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## Self-perception and malocclusion and their relation to oral appearance and function

Auto-percepção e má oclusão relacionadas à aparência e a função bucal.

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**Abstract** *The aim of this study was to evaluate the relationship between malocclusion and self-perception of oral appearance/function, in 12/15-year-old Brazilian adolescents. The cluster sample consisted of 717 teenagers attending 24 urban public (n=611) and 5 rural public (n=107) schools in Maringá/PR. Malocclusion was measured using the Dental Aesthetic Index (DAI), in accordance with WHO recommendations. A parental questionnaire was applied to collect information on esthetic perception level and oral variables related to oral health. Univariate and multiple logistic regression analyses were performed. Multiple logistic regression confirmed that for 12-year-old, missing teeth (OR=2.865) and presence of openbite (open occlusal relationship) (OR=2.865) were risk indicators for speech capability. With regard to 15-year-old, presence of mandibular overjet (horizontal overlap) (OR=4.016) was a risk indicator for speech capability and molar relationship (OR=1.661) was a risk indicator for chewing capability. The impact of malocclusion on adolescents' life was confirmed in this study. Speech and chewing capability were associated with orthodontic deviations, which should be taken into consideration in oral health planning to identify risk groups and improve community health services.*

**Key words** *Malocclusion, Adolescent health, Self concept, Oral health*

**Resumo** *Este estudo objetivou avaliar a relação entre a má oclusão e a autopercepção da aparência/função bucal em adolescentes brasileiros de 12/15 anos de idade. A amostragem foi probabilística, constituída por 717 adolescentes de escolas públicas, sendo 24 urbanas (n=611) e 5 rurais (n=107), em Maringá/PR. A má oclusão foi medida por meio do Índice de Estética Dental (DAI), de acordo com os critérios da OMS. Foi aplicado um questionário aos pais para coletar informações sobre o nível de percepção estética e as variáveis relacionadas à saúde bucal. Análises univariada e de regressão logística múltipla foram realizadas. A regressão logística múltipla confirmou que para 12 anos, os dentes ausentes (OR=2,865) e a presença de mordida aberta (OR=2,865) foram indicadores de risco na capacidade de fala. Com relação aos 15 anos, a presença de overjet mandibular (OR=4,016) foi um indicador de risco para a capacidade de expressão e a relação molar (OR=1,661) foi um indicador de risco para a capacidade mastigatória. O impacto da má oclusão na vida dos adolescentes foi confirmado neste estudo. A capacidade da fala e da mastigação esteve associada às alterações ortodônticas, as quais devem ser levadas em consideração no planejamento de saúde bucal, para identificar grupos de risco e para melhorar os serviços de saúde.*

**Palavras-chave** *Má oclusão, Saúde do adolescente, Autoimagem, Saúde bucal*

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## Introduction

It has been reported that clinical (normative) and subjective (self-assessment) evaluation of malocclusion demonstrate a significant disparity. The dental public health team is obliged to recognize and understand this gap.

Esthetic perception varies from person to person and is influenced by their personal experience and social environment. For this reason, professional opinions regarding evaluation of facial esthetics may not coincide with the perceptions and expectations of patients or lay people<sup>1,2</sup>.

The anterior visible occlusion and examiner's level of education may be important for understanding the patient's perception when discussing the esthetic considerations of orthodontic treatment<sup>3</sup>.

An important motivational factor is to improve dentofacial appearance<sup>4,5</sup>. The relationship between physical appearance and perception of an esthetic deviation, and the impact of such a deviation on self-esteem and body image is an important issue in determining the benefits of orthodontic treatment.

A variety of social, cultural and psychological factors, and personal norms influence the perception of physical attractiveness<sup>6,7</sup>. Studies in social psychology indicate that physical attractiveness plays a major role in social interaction and influences the impression of an individual's social skill<sup>7,8</sup>.

