

# The Impact of Mixed Dentition Malocclusion on the Oral Health-Related Quality of Life for Children and Their Families: A Case-Control Study

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**Objective:** The aim of this study was to investigate the relation between malocclusion in mixed dentition and its impact on the oral health-related quality of life OHRQoL of children and their families as well to determine if there were any reported differences in OHRQoL due to malocclusion severity. **Study design:** A total of 144 subjects, which included 70 children (aged 8-10 years) and their parents, were recruited on the basis of predetermined criteria and divided into the following groups: children with malocclusion (case group) and children without malocclusion (control group). The OHRQoL was assessed using the Child Perceptions Questionnaire (CPQ<sub>8-10</sub>) and the Family Impact Scale (FIS). The severity of malocclusion was assessed using the Dental Aesthetic Index. The specific types of malocclusions (anterior open bite, anterior/posterior crossbite and overjet) and their severity were considered for the statistical analyses by applying the Mann-Whitney and Kruskal-Wallis tests, respectively, with a set at  $p < 0.05$ . **Results:** The CPQ<sub>8-10</sub> and FIS scores demonstrated higher impact on OHRQoL in the case group ( $p < 0.01$ ). There were no reported differences in OHRQoL according to the dental aesthetic index severity ( $p > 0.05$ ) and no differences between specific types of malocclusion ( $p > 0.05$ ). **Conclusions:** Mixed dentition malocclusion impacted the oral-health quality of life for children and their families independently of the severity.

**Keywords:** malocclusion, mixed dentition, quality of life, oral health, child, family

## INTRODUCTION

The period of mixed dentition is when both the deciduous and permanent teeth are present in the dental arches and there are a wide range of variations, mainly physiological occlusal changes at this stage of development. This variability begins with the eruption of the permanent teeth and their alignment.<sup>1,2</sup> Parallel to these physiological changes, occlusal disorders such as malocclusions may occur. In such cases, early orthodontic intervention should be carried out to prevent progression to the full form of a given disorder and to eliminate factors interfering with the regular development of the dental arches.<sup>2</sup> Previous studies, regardless of the methodological criteria, have revealed a high prevalence of malocclusion in mixed dentition, ranging from 32.2% to 82.5%.<sup>3-5</sup>

Malocclusion and its treatments are often only based on occlusal features as defined by the profession either clinically or from a set of models. The oral health-related quality of life (OHRQoL) questionnaire was developed to complement clinical indicators by detailing the functional and psychosocial disadvantages of such disorders and to provide a more complete picture of the health of the individual.<sup>6</sup>

One of the main reasons people seek orthodontic treatment is dissatisfaction with their dental appearance, a warning of low

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self-esteem, and the concerns of parents about their child's teeth.<sup>7,8</sup> A study by Sadenberg<sup>5</sup> with 8 to 10-year-old schoolchildren reported that the children with malocclusion experienced a 30% greater negative impact on OHRQoL than those without malocclusion. This result suggests that unpleasant dental esthetics have a negative impact on psychosocial well-being. Furthermore the parents expressed greater interest in the orthodontic treatment of their children than the children themselves.<sup>9</sup> Considering the contemporary concepts of child health, the OHRQoL measurement must be from the perspective of the child and the family.<sup>11</sup> Thus, when assessing the impact of malocclusion on the OHRQoL of the child, it is also important to assess this impact on the family.

Some types of malocclusions may have a greater adverse effect on OHRQoL than others. Some specific types of malocclusions such as anterior open bite, overjet, anterior crossbite and posterior crossbite may be prevented or intercepted at an early stage. So, it is important to evaluate any incorrect occlusion at the mixed dentition period in order to avoid any further functional harm and negative effects on the OHRQoL of children; this applies mainly to the fields of emotional and social well-being.<sup>2,11</sup> Thus, the use of the OHRQoL questionnaire is recommended (in orthodontics) to study treatment needs, outcomes, and to design preventive and treatment programs for the oral health of children.<sup>12</sup>

Considering the importance of OHRQoL studies in the age range of 8 to 10-year-old children and the fact that there is a lack of studies addressing the impact of an 8 to 10-year-old child's malocclusion on the family's quality of life this study investigated the relation between specific malocclusions (anterior open bite, anterior/posterior crossbite and overjet) in the period of mixed dentition and their impact on OHRQoL of children and their families. The study also aims to determine if there are any reported differences in the OHRQoL due to the malocclusion severity (minor, definite, severe and very severe).

