Original Article

Malocclusion and oral health-related quality of life in Brazilian school children
A population-based study

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ABSTRACT

Objective: To test the hypothesis that malocclusion and its impact on quality of life has no effect on 8- to 10-year-old Brazilian schoolchildren as measured by an oral health-related quality of life (OHRQoL) instrument.

Materials and Methods: A cross-sectional study was carried out with a population-based sample of 1204 8- to 10-year-old children attending elementary schools in Belo Horizonte, Brazil. Dental examinations were carried out by two calibrated examiners. OHRQoL was assessed using the Brazilian version of the Child Perceptions Questionnaire. The Dental Aesthetic Index was used for the clinical assessment of malocclusion. Dental caries and socioeconomic factors were used as controlling variables. Bivariate analysis involved the chi-square test and the Fisher exact test. A Poisson regression model was employed for the multivariate analysis ($P < .05$).

Results: Anterior segment spacing and anterior mandibular overjet were significantly associated with impact on OHRQoL ($P < .05$). Schoolchildren with malocclusion were 1.30-fold (95% CI: 1.15–1.46; $P < 0.001$) more likely to experience a negative impact on OHRQoL than those without malocclusion. Children belonging to families with an income less than or equal to two times the minimum wage were 1.59-fold (95% CI: 1.35–1.88; $P < 0.001$) more likely to experience a negative impact on OHRQoL than those belonging to families with the highest income.

Conclusions: Schoolchildren with malocclusion from lower-income families experience a greater negative impact on OHRQoL. (*Angle Orthod.* 2013;83:83–89.)

KEY WORDS: Oral health-related quality of life; Malocclusion; Children

INTRODUCTION

Perceptions regarding health status and physical, psychological, social, and material aspects characterize the multidimensional concept of quality of life, which can be satisfactorily addressed when individuals are evaluated based on their own experiences.[1] In order to evaluate subjective perceptions, such as pain, esthetics, and functionality, indicators of oral health-related quality of life (OHRQoL) are used to determine the impact of oral conditions.[2]

Esthetic appearance plays an important role in social interactions and psychological well-being. The appearance of the mouth and smile has a significant impact on judgments regarding facial attraction. Thus, malocclusion may adversely affect social interactions and psychological well-being.[3–7]

Orthodontic treatment traditionally focuses on normative, clinician-measured criteria based on occlusal indices, despite the fact that the psychosocial impact of dental esthetics has equal importance.[3,5] Dissatisfaction with the alignment of the teeth, missing teeth, and peer-based teasing due to the appearance of the teeth are factors that influence self-perceptions regarding the need for orthodontic treatment among Brazilian schoolchildren.[8] However, the majority of the studies that investigated the impact of malocclusion on

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OHRQoL focused on adolescents with permanent dentition.[3–5,8–18]

As children's feelings about their dental appearance begin early, at about 8 years of age, children have criteria similar to those of adults regarding the self-perception of body image. Occlusal changes may occur in the mixed dentition and affect self-image. Therefore, it is important to evaluate the occlusion in the mixed dentition and early permanent dentition in order to avoid further functional and psychological harm. Thus, the assessment of the need for orthodontic treatment should also consider the child's age.[19,20] Moreover, there is a lack of studies addressing the impact of malocclusion in the mixed dentition. Especially lacking are studies dealing with the psychosocial factors that influence the demand for orthodontic treatment.

It is important to address the malocclusion as a public health problem, because it has a high prevalence and it is preventable and treatable. For this it is necessary to understand the biopsychosocial aspects of malocclusion and its effect on quality of life of individuals.[3,4] Given the lack of representative population-based studies addressing this subject in the extant literature, the aim of the present study was to evaluate factors associated with malocclusion and its impact on the quality of life of 8- to 10-year-old Brazilian schoolchildren.

MATERIALS AND METHODS

This study received approval from the Human Research Ethics Committee of the Federal University of Minas Gerais, Brazil. Prior to data collection, only those children and parents/guardians who agreed to participate by signing a statement of informed consent were included in the study.

