

SCIENTIFIC  
SECTION

# Aesthetic impact of malocclusion in the daily living of Brazilian adolescents

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**Objective:** The aim of the present study was to determine the biopsychosocial impact of malocclusion on the daily living of Brazilian adolescents (14 to 18 years of age) through normative and subjective records and identify factors directly involved in the self-perception of malocclusions.

**Design:** Cross-sectional.

**Setting:** Public and private schools in the city of Belo Horizonte, Brazil.

**Subjects and methods:** The sample was made up of 403 adolescents, with no prior history of orthodontic treatment, who were selected randomly from a population of 182,291 students in the same age range. The oral impact of malocclusion was assessed using the Oral Impact on Daily Performance (OIDP), whereas clinical criteria were assessed using the Dental Aesthetic Index (DAI). Self-perception of dental aesthetics was assessed using the Oral Aesthetic Subjective Impact Scale (OASIS) and self-esteem was assessed using the Global Negative Self-Evaluation (GSE) scale. Other variables were assessed using questionnaires. The chi-square test, simple and multiple logistic regression analyses were used for the statistical analysis.

**Results:** Ninety five adolescents (24%) reported feeling embarrassed to smile (aesthetic impact). A logistic regression suggested that the following variables were directly involved in the self-perception of malocclusion: upper anterior crowding  $\geq 2$  mm ( $P=0.009$ ), median diastema  $\geq 2$  mm ( $P=0.040$ ), normative treatment need (highly desirable) ( $P<0.001$ ) and low economic level ( $P<0.001$ ).

**Conclusion:** Negative repercussions on daily living were found in Brazilian adolescents with malocclusions affecting anterior dental aesthetics.

**Key words:** Aesthetics, quality of life, malocclusion, adolescents

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## Introduction

Current scientific evidence on the aesthetic repercussions of malocclusion on quality of life has yet to provide definitive conclusions on the issue. The demarcation between acceptable and unacceptable occlusion is influenced by psychological and social factors as well as measurement methods regarding subjective or perceived needs.<sup>1</sup> Recent studies, such as those by Marques *et al.* and Bernabé *et al.*, have reported that compromised aesthetics stemming from malocclusions have a significant impact on the quality of life of children between 10 and 14 years of age.<sup>2,3</sup> However, there is a gap in the literature regarding the effects of malocclusions in adolescents. During adolescence physical appearance takes on significant importance, as the

construction of personal identity in this period necessarily includes one's relationship with one's own body. Between the ages of 14 and 18 years, there is full identification with one's peer group, along with the search for identity and a place in society. With puberty established, adolescents seek to improve their image through physical culture and clothing.<sup>4</sup>

It is calculated that 25% of the current world population is made up of teenagers and Latin America has two thirds of the adolescent population of the American continents. Approximately 80% of a population of 1.5 billion youths in the world between 10 and 24 years of age live in developing countries.<sup>5</sup> Regarding the problems that teenagers experience, migration to urban areas is recognized as an aggravating factor in the growth of the young population in Latin America,

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which further hinders the access of this group to education, work and healthcare, resulting in an increase in delinquency and teenage violence.<sup>6</sup>