## MATERIALS AND METHOD

This research project was approved by the local Ethics Committee (Process no:185.297 and no:38A/2013). Parents/caregivers and children signed a statement of informed consent.

This case-control study was composed of children aged from 8 to 10 years old and their parents/caregivers recruited over a 19-month period from at Preventive/Interceptive Orthodontic Clinic of a public hospital, in Rio de Janeiro, Brazil. A consecutive sample of 82 and 62 children composed, respectively, the case and control groups were recruited during this period.

The following criteria were used to include the children in the study: 1) children with the four upper and lower incisors and the four first permanent molars fully erupted; 2) children and parents fluent in Portuguese; 3) parents/caregivers of the children residing at the same address. The exclusion criteria were: 1) children who did not cooperate during the physical exam or administration of the questionnaire 2) children with systemic problems or psychological disorders; 3) dental anomaly, craniofacial deformity and history of dental trauma; 4) presence of untreated dental caries and missing teeth.

Children aged 8 to 10 years old and with no history of orthodontic treatment were included. None of these children had

previously undergone interceptive orthodontics or were in active treatment. In the case group, malocclusions that can be treated in a pediatric dentistry clinic were included. Also, the child should have at least one of the following malocclusions— anterior open bite, anterior overjet and anterior/posterior crossbite,—or classified as definite, severe or very severe malocclusion, measured by the Dental Aesthetic Index.<sup>13</sup>

## Sample and malocclusion characterization

The sociodemographic characteristics collected included the educational level and socioeconomic categories, age, and gender of the parents/caregivers, as well as the child's age and gender. The socioeconomic classification was based on the possession of specific items by the families and the educational level of the household head, according to the Brazil economic classification criteria.<sup>14</sup> The educational level of the parents was based the number of years of schooling and categorized into two levels: up to 8 years of schooling or over 8 years.

The training exercise for malocclusion was done using images of different clinical situations. A calibration process for the diagnosis of malocclusion was performed prior to the survey in a group of 10 children, 8 to 10 years old. Ten children were examined and re-examined after a one-week-interval to assess inter and intra-examiner agreement. Calibration results were very good for intra-examiner reliability and reproducibility (Kappa, 0.83). The inter-examiner reliability and reproducibility was also satisfactory (Kappa, 0.90).

All dental screenings were performed by one calibrated examiner (EP). All children were examined in a dental chair under artificial light, with a dental mirror, tongue depressor and millimeter periodontal probes to measure the linear components of the Dental Aesthetic Index –DAI.<sup>13</sup>

The criteria of the Dental Aesthetic Index (DAI) were used to measure the presence or absence of malocclusion and its severity. The DAI includes 10 variables of dentofacial anomalies related to both clinical and esthetic aspects: missing anterior teeth, incisal segment spacing and midline diastema, incisal segment crowding, largest anterior irregularity in the maxilla, largest anterior irregularity in the mandible, anterior maxillary overjet, anterior mandibular overjet, anterior open bite, and anteroposterior molar relation. Following the measurements, an equation was applied to calculate the DAI<sup>13</sup> score into one of four categories of malocclusion:

- Category 1 (DAI  $\leq 25$ ): normal or minor malocclusion;
- Category 2 (DAI 26–30): definite malocclusion;
- Category 3 (DAI 31–35): severe malocclusion;
- Category 4 (DAI  $\geq 36$ ): very severe malocclusion;

Children in Category 1 (DAI  $\leq 25$ ) were included in the control group (no malocclusion) and the children in the Categories 2–4 (DAI results  $\geq 26$ ) were placed in the case group (with malocclusion).