Study Design and Sample Characteristics

A cross-sectional study was carried out at public and private elementary schools in the city of Belo Horizonte, Brazil, from March to December 2010. Belo Horizonte is divided into nine administrative districts. To ensure the representativeness of the sample, children were selected in proportion to the distribution of schoolchildren and public and private institutions in the different districts. For such, a two-stage sampling method was employed. The first stage was the randomization of public and private schools in each administrative district. In the second stage, classes were randomly chosen from the schools selected. All 8- to 10-year-old children belonging to the selected classrooms were invited to participate. For those who expressed interest, the researcher sent a letter to the parents explaining the purpose, characteristics, importance, and methods of the study and requesting written consent for participation of their children.

The sample size was calculated to give a standard error of 3%, a 95% confidence interval, and a 62.6% prevalence of malocclusion.[4] A correction factor of 1.2 was applied to increase the precision, as a multistage sampling method was adopted rather than random sampling.[21] The minimal sample size needed to satisfy the requirements was estimated at 1197 children, to which 20.0% was added ($n = 1436$) to compensate for potential losses due to refusal to participate.

The inclusion criteria were either gender, age 8 to 10 years, presence at school on the day of data collection, and authorization from parent/guardian. The exclusion criterion was previous orthodontic treatment.

Calibration Exercise and Pilot Study

Seventy children were examined for malocclusion and dental caries by two examiners previously calibrated. Cohen kappa values for interexaminer agreement ranged from .78 to 1.00. Fifty children were reexamined after 2 weeks to assess intraexaminer agreement, for which Cohen kappa values ranged from .93 to 1.00.

A pilot study was carried out at a public school to test the methods and comprehension of the instruments. The children in the pilot study were not included in the main sample. The results demonstrated that there was no need to change the methodology proposed.

Clinical Oral Examination

Oral examinations were performed at school during daytime hours. The criteria of the Dental Aesthetic Index (DAI) were used to measure malocclusion, which was dichotomized as either absent ($DAI \leq 25$) or present ($DAI > 25$). The molar relationship was not analyzed as a single variable since it is not directly related to dental esthetics, but was retained for the calculation of the DAI, as it is a component of the DAI regression equation.

The criteria for the diagnosis of dental caries were based on World Health Organization recommendations, using the decayed, missing, and filled teeth index.[22] The children were allocated to two groups: those without untreated lesions (component $D = 0$) and those with one or more untreated lesions (component $D \geq 1$).

Nonclinical Oral Examination

Impact on OHRQoL was measured using the Brazilian version of the Child Perceptions Questionnaire ($CPQ_{8–10}$).[23] This instrument is made up of 25 items distributed among four subscales: oral

symptoms (five items), functional limitations (five items), emotional well-being (five items), and social well-being (10 items). The items address the frequency of events in the 4 previous weeks. A five-point rating scale is used, with the following options: never = 0, once/twice = 1, sometimes = 2, often = 3, and every day/almost every day = 4. $CPQ_{8–10}$ scores are calculated by summing all the item scores, with the total score ranging from 0 (no impact of oral condition on OHRQoL) to 100 (maximal impact of oral condition on OHRQoL). There are also two questions on patient identification (gender and age) and two global indicators asking the children for a global rating of their oral health and the extent to which the orofacial condition affects their overall well-being. For the statistical analysis, impact on OHRQoL was classified as either low impact ($CPQ_{8–10} \leq 10$) or high impact ($CPQ_{8–10} > 10$) based on median value of $CPQ_{8–10}$ total score.

A questionnaire addressing demographic data (child's birth date and gender, parents'/guardians' schooling, and place of residence) was sent to the parents/guardians. The Social Vulnerability Index (SVI) was used for the determination of socioeconomic status for the city of Belo Horizonte to determine the degree of social exclusion. This index measures the vulnerability of the population through the determination of neighborhood infrastructure, access to work, income, sanitation services, healthcare services, education, legal assistance, and public transportation.[24] A value of social exclusion is given for each region of the city, which is divided into five classes. For the statistical analysis, the SVI was grouped into two categories: "high social vulnerability" and "low social vulnerability."[24,25] Monthly family income (categorized based on the minimum wage used in Brazil—one minimum wage is roughly equal to US $258.33) and parents'/guardians' schooling (categorized in years of study) were also used as socioeconomic indicators.