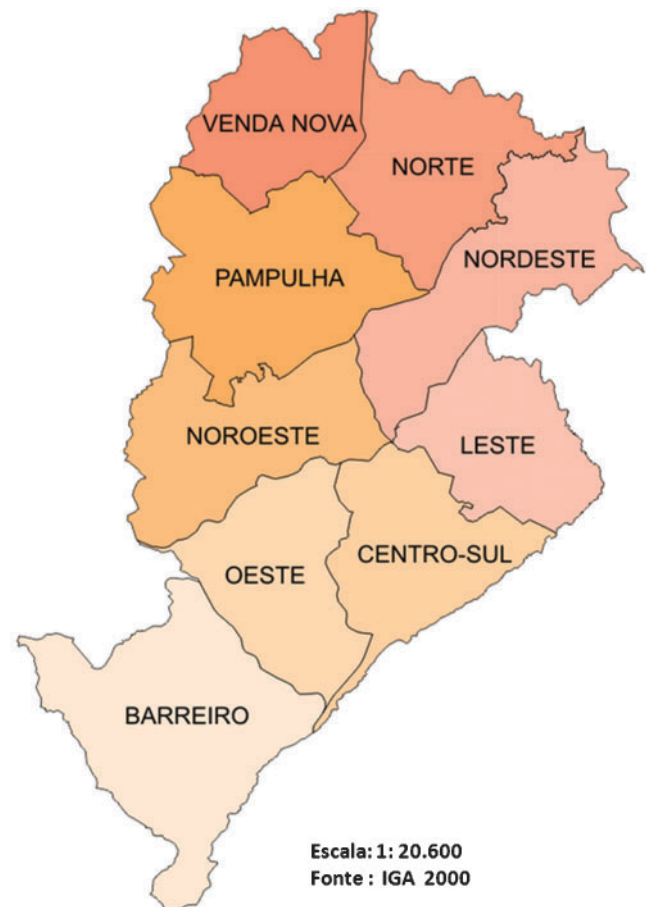
In such a context, it is important to have a greater comprehension of the biopsychosocial aspects of malocclusions and their repercussions on the quality of life of adolescents, addressing the issue as a public health problem. Information on this issue may favour a better assessment of treatment needs and priorities as well as contribute toward a better planning of the resources necessary for access to orthodontic treatment on the part of the population.<sup>2,7,8</sup> Thus, the aim of the present study was to determine the biopsychosocial repercussions of malocclusions on the daily living of Brazilian adolescents and young adults through normative and subjective records and identify factors directly involved in the self-perception of malocclusions.

## Materials and methods

This cross-sectional study was carried out between March and July 2007 and involved students at public and private schools in the city of Belo Horizonte (Brazil). Ethical approval was obtained from the Research Ethics Committee of the University of Vale do Rio Verde (UNINCOR) under process number 0015.0.380.000/07. Participants were randomly selected from a population of 182,291 students (102,083 females and 80,208 males), aged 14 to 18 years with no prior history of orthodontic treatment.

Belo Horizonte is the fifth largest city in Brazil and has approximately two million inhabitants. It is an industrialized city, with considerable economic, social and cultural disparities. The Municipal Secretary of Health organizes services based on the territorial layout of the city, which is divided into nine districts (Figure 1). Each district therefore has defined geographic, population and administrative dimensions.

To ensure that the sample was representative a distribution was determined in proportion to the actual distribution of schoolchildren throughout the city, based on the following steps. From information provided by local authorities (Health Council and Education Council), the percentage distribution of students between 14 and 18 years of age pertaining to each health district was calculated. Using data from the sample calculation ( $n=448$ ), the distribution of participants was then established in proportion to the existing population in the respective school systems. In order to maintain a representative sample with regard to socio-economic factors, a simple random selection by lots of one public and one private school pertaining to each



**Figure 1** Division of the city of Belo Horizonte into nine administrative districts

district was performed, totalling 18 schools. In order to provide each member of the study population with an equal chance of being included, a random selection by lots of the participants was performed, using the list of student names provided by the director of each school (Table 1).

A sample size calculation was carried out with a standard error of 4.5% or less, 95% confidence interval and a 27% prevalence of aesthetic impact due to malocclusion.<sup>2</sup> A minimal sample size was established as 373 adolescents. In order to compensate for possible losses during the data collection, the decision was made to increase the sample by 20%, totalling 448 adolescents.

A letter was sent to the parents explaining the design and importance of the study and asking for the participation of their children, emphasizing that no negative consequences would come about by refusal to participate. Written consent for their children to take part was obtained from the parents.

The aesthetic impact of malocclusion on the daily activities of the adolescents was the dependent variable, recorded by the Oral Impact on Daily Performances (OIDP) measure.<sup>9</sup> The OIDP is an instrument for recording the impact of oral conditions on the capability of an individual to execute daily activities over the previous 6 months. This measure has the advantage of being objective and addressing the principal psychosocial consequences of dental problems. Aesthetic impact was considered when a participant reported being embarrassed to smile due to missing front teeth, the position of his/her teeth (crooked teeth or teeth projecting forward), the shape or size of his/her teeth and deformity of his/her mouth or face. The dependent variable was dichotomized into individuals with aesthetic impact (OIDP=1) and those without aesthetic impact (OIDP=0).