The DAI is an orthodontic index based on socially defined aesthetic standards not a measure of posterior crossbite,<sup>13</sup> however, this condition was analyzed as a single variable as follows: a transverse discrepancy in the arch relationship in which the palatal cusps of one or more of the upper posterior teeth do not occlude in the central fossae of the opposing lower teeth.<sup>15</sup>

### Quality of life Assessment

The impact of a child’s oral condition on his/her OHRQoL was measured using the Brazilian version of the Child Perceptions Questionnaire (CPQ<sub>8-10</sub>) and the items addressed the frequency of events over the 4 previous weeks.<sup>16</sup> The questionnaire has 25 items organized into 4 health domains: oral symptoms (five items); functional limitations (five items); emotional well-being (five items); and social well-being (10 items). The items have five response options: ‘never = 0’, ‘once or twice = 1’, ‘sometimes = 2’, ‘often = 3’, ‘every day or almost every day = 4’. CPQ<sub>8-10</sub> scores are calculated by summing all the item scores, giving a total score ranging from 0 (no impact) to 100 (maximal impact); the higher scores indicate that the oral conditions have a greater negative impact on the child’s OHRQoL.<sup>18</sup> The questionnaire also contains two questions on the child’s personal information (gender and age) and two global indicators concerning the child’s oral health and the extent to which his/her orofacial condition affects his/her overall wellbeing.

The Brazilian version of the Family Impact Scale (FIS) was used to measure the impact of a child’s oral condition on his/her family life.<sup>17</sup> It consists of 14 items divided into 4 subscales: parental/family activity (5 items), parental emotions (4 items), family conflict (4 items) and financial burden subscale (1 item). The questions refer only to the frequency of events in the previous three months. The items have five response options. FIS scores are calculated by summing all the item scores, giving a total score ranging from 0 (no impact of oral condition on FIS) to 56 (maximal impact of oral condition on FIS). Higher scores indicate a higher negative impact on the family.<sup>17</sup> The questionnaire also contains three questions concerning the parents/guardians personal data (gender, age and relationship (to the patient) and two global ratings of the child’s oral health and impact of the oral condition on his or her overall wellbeing were obtained from the parents/guardians.

Previous to the data collection, a pretest study was conducted to test the psychometric properties of the CPQ<sub>8-10</sub> and FIS, using the internal consistency reliability (Cronbach’s Alpha) and test-retest reliability (intraclass correlation coefficient-ICC). The test-retest reliability analysis requires that the individuals’ conditions remain stable between the two administrations of the questionnaire. The test-retest reliability was assessed with a three-week interval using 8 children with malocclusion and their parents/caregivers who answered the questionnaire both times. The internal consistency reliability of the scale was assessed using Cronbach’s alpha. In this work, Cronbach’s alpha indicated satisfactory reliability of the scale for children (0.70) and parent/guardian’s OHRQoL (0.70). The test-retest reliabilities of the overall CPQ<sub>8-10</sub> and FIS scores were both excellent (ICC = 0.91, and ICC = 0.81 respectively).

### Statistical analysis

Data analysis was carried out using the statistical software SPSS 16.0. The level of statistical significance was set at P < 0.05.

The frequency (%) of the sample (children and their families) characteristics was obtained. The scores of the CPQ<sub>8-10</sub> and FIS indexes were calculated by summing up the numeric responses for each item. Means and medians were obtained for items overall and subscale scores for the case and control groups.

The Kolmogorov-Smirnov test revealed that the sample did not have a normal distribution indicating the use of non-parametric tests. Associations between the sample characteristics and case and control groups were tested using bivariate analyses (Mann-Whitney test, chi-square test and Fisher’s exact test).

The Mann-Whitney test was used to compare the mean and median scores for the case and control groups. The Kruskal-Wallis test was used to compare each malocclusion severity and the malocclusion subgroups.

### RESULTS

One hundred and forty four children and a parent (father or mother) were invited to participate in this study. There were no refusals to participate. There was a dropout of 47 participants in the case group and 27 in the control group due to the specific eligibility criteria designed. So, the final sample consisted of 35 children in the case group and 35 children in the control group each with a respective parent.