The Dental Aesthetic Index (DAI) adopted by the World Health Organization has been used to assess malocclusion and determine treatment needs<sup>9-11</sup>, and has been integrated into all items of the International Collaboration Study of Oral Health outcomes and guidelines by the WHO<sup>12,13</sup>. Self or patient opinions regarding orthodontic treatment needs have previously been recorded for dental and facial appearance<sup>6,14,15</sup>, and such concerns do not always concur with professional evaluations of treatment requirements<sup>16,17</sup>.

The aim of this study was to evaluate the relationship between the dental aesthetic index (DAI) and self-perception of oral appearance and function in 12/15-year-old Brazilian adolescents.

## Materials and method

### Ethical aspects

The study was approved by the Research Ethics Committee of the Bauru Dental School, Uni-

versity of São Paulo. Written permission was obtained from adolescents' parents before starting the clinical examinations.

### Sample

In total, a cluster sample composed of 717 students, aged 12 and 15 years, attending 30 representative public schools in Maringá, Brazil, were examined. The sample was organized by gender (340 girls, 377 boys) and age (402 – 12-year-olds, 315 – 15-year-olds). The clusters were rural (n=212) and urban (n=1192) schools. Schools and grades were randomly selected.

The cluster sampling method was used admitting a sampling error of 5%, mean dmft of 2.5 with standard deviation of 1.8, a confidence level of 95% and loss of 20%.

Students who had orthodontic treatment or were currently wearing an orthodontic appliance were not included in the study.

### Examination methodology

Clinical examination was performed by one previously calibrated examiner, outdoors, under natural light, using CPI probes ("ball point"), mirrors #5<sup>13</sup> and air-drying. Before examination each children performed tooth brushing supervised by a dental hygienist.

### Calibration

A benchmark dental examiner ("Gold Standard"), experienced in epidemiological surveys, conducted the calibration process that lasted 24 hours (4 sessions). Theoretical and practical activities with discussions on the diagnostic criteria of malocclusion were performed by two examiners (gold standard and main examiner). Approximately 10% of the sample was re-examined in order to verify the intra-examiner reproducibility. Inter-examiner agreement was 0.85 expressed by the Kappa statistics. This value indicated reliability within acceptable limits<sup>18</sup>.

### Diagnostic criteria and codes

Professional treatment needs were obtained by assessing the teenagers using the DAI in accordance with the WHO guideline<sup>13</sup>. All 10 components of the index were assessed (Table 1). One of the authors was previously calibrated using re-examination of dental students.

**Table 1.** The standard DAI regression equation.

DAI Components	Weight
1. Number of missing visible teeth (incisors, canines and premolars teeth in maxillary and mandibular arches).	6
2. Crowding in the incisal segment (0=no segment crowded; 1=1 segment crowded; 2=2 segments crowded).	1
3. Spacing in the incisal segment (0=no spacing; 1=1 segment spaced; 2=2 segment spaced).	1
4. Midline diastema in millimeters.	1
5. Largest anterior irregularity on the maxilla in millimeters.	1
6. Anterior maxillary overjet in millimeters.	2
7. Anterior mandibular overjet in millimeters.	4
8. Vertical anterior openbite in millimeters.	4
9. Anterior-posterior molar relation (largest deviation from normal either left or right): 0=normal; 1=1/2 cusp either mesial or distal; 2=one full cusp or more either mesial or distal.	3
10. Constant.	13
<b>Total</b>	<b>DAI score</b>

WHO, 1997.

### Questionnaire

All teenagers received a semi-structured questionnaire to be answered according to their self-perceptions and perceived esthetic of malocclusion. The goal of this questionnaire was to collect information about speech capability, chewing capability and report of pain.

### Data Analyses

Univariate analyses using the Chi-square test ( $\chi^2$ ) at 5% significance level were performed to test the influence of independent variables (openbite, missing teeth, crowding, spacing, midline diastema, maxillary irregularity, mandibular irregularity, maxillary overjet, mandibular overjet, molar relation and gender on dependent variables (speech capability, chewing capability and report of pain). The dependent variables (speech and chewing capability) were dichotomized into bad/regular and good/excellent while the dependent variable "report of pain" was dichotomized into children with or without pain. The independent variables related to DAI components (Table 1) were dichotomized according to absence (code 0) and presence (code 1). Next, multiple logistic regression analyses using the stepwise procedure were performed in order to identify the self-perception indicators. In order to eliminate variables that would make little contribution to the model, only the independent variables that showed significant association at  $p \leq 0.15$  in the univariate analysis were tested in regression model<sup>19,20</sup>. The logistic regression models were adjusted estimat-

ing the Odds Ratios (OR), their 95% confidence intervals (IC), and significance levels. All statistical analyses were performed using the SAS software<sup>21</sup> at 5% significance level.