For the analysis of specific types of malocclusion and the normative need for orthodontic treatment, the criteria of the Dental Aesthetic Index (DAI) were adopted.<sup>10</sup> After measurement, the equation for the calculation of the values was applied. The DAI provides four outcome possibilities: normality or mild malocclusion, the treatment of which is unnecessary (DAI=25); defined malocclusion, the treatment of which is elective (DAI=26 to 30); severe malocclusion, the treatment of which is highly desirable (DAI=31 to 35); and very severe or incapacitating malocclusion, for which orthodontic treatment is fundamental (DAI=36). This variable was dichotomized into no treatment need (DAI=25) and treatment need (DAI>25).

A clinical examination was performed by a single orthodontist (CABF), who had previously participated in a training and standardization exercise for the criteria used in the identification of the different types of malocclusion. Intra-examiner agreement for each type of malocclusion was good to excellent (maximal and minimal Kappa values were 1.00 and 0.75, respectively). The adolescents were examined in a room offered by the school at predetermined times. The necessary instruments and materials were sterilized and packed in sufficient amounts for each day of work.

Self-perception of dental aesthetics was assessed using the Oral Aesthetic Subjective Impact Scale (OASIS).<sup>11</sup> The final result is obtained by adding the questionnaire responses to the value of the photograph selected on the aesthetic component of the Index of Orthodontic Treatment Need (IOTN-AC), thereby obtaining a single score. The variable was dichotomized into 0=positive self-perception (OASIS<14) and 1=negative self-perception (OASIS=14). Self-esteem was assessed using the Global Negative Self-Evaluation (GSE) based on the following scores: 1.0 to 2.69 (0=high self-esteem) and 2.7 to 6.0 (1=self-esteem).<sup>12</sup>

The desire of the adolescents and young adults for orthodontic treatment and demographic variables (age and gender) was investigated using a questionnaire administered to the participants. The parents also responded to a questionnaire regarding their perception of their child's dental aesthetics (0=satisfactory, 1=unsatisfactory), need for orthodontic treatment

**Table 1** Sample distribution in relation to regions and types of school

Regions	Total no. of students	Percentage	No. of students for evaluation	No. and percentage of students, education system		
Barreiro	21,096	11.6	52	State	46	(10.3%)
				Private	6	(1.3%)
Central-south	39,885	21.9	98	State	55	(12.3%)
				Private	43	(9.6%)
East	18,395	10	45	State	39	(8.7%)
				Private	6	(1.3%)
Northeast	17,868	9.8	44	State	35	(7.8%)
				Private	9	(2%)
Northwest	19,903	10.9	49	State	36	(8%)
				Private	13	(2.9%)
North	13,100	7.2	32	State	27	(6%)
				Private	5	(1.2%)
West	17,798	9.8	44	State	30	(6.7%)
				Private	14	(3.1%)
Pampulha	15,237	8.3	37	State	25	(5.6%)
				Private	12	(2.7%)
Venda nova	19,009	10.5	47	State	40	(9.0%)
				Private	7	(1.5%)
Total	182,291	100	448		448	

(0=No, 1=Yes) and the reasons their child was not in treatment.

The criteria of the Brazilian Economic Classification (BEC) was used to determine the socioeconomic classification.<sup>13</sup> The BEC includes a series of questions on household possessions, such as bathroom, radio, television, washing machine, car and full-time house-keeper as well as father's schooling and mother's schooling. Scores for this variable are 0=high, 1=intermediate and 2=low.

All measures in the present study had been previously employed in studies by Marques *et al.*<sup>2,8</sup> Nonetheless, they were tested again in a pilot study with 80 adolescents (participants in the pilot study were not included in the main study).

Associations between the dependent variable and independent variables were tested using univariate analysis (chi-square test and Fisher's exact test) and both simple and multiple logistic regression analysis. The significance level was set at  $P < 0.05$ .

## Results

A total of 448 adolescents and their respective parents were invited to take part in the study and 403 (90%) agreed to participate. The reasons for non-participation included lack of authorization from the parents (8%) or not being in school the day the study team were present (2%). The characteristics of the individuals who did not participate were examined with regard to type of school (public or private) and administrative region of Belo Horizonte and found to be similar to those who did participate, therefore we considered that the sample was representative of the population. There were 142 (35%) males and 261 (65%) females; 203 (50%) were between 14 and 15 years of age and 200 (50%) were between 16 and 18 years of age.