Table 1 provides an overview of the sample and malocclusion characterization. The first stage of data analysis was to test for the presence of any confounding factors. According to socio-demographic characteristics, no statistically significant differences were observed between case and control groups. These results demonstrated that the two groups (case/control) of children and parents/caregivers were similar.

**Table 1: Sample characterization and association between case/control group and exploratory variables.**

Parents/ Caregivers Variables	Total (70)	Group		P-value
		Case (n=35)	Control (n=35)	
Mean Age (SD)	37.5 (9.4)	37.9 (9.7)	37.0 (9.2)	0.69*
Sex (%)				
Female	66 (94.0)	32 (91.4)	34 (97.1)	0.61†
Male	4 (6.0)	3 (8.6)	1 (2.9)	
Informants (%)				
Father	3 (4.3)	2 (5.7)	1 (2.9)	0.61**
Mother	62 (88.6)	30 (85.7)	32 (91.4)	reference
Grandmother/ father	5 (7.1)	3 (8.6)	2 (5.7)	0.67**
Educational level—years of study (%)				0.60†
≤ 8 years	21 (30.0)	12 (34.3)	9 (25.7)	
> 8 years	49 (70.0)	23 (65.7)	26 (74.3)	
Socioeconomic categories				
B	10 (14.0)	4 (11.4)	6 (17.2)	0.49**
C	55 (79.0)	30 (85.7)	25 (71.4)	reference
D	5 (7.0)	1 (2.9)	4 (11.4)	0.18**

**Table 1: Sample characterization and association between case/control group and exploratory variables (continued).**

Children Variables	Total (70)	Group		P-value
		Case (n=35)	Control (n=35)	
Mean Age (SD)	8.6 (0.7)	8.5 (0.7)	8.8 (0.7)	0.10*
Gender (%)				
Female	43 (61.0)	22 (62.9)	21 (60.0)	1.00†
Male	27 (39.0)	13 (37.1)	14 (40.0)	
Malocclusion (%)				
Anterior open bite (AOB)		4 (11.4)	-	
Anterior cross-bite (AC)		12 (34.3)	-	
Posterior crossbite (PC)		2 (5.7)	-	
AOB and PC		3 (8.6)	-	
AC and PC		3 (8.6)	-	
AOB and Overjet		11 (31.4)	-	
DAI (Malocclusion severity) (%)				
No/minor malocclusion			35 (100.0)	
Definite malocclusion		10 (28.6)	-	
Severe malocclusion		10 (28.6)	-	
Very severe malocclusion		15 (42.8)	-	

Mann-Whitney Test,\* Chi-square test,\*\* Fisher's exact test†

SD= standard deviation; DAI= Dental Aesthetic Index

In relation to the impact on children's OHRQoL (Table 2), there was a statistically significant difference for the total mean CPQ<sub>8-10</sub> scores between the case (9.0 SD 6.2) and control (5.5 SD 5.6) groups (p < 0.01). There were higher CPQ<sub>8-10</sub> scores in the children with malocclusion (case group). Considering each subscale (domains), there were statistically significant differences in the emotional and social well-being domains, with higher scores in the case group (p < 0.01). The impact on the parents' OHRQoL also shows there was a statistically significant difference for the total mean FIS scores between the case (8.8 SD 4.8) and control (0.9 SD 2.9) groups (p < 0.01). The parents that had children with malocclusion (case group) demonstrated higher FIS scores. Considering each domain, there was a statistically significant difference in parental emotions and parental/family activity domains, with higher scores in the case group (p < 0.01).

Although the total and subscales scores of CPQ<sub>8-10</sub> and FIS varied according to the severity of malocclusion, no statistically significant difference was observed (Table 3).

Considering the malocclusion subgroups (anterior open bite, anterior overjet, anterior and posterior crossbite) we did not observe any statistical significance for total and for subscale CPQ<sub>8-10</sub> and FIS scores (Table 4).