Statistical Analysis

The Statistical Package for the Social Sciences (version 19.0; SPSS Inc, Chicago, IL, USA) was used for the data analysis. Descriptive analyses were performed (frequency distribution and cross-tabulation). The Kolmogorov-Smirnov test revealed that the normality of the sample could not be confirmed. The chi-square test and Fisher exact test were used to test associations between the impact on OHRQoL and the independent variables. Based on the Bonferroni correction, a *P* value less or equal to .017 was considered significant for the partition of the variables "family income," "parents/guardians," "schooling," and "anterior segment spacing." This *P* value resulted from the division of 0.05 by three (0.05/3; three 2 × 2 sub-tables were constructed as result of the partition for each variable). The Poisson regression model with robust variance was used for the multivariate analysis. Independent variables were introduced into the model based on their statistical significance ($P < .20$) and/or clinical epidemiological importance. The significance level was set at 5%.

Table 1. Frequency Distribution of Sample (n = 1204) According to Variables; Belo Horizonte, Brazil, 2010

Variables	Frequency n (%)
Child's gender	
Male	538 (44.7)
Female	666 (55.3)
Age (y)	
8	339 (28.2)
9	428 (35.5)
10	437 (36.3)
Malocclusion	
No	816 (67.8)
Yes	388 (32.2)
Presence of untreated dental caries	
No	926 (76.9)
Yes	278 (23.1)
Social vulnerability	
Low	759 (63.0)
High	445 (37.0)
Family income	318 (26.7)
≥5 minimum wages	288 (24.2)
3 to 4 minimum wages	586 (49.2)
≤2 minimum wages	
Parents'/guardians' schooling	
≥12 years of study (college)	300 (25.0)
9 to 11 years of study (high school)	474 (39.5)
≤8 years of study (elementary school)	426 (35.5)
Number of people in the household	
≤4 people	722 (60.0)
≥5 people	482 (40.0)

RESULTS

A total of 1204 children showing similar distribution in relation to gender (44.7% boys and 55.3% girls) and age (8 years: 28.2%, 9 years: 35.5%, and 10 years: 36.3%) and being representative of 8 to 10-year-old schoolchildren living in Belo Horizonte, Brazil, participated in the present study. The response rate was 83.8%.

A total of 388 (32.2%) had malocclusion, and 278 (23.1%) had untreated dental caries. Regarding the socioeconomic factors, the majority of children lived in areas of low social vulnerability (63.0%), had a monthly family income lower than or equal to two times the minimum wages (49.2%), had parents/guardians with less than 12 years of schooling (75.0%), and lived in a household with up to four residents (60.0%; Table 1).

Table 2. Bivariate Analysis of Associations Between OHRQoL and Independent Variables (n = 1204); Belo Horizonte, Brazil, 2010

Variables	OHRQoL		Unadjusted PR (95% CI)	*P* value*
	Low impact n (%)	High impact n (%)		
Child's gender				
Male	298 (55.4)	240 (44.6)	1	0.134
Female	340 (51.1)	326 (48.9)	1.09 (0.98–1.21)	
Type of child's school				
Private	181 (64.0)	102 (36.0)	1	**<0.001**
Public	457 (49.6)	464 (50.4)	1.29 (1.16–1.44)	
Number of people in the household				
≤4 people	401 (55.5)	321 (44.5)	1	**0.03**
≥5 people	237 (49.2)	245 (50.8)	1.13 (1.01–1.26)	
Family income				
≥5 minimum wages[a]	208 (65.4)	110 (34.6)	1.00	**<0.001**
3 to 4 minimum wages[a]	165 (57.3)	123 (42.7)	1.23 (1.01–1.51)	
≤2 minimum wages[b]	255 (43.5)	331 (56.5)	1.63 (1.38 –1.93)	
Parents'/guardians' schooling				
≥12 years of study[c]	204 (68.0)	96 (32.0)	1	**<0.001**
9 to 11 years of study[b]	247 (52.1)	227 (47.9)	1.50 (1.24–1.81)	
≤8 years of study[a]	186 (43.7)	240 (56.3)	1.76 (1.46–2.12)	
Social vulnerability				
Low	420 (55.3)	339 (44.7)	1	**0.033**
High	218 (49.0)	227 (51.0)	1.13 (1.01–1.27)	
Malocclusion				
No	472 (57.8)	344 (42.2)	1	**<0.001**
Yes	166 (42.8)	222 (57.2)	1.35 (1.19–1.54)	
Presence of untreated dental caries				
No	537 (58.0)	389 (42.0)	1	**<0.001**
Yes	101 (36.3)	177 (63.7)	1.60 (1.35–1.88)	

Values in parentheses refer to percentages between rows. OHRQoL indicates oral health-related quality of life; PR, prevalence ratio (obtained by adjusted Poisson regression with robust variance); CI, confidence interval.