Ninety five adolescents [24% (95% CI= 20%–28%)] reported feeling embarrassed to smile due to missing front teeth, the position of the teeth (crooked teeth or teeth projecting forward), the shape or size of the teeth

**Table 2** Bivariate analysis of the relationship between aesthetic impact due to malocclusion and type of malocclusion, using the chi-square test

	Aesthetic impact – OIDP		$\chi^2$	P
	No n (%)	Yes n (%)		
Malocclusion				
Absent	159 (77.6)	46 (22.4)	29.3	<0.001
Present	102 (51.8)	95 (48.2)		
Missing teeth				
None	257 (66.1)	132 (33.9)	*Fisher	0.041
One or more	5 (35.7)	9 (64.3)		
Anterior open bite				
<2 mm	243 (66.0)	125 (34.0)	1.9	0.164
>2 mm	19 (54.3)	16 (45.7)		
Upper anterior crowding				
<2 mm	162 (74.7)	55 (25.3)	19.2	<0.001
>2 mm	100 (53.8)	86 (46.2)		
Lower anterior crowding				
<2 mm	107 (69.0)	48 (31.0)	1.8	0.181
>2 mm	155 (62.5)	93 (37.5)		
Anterior segment spacing				
None	206 (65.8)	107 (34.2)	3.9	0.529
One or two segments	56 (62.2)	34 (37.8)		
Median diastema				
<2 mm	241 (66.9)	119 (33.1)	5.5	0.019
>2 mm	21 (48.8)	22 (51.2)		
Anterior maxillary overjet				
<4 mm	226 (70.8)	93 (29.2)	22.9	<0.001
>4 mm	36 (42.9)	48 (57.1)		
Anterior mandibular overjet				
No	252 (66.0)	130 (34.0)	2.9	0.086
Yes	10 (47.6)	11 (52.4)		

\*Fisher's exact test.

and deformity of the mouth or face. Statistically significant associations were found between the aesthetic impact and the following types of malocclusion: missing teeth in anterior region (one or more) ( $P=0.041$ ); upper anterior crowding  $\geq 2$  mm ( $P<0.001$ ); median diastema  $\geq 2$  mm ( $P=0.019$ ) and anterior maxillary overjet  $\geq 4$  mm ( $P<0.001$ ) (Table 2). There were significant correlations between the aesthetic impact and the biopsychosocial variables except for gender ( $P=0.214$ ), age ( $P=0.672$ ) and self-esteem ( $P=0.628$ ) (Table 3).

The results of the logistic regression indicate that the following variables are risk factors for causing aesthetic impact: upper anterior crowding  $\geq 2$  mm ( $P=0.009$ ),

median diastema  $\geq 2$  mm ( $P=0.040$ ), normative treatment need (highly desirable) ( $P<0.001$ ) and low economic level ( $P<0.001$ ) (Table 4). The final model showed a good fit (Hosmer and Lemeshow test,  $P=0.89$ ).

## Discussion

The results of the present study revealed that 95 (24%) of the adolescents exhibited an aesthetic impact on daily living due to malocclusion. Upper anterior crowding and median diastema were determinant factors. A

**Table 3** Bivariate analysis of the relationship between aesthetic impact due to malocclusion and biopsychosocial variables, using the chi-square test