### Results

The Dental Aesthetic Index (DAI) was calculated using the scores expressed in Table 1.

Tables 2, 3 and 4 present univariate analyses, using Chi-square or the Fisher's Exact Test, associating dependent variables (speech capability, chewing capability and report of pain) with independent variables cited in DAI classification (Table 1).

Table 2 shows the statistically significant association (all variables at  $p < 0.15$  were tested in regression analysis) between "speech capability" and openbite, missing teeth and spacing for 12-year-olds, while for 15-year-old sample "speech capability" was associated with maxillary irregularity, mandibular overjet and molar relationship.

In Table 3 a statistically significant association between "chewing capability" and mandibular irregularity can be found for 12 year olds, as well as openbite, maxillary overjet and molar relationship for 15-year-olds.

"Report of pain" was statistically associated with missing teeth and mandibular irregularity for 12-year-olds, as well as mandibular overjet and gender for 15 year olds (Table 4).

The data from the regression analyses confirmed most of these associations. For the 12-year-old sample, missing teeth (OR=2.865) and presence of openbite (OR=2.865) were risk indi-

**Table 2.** Univariate analyses of the association between “speech capability” (dichotomization in bad/regular and good/excellent) and malocclusion in 12-15 year-old adolescents.

Independent variables	Absence (0), presence (1)	Dependent variable (Speech capability)					
		12 years			15 years		
		bad, regular n (%)	good, excellent n (%)	p	bad, regular n (%)	good, excellent n (%)	p
Openbite	0	70 (19.77)	284 (80.23)	0.0578	48 (18.05)	218 (81.95)	0.3413
	1	6 (40.00)	9 (60.00)		8 (25.00)	24 (75.00)	
Missing teeth	0	70 (19.77)	284 (80.23)	0.0578	54 (18.62)	236 (81.38)	0.6486
	1	6 (40.00)	9 (60.00)		2 (25.00)	6 (75.00)	
Crowding	0	57 (20.14)	226 (79.86)	0.6951	21 (15.79)	112 (84.21)	0.2336
	1	19 (22.09)	67 (77.91)		35 (21.21)	130 (78.79)	
Spacing	0	50 (18.66)	218 (81.34)	0.1334	48 (20.00)	192 (80.00)	0.2775
	1	26 (25.74)	75 (74.26)		8 (13.79)	50 (86.21)	
Midline diastema	0	56 (19.86)	226 (80.14)	0.5279	45 (19.40)	187 (80.60)	0.6164
	1	20 (22.99)	67 (77.01)		11 (16.67)	55 (83.33)	
Maxillary irregularity	0	51 (19.03)	217 (80.97)	0.2255	37 (16.52)	187 (83.48)	0.0804
	1	25 (24.75)	76 (75.25)		19 (25.68)	55 (74.32)	
Mandibular irregularity	0	54 (20.38)	211 (79.62)	0.8682	49 (18.77)	212 (81.23)	0.9831
	1	22 (21.15)	82 (78.85)		7 (18.92)	30 (81.08)	
Maxillary overjet	0	8 (25.81)	23 (74.19)	0.4535	37 (18.50)	163 (81.50)	0.8538
	1	68 (20.12)	270 (79.88)		19 (19.39)	79 (80.61)	
Mandibular overjet	0	76 (20.94)	287 (79.06)	0.2085	12 (28.57)	30 (71.43)	0.0800
	1	0 (0.00)	6 (100.00)		44 (17.19)	212 (82.81)	
Molar relationship	0	41 (21.13)	153 (78.87)	0.7879	53 (18.15)	239 (81.85)	0.0481
	1	35 (20.00)	140 (80.00)		3 (50.00)	3 (50.00)	
Gender	1	37 (20.33)	39 (20.86)	0.9006	32 (18.60)	140 (81.40)	0.9230
	2	145 (79.67)	148 (79.14)		24 (19.05)	102 (80.95)	

cators for “speech capability”. As regards the 15-year-old sample, presence of mandibular overjet (OR=4.016) was a risk indicator for “speech capability” and molar relationship (OR=1.661) was a risk indicator for “chewing capability” (Tables 5 and 6).