**DISCUSSION**

In the present study, children aged from 8 to 10 years old with malocclusion had a significantly greater negative impact on their OHRQoL than those without malocclusion. In addition, children with malocclusion experienced a greater psychosocial impact on their daily lives than those without malocclusion. These results corroborate with some systematic reviews that have reported that malocclusions have negative effects on OHRQoL.<sup>6,11</sup>

Only two studies have evaluated malocclusion in children aged 8-10 using CPQ 8-10. Martins Junior et al.<sup>4</sup> and Sardenberg et al.<sup>5</sup> evaluated malocclusion based on the Dental Aesthetic Index. They

**Table 2: Comparison of total score mean/median and subscale means/medians for case and control groups (n=70)**

CPQ <sub>8-10</sub> (variation)	Case Group		Control group		p-value*
	Mean (SD)	Median	Mean (SD)	Median	
Total Score (0-100)	9.0 (6.2)	7.0	5.5 (5.6)	4.0	<0.01
Subscales					
Oral Symptoms (0-20)	2.3 (2.7)	2.0	2.6 (2.1)	2.0	0.31
Functional Limitation (0-20)	1.6 (1.9)	0.0	0.9 (1.6)	0.0	0.10
Emotional well-being (0-20)	4.3 (4.4)	4.0	1.9 (4.4)	0.0	<0.01
Social well-being (0-40)	0.8 (1.1)	0.0	0.0 (0.2)	0.0	<0.01
FIS (variation)	Case Group		Control Group		p-value*
	Mean (SD)	Median	Mean (SD)	Median	
Total Score (0-56)	8.8 (4.8)	8.0	0.9 (2.9)	0.0	<0.01
Subscales					
Parental emotions (0-16)	5.4 (3.1)	5.0	0.2 (0.6)	0.0	<0.01
Family conflict (0-16)	0.4 (0.9)	0.0	0.5 (2.5)	0.0	0.07
Parental/family activity (0-20)	2.8 (2.8)	2.0	0.2 (0.5)	0.0	<0.01
Financial burden (0-4)	0.0 (0.3)	0.0	0.0 (0.0)	0.0	0.31

\*Mann-Whitney Test, SD= standard deviation, CPQ<sub>8-10</sub> = Child Perceptions Questionnaire, FIS = Family Impact Scale

also concluded that malocclusion had significantly more negative impact on the OHRQoL of those with malocclusion than those without malocclusion. Sardenberg et al.<sup>5</sup> observed that schoolchildren with malocclusion from lower-income families experience a greater negative impact. Martins Junior et al.<sup>4</sup> concluded that

malocclusions had a negative influence on the quality of life of children between 8-10 years old, and that more severe malocclusions had a greater impact with regard to social, emotional and functional aspects.

**Table 3: Descriptive distribution of domain-specific CPQ8-10 and FIS scores by severity of malocclusion in the case group (n = 35)**

	Malocclusion severity categories						p-value*
	Definite (n=10)		Severe (n=10)		Very severe (n=15)		
	Mean (SD)	Median (SD)	Mean (SD)	Median (SD)	Mean (SD)	Median (SD)	
CPQ <sub>8-10</sub>							
Total score	8.2 (4.9)	6.0	8.8 (6.4)	8.5	9.8 (7.1)	7.0	0.92
Subscale							
Oral Symptoms	2.5 (3.2)	1.5	1.3 (2.3)	0.0	2.9 (2.7)	2.0	0.18
Functional Limitation	1.1 (1.4)	0.0	1.8 (2.1)	1.0	1.8 (2.1)	2.0	0.75
Emotional well-being	3.7 (3.5)	3.0	5.1 (5.4)	2.5	4.2 (4.4)	4.0	0.96
Social well-being	0.9 (1.5)	0.0	0.6 (0.6)	0.5	0.8 (1.1)	1.0	0.83
FIS							
Total score	6.8 (4.3)	7.5	8.6 (4.1)	8.0	10.2 (5.4)	11.0	0.22
Subscale							
Parental emotions	3.7 (2.4)	4.0	6.2 (3.1)	6.5	6.0 (3.3)	7.0	0.10
Family conflict	1.1 (1.3)	0.5	0.1 (0.3)	0.0	0.3 (0.7)	0.0	0.07
Parental/family activity	2.0 (1.5)	2.0	2.1 (2.3)	2.0	3.9 (3.4)	4.0	0.13
Financial burden	0.0 (0.0)	0.0	0.2 (0.6)	0.0	0.0 (0.0)	0.0	0.28

\*Kruskal-Wallis Test; SD= standard deviation; CPQ<sub>8-10</sub> = Child Perception Questionnaire, FIS = Family Impact Scale.