	Aesthetic impact – OIDP		$\chi^2$	<i>P</i>
	No <i>n</i> (%)	Yes <i>n</i> (%)		
Normative treatment need (DAI)				
No need	159 (77.6)	46 (22.4)	39.5	<0.001
Elective	63 (62.4)	38 (37.6)		
Highly desirable	39 (40.6)	57 (59.4)		
Desire for treatment				
No	81 (93.1)	6 (6.9)	38.5	<0.001
Yes	181 (57.3)	135 (42.7)		
Need for treatment (parents)				
No	92 (88.5)	12 (11.5)	35.5	<0.001
Yes	162 (55.9)	128 (44.1)		
Aesthetic self-perception (OASIS)				
Positive	177 (88.9)	22 (11.1)	103.1	<0.001
Negative	81 (40.5)	119 (59.5)		
Parents' perception (child's aesthetics)				
Satisfactory	203 (77.5)	59 (22.5)	59.9	<0.001
Unsatisfactory	50 (37.9)	82 (62.1)		
Gender				
Male	98 (69.0)	44 (31.0)	1.5	0.214
Female	164 (62.8)	97 (37.2)		
Age				
14–15 years	134 (66.0)	69 (34.0)	0.2	0.672
16–18 years	128 (64.0)	72 (36.0)		
Self-esteem (GSE)				
High	244 (65.2)	130 (34.8)	0.2	0.628
Low	17 (60.7)	11 (39.3)		
Socioeconomic level				
High	111 (81.0)	26 (19.0)	32.1	<0.001
Intermediate	114 (62.6)	68 (37.4)		
Low	37 (44.0)	47 (56.0)		
Father's schooling				
$\geq 8$ years	164 (69.8)	71 (30.2)	8.5	0.004
$< 8$ years	78 (54.9)	64 (45.1)		
Mother's schooling				
$\geq 8$ years	174 (71.9)	68 (28.1)	15.8	<0.001
$< 8$ years	73 (51.8)	68 (48.2)		

number of studies on the self-perception of malocclusion have found that upper anterior crowding and maxillary overjet  $\geq 4$  mm are the most significant conditions for dissatisfaction with dental-facial appearance.<sup>2,14-18</sup> This suggests that Brazilian teenagers are more tolerant of

accentuated overjet than median diastema  $\geq 2$  mm. In this context, adolescents and young adults Peruvians considered that the presence of upper labial spacing, more than incisal irregularity, was the occlusal characteristic with the most negative influence on self-

**Table 4** Univariate and multivariate logistic regression analysis considering associations between the dependent variable (aesthetic impact) and independent variables

	Unadjusted OR (95% CI)	P	Adjusted OR * (95% CI)	P
Malocclusion				
Absent	1			
Present	3.22 (2.1-4.9)	<0.001		
Missing teeth				
None	1			
One or more	3.51 (1.2-10.7)	0.027		
Upper crowding				
<2 mm	1		1	
$\geq 2$ mm	2.53 (1.7-3.9)	<0.001	2.01 (1.2-3.4)	0.009
Median diastema				
<2 mm	1		1	
$\geq 2$ mm	2.12 (1.1-4.0)	0.021	2.26 (1.1-4.9)	0.040
Upper overjet				
<4 mm	1			
$\geq 4$ mm	3.24 (2.0-5.3)	<0.001		
Lower overjet				
No	1			
Yes	2.13 (0.9-5.2)	0.092		
Normative treatment need (DAI)				
No need	1		1	
Elective	2.09 (1.2-3.5)	0.006	1.4 (0.7-2.5)	0.295
Highly desirable	5.05 (2.9-8.5)	<0.001	2.9 (1.6-5.4)	<0.001
Desire for treatment				
No	1			
Yes	10.07 (4.3-23.8)	<0.001		
Need for treatment (parents)				
No	1			
Yes	6.06 (3.2-11.5)	<0.001		
Aesthetic self-perception (OASIS)				
Positive	1			
Negative	11.82 (7.0-20.0)	<0.001		
Parents' perception (child's aesthetics)				
Satisfactory	1			
Unsatisfactory	5.64 (3.6-8.9)	<0.001		
Socioeconomic level				
High	1		1	
Intermediate	2.55 (1.5-4.3)	<0.001	1.83 (1.1-3.2)	0.037
Low	5.42 (2.9-9.9)	<0.001	3.98 (2.1-7.7)	<0.001
Father's schooling				
$\geq 8$ years	1			
<8 years	1.89 (1.2-2.9)	0.004		
Mother's schooling				
$\geq 8$ years	1			
<8 years	2.38 (1.5-3.7)	<0.001		

\*Adjusted for gender and age. All variables are in the same model.