## Discussion

Botazzo<sup>22</sup> presents how the problems arising from the concept of collective buccal health are seen as having the same nature and can only be faced using analytical categories from collective health or the social theory of health. Concern over appearance and dental attractiveness appears to be affected by gender, social class and age<sup>23,24</sup>. The place of esthetic and functional criteria in determining orthodontic treatment need cannot be underestimated, as these are major indications for patients seeking orthodontic services.

Due to the increasing global demand for orthodontic care, there is a need to develop meth-

ods to assess and grade malocclusion in order to prioritize treatment, particularly for publicly funded programs<sup>25</sup>.

Deviant occlusal traits are relatively easy to use, are identified by DAI, and link clinical and esthetic components mathematically to produce a single score<sup>11</sup>. The structure of the DAI consists of 10 prominent traits of malocclusion, weighted on the basis of their relative importance according to a panel of lay judges.

The DAI combines physical and esthetic aspects of occlusion, including patient perceptions. The DAI equation loses some precision when regression coefficients are rounded, but this small sacrifice in precision is offset by convenience in many clinical and research applications<sup>26</sup>. Moreover, its acceptance by the WHO as index will encourage international comparisons.

Epidemiological data concerning occlusal conditions have been accumulated by the WHO from all over the world using the DAI. The DAI is becoming a common standard for evaluating malocclusion, and WHO has recognized it as a cross-

**Table 3.** Univariate analyses of the association between “chewing capability” (dichotomization in bad/regular and good/excellent) and malocclusion in 12-15 year-old adolescents.

Independent variables	Absence (0), presence (1)	Dependent variable (Chewing capability)					
		12 years			15 years		
		bad, regular n (%)	good, excellent n (%)	p	bad, regular n (%)	good, excellent n (%)	p
Openbite	0	337 (95.20)	17 (4.80)	0.3849	73 (27.44)	193 (72.56)	0.1200
	1	15 (100.00)	0 (0.00)		13 (40.63)	19 (59.38)	
Missing teeth	0	337 (95.20)	17 (4.80)	0.3849	84 (28.97)	206 (71.03)	0.8071
	1	15 (100.00)	0 (0.00)		2 (25.00)	6 (75.00)	
Crowding	0	271 (95.76)	12 (4.24)	0.5421	70 (29.17)	170 (70.83)	0.8116
	1	81 (94.19)	5 (5.81)		16 (27.59)	42 (72.41)	
Spacing	0	256 (95.52)	12 (4.48)	0.8468	63 (27.16)	169 (72.84)	0.2236
	1	96 (95.05)	5 (4.95)		23 (34.85)	43 (65.15)	
Midline diastema	0	269 (95.39)	13 (4.61)	0.9962	75 (28.74)	186 (71.26)	0.9006
	1	83 (95.40)	4 (4.60)		11 (29.73)	26 (70.27)	
Maxillary irregularity	0	255 (95.15)	13 (4.85)	0.7160	65 (29.02)	159 (70.98)	0.9162
	1	97 (96.04)	4 (3.96)		21 (28.38)	53 (71.62)	
Mandibular irregularity	0	250 (94.34)	15 (5.66)	0.1234	61 (30.50)	139 (69.50)	0.3718
	1	102 (98.08)	2 (1.92)		25 (25.51)	73 (74.49)	
Maxillary overjet	0	29 (93.55)	2 (6.45)	0.6087	17 (40.48)	25 (59.52)	0.0730
	1	323 (95.56)	15 (4.44)		69 (26.95)	187 (73.05)	
Mandibular overjet	0	346 (95.32)	17 (4.68)	0.5873	83 (28.42)	209 (71.58)	0.2483
	1	6 (100.00)	0 (0.00)		3 (50.00)	3 (50.00)	
Molar relationship	0	187 (96.39)	7 (3.61)	0.3352	42 (24.42)	130 (75.58)	0.0481
	1	165 (94.29)	10 (5.71)		44 (34.92)	82 (65.08)	
Gender	1	171 (93.96)	11 (6.04)	0.1940	42 (31.58)	91 (68.42)	0.3522
	2	181 (96.79)	6 (3.21)		44 (26.67)	121 (73.33)	