**Table 4: Total and subscale CPQ<sub>8-10</sub> and FIS scores by malocclusion subgroup (n=35)**

	Malocclusion subgroup												p-value*
	AOB (n=4)		AC (n=12)		PC (n=2)		AOB and PC (n=3)		AC and PC (n=3)		AOB and Overjet (n=11)		
	Mean (SD)	Median	Mean (SD)	Median	Mean (SD)	Mean (SD)	Mean (SD)	Median	Mean (SD)	Median	Mean (SD)	Median	
CPQ <sub>8-10</sub>													
Total score	14.0 (6.3)	14.5	7.1 (4.8)	6.0	4.0 (2.8)	4.0	6.6 (1.1)	6.0	9.0 (9.1)	7.0	10.9 (7.2)	12.0	0.33
Subscale													
Oral Symptoms	2.2 (2.6)	2.0	2.7 (3.0)	2.0	1.5 (2.1)	1.5	1.3 (1.1)	2.0	2.0 (2.6)	1.0	2.4 (3.3)	0.0	0.98
Functional Limitation	2.0 (1.6)	2.0	1.3 (1.4)	1.0	1.5 (2.1)	1.5	1.6 (1.5)	2.0	4.0 (3.4)	6.0	1.1 (2.1)	0.0	0.57
Emotional well-being	8.5 (5.7)	11.0	2.2 (2.3)	1.0	1.0 (1.4)	1.0	3.3 (1.1)	4.0	2.6 (3.7)	1.0	6.4 (5.2)	6.0	0.25
Social well-being	1.2 (1.9)	0.5	0.8 (1.2)	0.0	0.0 (0.0)	0.0	0.3 (0.5)	0.0	0.3 (0.5)	0.0	1.0 (1.0)	1.0	0.62
FIS													
Total score	15.5 (6.6)	15.0	8.0 (4.9)	8.5	10.5 (4.9)	10.5	8.0 (3.6)	9.0	6.3 (4.0)	4.0	7.7 (3.2)	8.0	0.31
Subscale													
Parental emotions	9.5 (1.9)	9.0	4.9 (2.6)	5.0	5.0 (4.2)	5.0	5.0 (1.7)	4.0	3.3 (4.1)	2.0	5.2 (3.3)	4.0	0.16
Family conflict	0.5 (1.0)	0.0	0.4 (0.7)	0.0	3.0 (1.4)	3.0	0.0 (0.0)	0.0	0.0 (0.0)	0.0	0.4 (0.7)	0.0	0.08
Parental/family activity	5.5 (6.1)	4.0	2.5 (2.3)	2.5	2.5 (0.7)	2.5	3.0 (2.6)	4.0	3.0 (1.0)	3.0	2.2 (2.1)	2.0	0.92
Financial burden	0.0 (0.0)	0.0	0.1 (0.5)	0.0	0.0 (0.0)	0.0	0.0 (0.0)	0.0	0.0 (0.0)	0.0	0.0 (0.0)	0.0	0.86

\*Kruskal-Wallis Test; AOB= Anterior open bite; AC= Anterior crossbite; PC= Posterior crossbite; SD= standard deviation;

CPQ<sub>8-10</sub> = Child Perceptions Questionnaire; FIS = Family Impact Scale

Oral conditions of children affect the activities of the parents/caregivers and cause an impact on parental emotions which can result in conflicts within the family.<sup>18</sup> Until now, as far as the authors know, this is the first study to evaluate the impact of malocclusion in mixed dentition on the family and therefore this study will be a contribution to the literature. Our findings showed a significant negative impact on the family life of families with children presenting malocclusion compared to those families where the children did not have malocclusion; this negative impact is predominantly in the emotional and parental/family activity domains. Assessing the impact on the daily activities of the families is important because the parents are often the principal decision makers in respect to a child's health and their perceptions. Therefore, the information from parents/caregivers should be seen as complementary to those provided by their children, because according to Locker et al.<sup>18</sup> parental and child reports measure different realities; moreover information provided by parents is useful even if it is incomplete.

