2.0, 1.4	0.6, 1.4	0.9, 1.9	0.0, 2.3	0.6, 1.4
Social Impact	1.0, 1.0	0.0, 1.0	1.0, 1.0	2.0, 2.0	3.0, 0.5	2.5, 1.5
Psychological Impact	2.0, 1.0	1.0, 1.0	2.0, 2.0	2.0, 2.0	3.0, 0.5	3.0, 3.3
Aesthetic Concern	1.0, 2.0	1.0, 1.0*	2.0, 2.0	2.0, 2.0	3.0, 1.0	3.0, 1.7
PIDAQ Total Score	1.2, 0.6	1.0, 0.5*	1.4, 0.9	1.4, 0.9	2.4, 0.4	2.2, 0.3

* = $p < 0.05$, Mann-Whitney test for gender scores in PIDAQ domains across IOTN-DHC categories

Table 4. Linear regression models of predictors of the total PIDAQ and subscale scores

Dependent variable	Predictor variables				
	IOTN-DHC β , p	Gender β , p	Age β , p	R^2	p
Dental self-confidence*	-0.614, <0.001	0.247, 0.012	-0.127, 0.005	0.469	<0.05
Social impact	0.494, <0.001	0.171, 0.065	0.029, 0.491	0.400	<0.05
Psychological Impact	0.544, <0.001	0.221, 0.020	0.082, 0.056	0.431	<0.05
Aesthetic Concern	0.646, <0.001	0.289, 0.007	0.102, 0.037	0.450	<0.05
Total PIDAQ score	0.249, <0.001	0.124, 0.015	0.020, $p=0.389$	0.378	<0.05

* DSC is a positive domain meaning that a higher score indicates greater confidence whereas high scores for the other domains indicate greater negative impact.

2) affect females' social interactions (SI of PIDAQ) and self-perception of attractiveness (AC of PIDAQ). On the other hand, greater irregularities (IOTN-DHC: grade 3), have a greater impact on females' confidence (DSC domain of PIDAQ) and the psychological domain (PI of PIDAQ). The same conclusion arose when the severity of malocclusion was assessed using the IOTN-AC index. Females recorded higher scores in the AC subscale, indicating the concern of females with self-image and aesthetics even at minor levels of malocclusion. One possible explanation why females score worse might be due to gender perceptions and expectations, whereby females feel under greater pressure to adhere to certain beauty standards. The very same standards may cause males to be less concerned than females with their dental appearance, even at the same or slightly higher level of malocclusion. Although further analysis with larger study groups is required, the current data suggest that malocclusion in females negatively impacts overall aesthetic related confidence and social interactions in comparison to their male counterparts.

Younger participants had lower median PIDAQ scores in relation to the severity of their malocclusion, as assessed by IOTN-DHC and DAI, but significant age-dependent differences were not noted in total PIDAQ scores for any category of IOTN and DAI indices. These findings are supported by the study of Bos et al. (2003), while contradicted by Marques et al. (2006) and Twigge et al. (2016), who found OHRQoL not to be age dependent. These differences might be explained by differences in study design such as the type of the questionnaires used and cultural differences between the samples.

PIDAQ and its subscales were associated with greater severity of malocclusion (Table 4) confirming its construct validity. Linear regression analysis confirmed that besides severity, gender and age are related to the impact on the psychosocial wellbeing young people, where the impact of malocclusion as measured by PIDAQ tended to be worse in female and older participants. Our findings are in line with other observations about the impact of malocclusion (Hassan and Amin, 2010; Manjith *et al.*, 2012). Our study's results can be utilized in the policy-making sector to plan public health care expenditures and services to ensure coverage of early and preventive dental care.

Conclusion

This research revealed that adolescents with malocclusion experienced negative psychosocial impact on their quality of life. In addition to its severity, gender and age influence the impact of malocclusion on the psychosocial wellbeing of young people, with females and older adolescents experiencing worse psychosocial impacts.

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