cultural international index. Katoh et al.<sup>27</sup> confirmed that Japanese and Native Americans showed significantly poorer dental esthetics than found in American white populations<sup>9,28</sup>. The present study did not consider the sample in relation to nationalities or ethnic origins. However, average 20.0% of adolescents had no abnormality or minor malocclusion requiring no or slight orthodontic treatment need. The results of the present study were no correlation with the studies by Brazilian Oral Health Survey-2002-2003<sup>29</sup> (58.1%) and Frazão et al.<sup>30</sup> in São Paulo (71.3%) and Marques et al.<sup>31</sup> in Belo Horizonte (62.0%). The differences may have occurred through the methods of sample selection and the criteria used for diagnosis. A point to be considering is miscegenation existing in southern region, which may in some way have contributed to the occurrence of a lower prevalence of malocclusion in Maringá-PR.

The reasons for improved self-image are probably the result of age-related conditions<sup>32</sup>, rather than the effects of orthodontic treatment. The pattern of no change in self-esteem corroborates the finding in another study<sup>33</sup>. Orthodon-

tic treatment may enhance body image, and particularly facial image<sup>34</sup>. The results of this study showed that gender did not significantly influence an adolescent's orthodontic esthetic self-perception in 12- and 15-year-old people (Tables 2, 3 and 4), however, malocclusion measured by DAI, can strongly influence the perception of esthetic appearance.

In this study, a statistically significant relationship between self-perceived malocclusion and oral appearance/function in adolescents was verified. Missing teeth, openbite presence, mandibular overjet and molar relationship were risk indicators to speech and chewing capability. These findings indicate that the DAI can identify deviant occlusal traits, which suggests that community programs involving orthodontic treatment should take it into consideration during trials.

The association between a subject's perceptions of malocclusion and the DAI score was weak but significant in some variables. Molar relationship discrepancy was the only variable associated with poorer conditions of chewing capability, which supports the findings of Onyeaso and



**Table 4.** Univariate analyses of the association between report of pain (dichotomization in without and with) and malocclusion in 12-15 year-old adolescents.

Independent variables	Absence (0), presence (1)	Dependent Variable (report of pain)					
		12 years			15 years		
		without n (%)	with n (%)	p	without n (%)	with n (%)	p
Openbite	0	226 (63.84)	128 (36.16)	0.2002	178 (66.92)	88 (33.08)	0.2295
	1	12 (80.00)	3 (20.00)		18 (56.25)	14 (43.75)	
Missing teeth	0	231 (65.25)	123 (34.75)	0.1406	190 (65.52)	100 (34.48)	0.5771
	1	7 (46.67)	8 (53.33)		6 (75.00)	2 (25.00)	
Crowding	0	181 (63.96)	102 (36.04)	0.6936	161 (67.08)	79 (32.92)	0.3317
	1	57 (66.28)	29 (33.72)		35 (60.34)	23 (39.66)	
Spacing	0	176 (65.67)	92 (34.33)	0.4431	150 (64.66)	82 (35.34)	0.4462
	1	62 (61.39)	39 (38.61)		46 (69.70)	20 (30.30)	
Midline diastema	0	183 (64.89)	99 (35.11)	0.7753	169 (64.75)	92 (35.25)	0.3239
	1	55 (63.22)	32 (36.78)		27 (72.97)	10 (27.03)	
Maxillary irregularity	0	170 (63.43)	98 (36.57)	0.9848	150 (66.96)	74 (33.04)	0.4503
	1	68 (67.33)	33 (32.67)		46 (62.16)	28 (37.84)	
Mandibular irregularity	0	171 (64.53)	94 (35.47)	0.0185	129 (64.50)	71 (35.50)	0.5086
	1	67 (64.42)	37 (35.58)		67 (68.37)	31 (31.63)	
Maxillary overjet	0	26 (83.87)	5 (16.13)	0.3310	25 (59.52)	17 (40.48)	0.3572
	1	212 (62.72)	126 (37.28)		171 (66.80)	85 (33.20)	
Mandibular overjet	0	233 (64.19)	130 (35.81)	0.6833	190 (65.07)	102 (34.93)	0.0742
	1	5 (83.33)	1 (16.67)		6 (100.00)	0 (0.00)	
Molar relationship	0	127 (65.46)	67 (34.54)	0.4858	115 (66.86)	57 (33.14)	0.6435
	1	111 (63.43)	64 (36.57)		81 (27.18)	45 (35.71)	
Gender	1	115 (63.19)	67 (36.81)	0.6034	80 (60.15)	53 (39.85)	0.0663
	2	123 (65.78)	64 (34.22)		116 (70.30)	49 (29.70)	