When we evaluated the severity of the malocclusions, the total scale and subscales scores of CPQ<sub>8-10</sub> and FIS varied according to the categories of the severity but we did not find any significant statistical difference among them; however the findings of another study<sup>4</sup> found a positive statistical relation, indicating that malocclusions of greater severity have a greater impact on OHRQoL of children aged between 8 and 10 years old. Martins-Junior et al.<sup>4</sup> observed that the severity of malocclusion is related to an increased impact on OHRQoL. Their findings suggest that the parents of children with more severe malocclusion are very likely to be uncomfortable, worried or upset about their child's condition. However, in our study, we did not find any statistical relation, despite the fact that distinct differences in total scale across the categories of malocclusion were observed, whereby those in the "very severe" category had the highest and those in the "definite" category had the lowest average scores. This fact occurred with the total scores of the family (FIS) as reported in the previous cited study<sup>4</sup> and also in the total scores of the children (CPQ<sub>8-10</sub>). So, we suggest that children with more severe malocclusion are also more likely to be uncomfortable, worried or upset.

Specific types of malocclusions such as anterior open bite, overjet, anterior crossbite and posterior crossbite were chosen to ensure that there was a representative sample of the common malocclusions in the period of mixed dentition. Also the malocclusions chosen were ones that can be prevented if intercepted at an early stage. Although these specific types of malocclusion have an impact on the OHRQoL of children and families, there was no statistical difference between the malocclusion subgroups. On the other hand, other studies have found difference between such subgroups.<sup>4,5</sup> This fact suggests that the children and their families detect the malocclusions and their OHRQoL was affected by them but the differences between them were not perceived by the children and their families.

Some limitations of this study need to be addressed. First, the present study was based on a convenience sample and collected from one clinical/hospital setting, which means that our results cannot be generalized to all children with malocclusion and for all Brazilian children. Another limitation was the sample size. A larger sample favors statistical analyses as well as being more representative of a population.

Also we could consider the five malocclusions chosen as a limitation. We could have used all the components of the Dental Aesthetic Index (missing anterior teeth, incisal segment spacing and midline diastema, incisal segment crowding, largest anterior irregularity in the maxilla, largest anterior irregularity in the mandible, anterior maxillary overjet, anterior mandibular overjet, anterior open bite, and anteroposterior molar relation), but we preferred only to consider some specific types of malocclusions presented in this index. The malocclusions investigated were anterior open bite, overjet, anterior crossbite and we also include the posterior crossbite (not evaluated in DAI) as these are the malocclusions that can be prevented and/or intercepted at an early stage, in mixed dentition. Also we consider that some of the other malocclusions in DAI, not used in our analyses, can be transitory in the ugly duckling stage.

Moreover, no specific instruments have been developed for use on patients with malocclusion. This fact can be pointed as a limitation of the CPQ<sub>8-10</sub> and FIS questionnaires used in this study. However, since this kind of instrument is not available in the literature we opted to use a generic OHRQoL measure and an oral health instrument focused on the age of our study group. Our work is also supported by a previous the data collection that conducted a pretest study to assess the psychometric properties of the CPQ<sub>8-10</sub> and FIS, the internal consistency reliability and test-retest reliability in this sample and we concluded that these instruments were valid and reliable to use with our target population. However, we recommend that an OHRQoL measure specific for malocclusion should be developed as it would probably be more suitable and could achieve more specific results.