* chi-square test; results in bold type significant at 5% level; Bonferroni corrections ($P < .017$); same letters indicate similarity between groups, different letters indicate differences between groups.

Negative impact on OHRQoL was significantly associated ($P < .05$) with presence of malocclusion, presence of untreated dental caries, and low socioeconomic factors (public schools, more people in household, lower family income, lower parents'/guardians' schooling, and higher social vulnerability; Table 2). No statistically significant association was found between OHRQoL and gender. The bivariate analysis demonstrated that most types of malocclusion were not significantly associated with OHRQoL. However, significant associations were found for anterior segment spacing and anterior mandibular overjet (Table 3).

In the Poisson regression model (Table 4), gender, social vulnerability, type of school, parents'/guardians' schooling, and number of people in household were initially included in the model. However, these variables did not remain in the final model, as they did not meet the statistical significance required. The model was also adjusted for untreated dental caries, which is a potential confounding variable. The final model revealed that schoolchildren with malocclusion were 1.30-fold (95% CI: 1.15–1.46; $P < .001$) more likely to experience a negative impact on OHRQoL than those without malocclusion, and those belonging to families with an income less than or equal to two times the minimum wage were 1.59-fold (95% CI: 1.35–1.88; $P < .001$) more likely to experience a negative impact on OHRQoL than those belonging to families with a higher income.

DISCUSSION

There is increasing interest in the impact of malocclusion on psychosocial well-being in childhood and adolescence. The experiences in childhood play a significant role in later years, and a negative dental appearance in childhood may be an object of teasing by other children.[26,27] In the present study, malocclusions in the anterior segment (anterior segment spacing and anterior mandibular overjet) were significantly associated with OHRQoL. This finding is consistent with previous studies, which indicate that

Table 3. Bivariate Analysis of Associations Between OHRQoL and Type of Malocclusion (n = 1204); Belo Horizonte, 2010

Variables	OHRQoL		*P* value
	Low impact n (%)	High impact n (%)	
Missing tooth			
No	632 (53.0)	560 (47.0)	0.835*
Yes	6 (50.0)	6 (50.0)	
Crowding			
Without crowding[a]	411 (55.2)	333 (44.8)	0.053*
One crowded segment[a]	170 (51.4)	161 (48.6)	
Two crowded segments[a]	57 (44.2)	72 (55.8)	
Anterior segment spacing			
Without spacing[a]	494 (56.5)	381 (43.5)	**<0.001***
One segment spacing[b]	112 (43.1)	148 (56.9)	
Two segments spacing[a,b]	32 (46.4)	37 (53.6)	
Median diastema			
≤2 mm	624 (53.5)	543 (46.5)	0.061*
>2 mm	14 (37.8)	23 (62.2)	
Upper anterior crowding			
≤2 mm	596 (53.6)	516 (46.4)	0.142*
>2 mm	42 (45.7)	50 (54.3)	
Lower anterior crowding			
≤2 mm	612 (53.0)	543 (47.0)	0.992*
>2 mm	26 (53.1)	23 (46.9)	
Anterior open bite			
≤2 mm	625 (53.5)	544 (46.5)	0.057*
>2 mm	13 (37.1)	22 (62.9)	
Anterior maxillary overjet			
≤4 mm	606 (54.7)	502 (45.3)	**<0.001***
>4 mm	32 (33.7)	63 (66.3)	
Anterior mandibular overjet			
No	617 (53.7)	532 (46.3)	**0.024***
Yes	21 (38.2)	34 (61.8)	

Values in parentheses refer to the percentages between rows. OHRQoL indicates oral health-related quality of life.