perceived dental appearance.<sup>19</sup> On the other hand, a study with adolescents in Brazil, showed that maxillary and mandibular overjet, centreline deviation, dental spacing, openbite, and maxillary irregularity were, in that order, directly associated with the presence of impacts on the quality of life attributed to malocclusion.<sup>20</sup> The reasons for these variations in the self-perception of specific dentofacial aesthetics in different populations is not apparent and comparisons must be carried out carefully. Adolescents with a low economic level and those for whom the normative need for treatment was considered highly desirable also had greater chances of experiencing aesthetic impact. This result was expected, as adolescents from underprivileged social classes do not have the same access to orthodontic treatment as those pertaining to more privileged classes.<sup>11,21,22</sup> Furthermore, 78.5% of the teenage participants in the present study reported the desire to wear an orthodontic appliance and 69% of the parents reported that their children were not in treatment due to the high costs. Thus, along with the high prevalence of malocclusion (49%), the results offer evidence of concern and desire on the part of the population for access to orthodontic treatment.

No significant associations were found in the present study between aesthetic impact and gender, age group or self-esteem. This suggests that in this phase of life, adolescents perceive the psychosocial effect of malocclusion in a homogeneous fashion. However, other studies have found that females are stricter with regard to the self-perception of facial aesthetics than males and that children with low self-esteem are more sensitive to the aesthetic effects of malocclusions.<sup>2,15,17,21,23,24</sup> These differences may be explained by differences in study designs, measures, age groups and populations.

This is the second study carried out in Brazil in which subjective criteria prevail over normative criteria when considering the need for orthodontic treatment.<sup>8</sup> The majority (78.5%) of the teenage participants in the present study reported a self-perceived need to wear an orthodontic appliance, whereas just 49% were judged in the treatment need category according to a normative index (DAI). This finding underlines the aesthetic values and importance society attributes to straight teeth and physical attractiveness in general.

Although the data collection had been thoroughly planned, we had a 10% dropout rate. A number of authors have reported that sample losses can trigger distortions in the results if distributed in an unequal fashion. In the present study, we found that dropouts occurred randomly and produced no significant effect on the results of the investigation, therefore we consider

that the final sample can be generalized to the entire population.

A number of authors have indicated their preference for the use of prevalence rate ratios (RR) rather than the more frequently encountered odds ratios (OR), especially when the prevalence of the outcome is 20% or less. In such cases, the OR overestimates prevalence ratios.<sup>25</sup> Although both measures (RR and OR) furnish responses in the same direction, there is a possibility of an overestimation of the OR in the present study.

Most studies in the literature on aesthetic impact and malocclusion have methodological limitations that can compromise the credibility of the results. Such limitations include a small sample size, lack of a representative sample, lack of random sampling and inadequate data collection instruments. The present study rigorously followed the basic presuppositions for ensuring the sample was representative of a population of 182,291 adolescents between 14 and 18 years of age and used validated instruments previously tested in another study carried out in the same country.<sup>2</sup> It should be stressed, however, that this is a cross-sectional study, for which the data related to each individual in the sample at a particular moment in their lives (for example, household income and self-esteem). Therefore longitudinal studies are needed to enable a greater understanding of the long-term effects of malocclusion on the quality of life of individuals.

## Conclusions

- Conditions that affect dental aesthetics have an influence on the psychological wellbeing and social interactions among Brazilian teenagers.
- Upper anterior crowding, median diastema  $\geq 2$  mm, low economic level and the normative need for orthodontic treatment (highly desirable) are factors that are directly involved in the aesthetic impact on quality of life.

## Contributor statement

Leandro Silva Marques and Maria Leticia Ramos-Jorge were responsible for study design; data analysis and data interpretation; drafting, critical revision, and final approval of the article.

Cid Afonso Buldrini Filogônio e Cíntia Buldrini Filogônio was responsible for recruitment of participants and data collection, obtaining funding; logistic, administrative, and technical support.

Luciano Pereira, Saul Paiva and Isabela Pordeus were responsible for critical revision, and final approval of the article. Leandro Silva Marques is the guarantor.