**Table 5.** Stepwise logistic regression for 12-year-old adolescents.

Independent variables	Dependent variable speech capability (bad , regular)		OR	95% CI	p
	n	%			
Missing teeth					
absence	70	19.77	1.000	0.984 - 8.33	0.044
presence	6	40.00	2.865		
Openbite					
absence	70	19.77	1.000	0.984 - 8.33	0.0578
presence	6	40.00	2.865		

**Table 6.** Stepwise logistic regression for 15-year-old adolescents.

Independent variables	Dependent variable speech capability (bad , regular)		OR	95% CI	p
	n	%			
Mandibular overjet					
absence	53	38.15	1.000	0.773 - 20.833	0.0481
presence	3	50.00	4.016		
Molar relationship				1.002 - 2.754	0.0481
absence	42	24.42	1.000		
presence	44	34.92	1.661		

Aderinokun<sup>11</sup>. The statistical association between malocclusion and speech capability verified in this study does not support the findings of Shue-Te Yeh et al<sup>35</sup>.

The analyses revealed (Table 4) an association between self-perception relating to "report of pain" and malocclusion, expressed by mandibular irregularity, which seems to confirm the interaction between functional aspects of occlusion and pain ( $p < 0.01$ ). Thus, DAI scores could be significantly associated with perception of need for treatment<sup>36</sup>.

The answers to the questionnaire indicated that the adolescents in the sample reported pleasant esthetics as an important factor for psychosocial well being. In general, this study showed that orthodontic treatment is accepted as an important part of the health service, especially due to the psychological impact of malocclusion on self-esteem. These findings highlight the importance of introducing a perceptual measure of the esthetic impact of malocclusion, in addition to measuring normative orthodontic treatment need.

Since the DAI has been accepted by the WHO, more clinic-based studies (demand populations)

should be encouraged across the globe. This could be helpful in assessing the severity of malocclusions being treated in several parts of the world, as this is different from epidemiological reports, at least for the purposes of comparison<sup>25</sup>.

The malocclusion perception measured by the DAI was associated with three dependent variables (speech capability, chewing capability and report of pain), which could suggest that in future studies, there may be value in pursuing further refinement of ways to measure these traits, as these may be important dimensions of oral health perceptions, and potential targets for interventions with the aim of improving use of and access to care.

## Conclusions

The impact of malocclusion on adolescents' lives was confirmed in this study. Speech and chewing capability were associated with orthodontic deviations, which should be taken into consideration in oral health planning, to identify risk groups and improve community health services.

## Collaborations

SHC Sales-Peres participated in the theoretical design, construction methodology, writing and research, as well as the review the final text; S Goya participated in the research; KL Cortellazzi and GMB Ambrosiano participated in the statistical analysis; MC Meneghim and AC Pereira participated in the review the final text.

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