* chi-square test; Results in bold type significant at 5% level Bonferroni corrections ($P < .017$); same letters indicate similarity between groups, different letters indicate differences between groups.

segment spacing and mandibular overjet are among the conditions of most concern to children,[9–11,28,29] though anterior spacing, particularly a midline diastema and a missing tooth in the anterior segment, does not necessarily indicate a malocclusion in this age of group.

In the present study, schoolchildren with malocclusion experienced 30.0% more negative impact on OHRQoL than those without malocclusion, which is supported by a number of studies suggesting that unpleasing dental esthetics have a negative impact on psychosocial well-being.[4,12–14] However, three of these previous studies were carried out with adolescents,[4,12,13] and the other one, despite investigating children with an age group similar to that of the present study, did not use a validated instrument to measure the OHRQoL.[14] Individuals with malocclusion (particularly in the anterior region) may require orthodontic treatment in order to improve oral health, dental function, and esthetics, resulting in an improvement in OHRQoL. This statement is supported by the present study, since anterior segment spacing and anterior mandibular overjet were associated with negative OHRQoL, as well as by a previous study with a similar age group that showed that malocclusion in the anterior teeth, especially crowding and increased overjet, was a cause of concern for children.[14]

Schoolchildren belonging to families with low income were almost 60.0% more likely to experience a negative impact on OHRQoL than those from families with the highest income. This result is in agreement with another study carried out in Brazil that found that 69.0% of individuals were unable to enjoy the benefits of treatment due to the financial costs involved.[13] As orthodontic treatment is elective, and Brazilian public healthcare services do not offer orthodontic treatment, investigations into esthetic alterations stemming from malocclusion are particularly important for a better

Table 4. Poisson Regression Model Explaining Independent Variables in Children With Impact on OHRQoL (n = 1204); Belo Horizonte, Brazil, 2010[a]

Variables	Adjusted PR (95% CI)[b]	*P* value*
Malocclusion		
No	1	**<0.001**
Yes	1.30 (1.15–1.46)	
Family income		
≤2 minimum wages	1.59 (1.35–1.88)	**<0.001**
3 to 4 minimum wages	1.23 (1.00–1.50)	0.048
≥5 minimum wages	1	

[a] OHRQoL indicates oral health-related quality of life; PR, prevalence ratio (obtained by adjusted Poisson regression with robust variance); CI, confidence interval.

[b] Adjusted for control variables (dental caries, gender, social vulnerability, type of school, parents'/guardians' schooling, and number of people in household).

* Results in bold type significant at 5% level.

assessment of treatment needs and for predicting the demand for public resources. Previous studies have demonstrated that socioeconomic status influences the association between different oral conditions and OHRQoL.[8,11,13,14]

No statistically significant differences were found between genders regarding the impact of malocclusion on OHRQoL, which corroborates some previous studies.[12,13,15,16,30] However, gender has been described as a factor affecting the self-perception of dental appearance/malocclusion.[17,18,31]

The sample size calculation was based on a different age group, and this could be a limitation of the present study. However, there was no previous Brazilian data for malocclusion only in mixed dentition in the same age group. Moreover, the DAI was developed for permanent teeth and so has a tendency to be oversensitive during the mixed dentition period, possibly confounding the results due to the transitory developmental conditions.[32] Also, the CPQ as a generic measure of OHRQoL could not address aspects specifically related to malocclusion. Thus, some items were perceived not to be relevant to children with this condition, which may possibly be a weakness of this study. Moreover, cross-sectional studies have limitations inherent in the design, as such studies are carried out either at a single point in time or over a short period, so the associations identified cannot be considered a causal relationship.[25,32,33]

It is important to evaluate schoolchildren presenting both the late mixed dentition and early permanent dentition, as an early diagnosis may facilitate preventive or interceptive orthodontics, if necessary, taking advantage of the child's growth potential. The present study corroborates the literature, which reports that malocclusion, especially in the anterior teeth, can compromise a child's psychosocial well-being. This underscores the importance of considering both the normative need observed by the dentist and the subjective need perceived by the child [8,17,20] in order to fulfill the patient's needs.

CONCLUSION

- The results of the present study revealed that individuals with malocclusion experienced a greater negative impact on OHRQoL than those without malocclusion.

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