## References

1. Peres KG, Traebert ES, Marcenes W. Differences between normative criteria and self-perception in the assessment of malocclusion. *Rev Saude Publica* 2002; **36**: 230–36.
2. Marques LS, Ramos-Jorge ML, Paiva SM, Pordeus IA. Malocclusion: esthetic impact and quality of life among Brazilian schoolchildren. *Am J Orthod Dentofacial Orthop* 2006; **129**: 424–27.
3. Bernabé E, Flores-Mir C, Sheiham A. Prevalence, intensity and extent of Oral Impacts on Daily Performances associated with self-perceived malocclusion in 11–12-year-old children. *BMC Oral Health* 2007, available at: <http://www.biomedcentral.com/1472-6831/7/6> (accessed 4 March 2009).
4. Tiba I. *Puberty and adolescence: biopsychosocial development*. São Paulo: Agora, 1986.
5. Capelatto A. Another day had said me that I have low self-esteem. What is this? BVS Adolec, available at: <http://www.bireme.br/bvs/adolec> (accessed 13 July 2003).
6. Goldstein G, Kickbusch I. WHO Healthy Cities Programme. *Urban Health News* 1996; **28**: 7–13.
7. Oliveira CM, Sheiham A. Orthodontic treatment and its impact on oral health-related quality of life in Brazilian adolescents. *J Orthod* 2004; **31**: 20–27.
8. Marques LS, Barbosa CC, Ramos-Jorge ML, Pordeus IA, Paiva SM. Malocclusion prevalence and orthodontic treatment need in 10–14-year-old schoolchildren in Belo Horizonte, Minas Gerais State, Brazil: a psychosocial focus. *Cad Saude Publica* 2005; **21**: 1099–06.
9. Adulyanon S, Vourapukjaru J, Sheiham A. Oral impacts affecting daily performance in a low dental disease Thai population. *Community Dent Oral Epidemiol* 1996; **24**: 385–89.
10. Cons NC, Jenny J, Kohout FJ, Freer TJ, Eismann D. Perceptions of occlusal conditions in Australia, the German Democratic Republic and the United States of America. *Int Dent J* 1983; **33**: 200–06.
11. Mandall NA, McCord JF, Blinkhorn AS, Worthington HV, O'Brien KD. Perceived aesthetic impact of malocclusion and oral self-perceptions in 14–15-year-old Asian and Caucasian children in greater Manchester. *Eur J Orthod* 2000; **22**: 175–83.
12. Alsaker FD, Olweus D. Global self-evaluations and perceived instability of self in early adolescence: a cohort longitudinal study. *Scand J Psychol* 1993; **34**: 47–63.
13. ABEP – Brazilian Association of Companies of Research, available at: <http://www.abep.org> (accessed 12 December 2007).
14. Ingervall B, Hedegard B. Awareness of malocclusion and desire of orthodontic treatment in 18-year old Swedish men. *Acta Odontol Scand* 1974; **32**: 93–101.
15. Shaw WC, Meek SC, Jones DS. Nicknames, teasing, harassment and the salience of dental features among school children. *Br J Orthod* 1980; **7**: 75–80.
16. Gosney MB. An investigation into some of the factors influencing the desire for orthodontic treatment. *Br J Orthod* 1986; **13**: 87–94.
17. Helm S, Petersen PE, Kreiborg S, Solow B. Effect of separate malocclusion traits on concern for dental appearance. *Community Dent Oral Epidemiol* 1986; **14**: 217–220.
18. Kilpelainen PV, Phillips C, Tulloch JF. Anterior tooth position and motivation for early treatment. *Angle Orthod* 1993; **63**: 171–74.
19. Bernabé E, Flores-Mir C. Influence of anterior occlusal characteristics on self-perceived dental appearance in young adults. *Angle Orthod* 2007; **77**: 831–36.
20. Bernabé E, de Oliveira CM, Sheiham A. Condition-specific sociodental impacts attributed to different anterior occlusal traits in Brazilian adolescents. *Eur J Oral Sci* 2007; **115**: 473–78.
21. Kenealy P, Frude N, Shaw W. An evaluation of the psychological and social effects of malocclusion: some implications for dental policy making. *Soc Sci Med* 1989; **28**: 583–91.
22. 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**: 241–47.
23. Shaw WC. Factors influencing the desire for orthodontic treatment. *Eur J Orthod* 1981; **3**: 151–62.
24. Pietilä T, Pietilä I. Parent's view on their own child's dentition compared with an orthodontist's assessment. *Eur J Orthod* 1994; **16**: 309–16.
25. Lee J. Odds ratio or relative risk for cross-sectional data? *Int J Epidemiol* 1994; **23**: 201–03.