Having established from the current investigation that malocclusion in the mixed dentition impacts negatively on OHRQoL of both the child and the family, longitudinal studies are needed to show that the data exhibits sensitivity to change over time, e.g. before and after orthodontic treatment, thereby establishing the responsiveness of the CPQ<sub>8-10</sub> and FIS in children and their families. The high prevalence of malocclusion in mixed dentition is significant to the point of being a public health problem. Based on our study, we reinforce the importance of an early diagnosis of malocclusion, the prevention and correction of malocclusion at an early stage as this condition only not affects health but also affects the psychosocial aspects as shown by the comparison between a group of children with and without malocclusion using the OHRQoL instruments. The use of OHRQoL measurements are as essential as clinical indicators that would allow better assessments of needs, priorities and outcomes of treatment, as well as helping in making clinical decisions. Moreover, such data can help develop public health policies that favor the access of the population to orthodontic treatment as recently observed in a systematic review which showed that orthodontic treatment reduces the impact of the oral health-related quality of life on children and adolescents.<sup>6</sup>

## CONCLUSION

Mixed dentition malocclusion impacted the oral health-related quality of life for children and their families independently of the malocclusion severity or if the children presented anterior open bite, overjet, anterior and posterior crossbite.

## REFERENCES

1. Broadbent BH. Ontogenetic Development of Occlusion. *Angle Orthod*; 11:223-41. 1941.
2. Tausche E, Luck O, Harzer W. Prevalence of malocclusions in the early mixed dentition and orthodontic treatment need. *Eur J Orthod* 26: 237-44, 2004.
3. Gois EG, Vale MP, Paiva SM. Incidence of malocclusion between primary and mixed dentitions among Brazilian children. A 5-year longitudinal study. *Angle Orthod* 82: 495-500, 2012.
4. Martins-Junior PA, Marques LS, Ramos-Jorge ML. Malocclusion: Social, Functional and Emotional Influence on Children. *J Clin Pediatr Dent* 37:103-8, 2012.
5. Sardenberg F, Martins MT, Bendo CB, Pordeus IA, Paiva SM, Auad SM, et al. Malocclusion and oral health-related quality of life in Brazilian school children. A population-based study. *Angle Orthod* 83:83-9, 2013.
6. Piassi E, Antunes LS, Antunes LA. Orthodontic treatment reduces the impact on children and adolescents' oral health-related quality of life. *Indian J Dent Res* 27: 213-19, 2016.
7. Badran SA. The effect of malocclusion and self-perceived aesthetics on the self-esteem of a sample of Jordanian adolescents. *Eur J Orthod* 32:638-44, 2010.
8. Samsonyanová L, Broukal Z. A Systematic Review of Individual Motivational Factors in Orthodontic Treatment: Facial Attractiveness as the Main Motivational Factor in Orthodontic Treatment. *Int J Dent* 20. Epub ahead of print. doi: 10.1155/2014/938274, 2014.
9. Dias PF, Gleiser R. Orthodontic concerns of Brazilian children and their parents compared to the normative treatment need. *J Oral Sci* 52:101-7, 2010.
10. Fink R. Issues and problems in measuring children's health status in community health research. *Soc Sci Med* 29:715-9, 1989.
11. Dimberg L, Arnrup k, Bondemark L. The impact of malocclusion on the quality of life among children and adolescents: a systematic review of quantitative studies. *Eur J Orthod* 37:238-47, 2015.
12. Cunningham SJ, Hunt NP. Quality of life and its importance in orthodontics. *J Orthod* 28:152-8, 2001.
13. Jenny J, Cons NC. Establishing malocclusion severity levels on the Dental Aesthetic Index (DAI) scale. *Aust Dent J* 41:43-6, 1996.
14. Associação Brasileira de Empresas de Pesquisa – ABEP. Critério de classificação econômica Brasil; 2012. Available at: “<http://www.abep.org>”. Accessed: 2015-10-05.
15. Ninou S, Stephens C. The early treatment of posterior crossbites: a review of continuing controversies. *Dent Update* 21:420-426, 1994.
16. Barbosa TS, Tureli MCM, Gavião MBD. Validity and reliability of the Child Perceptions Questionnaire applied in Brazilian children. *BMC Oral Health* 9:13-8, 2009.
17. Barbosa TS, Gavião MBD. Evaluation of the family impact scale for use in Brazil. *J Appl Oral Sci* 17:397-403, 2009.
18. Jokovic A, Locker D, Guyatt G. How well do parents know their children? Implications for proxy reporting of child health-related quality of life. *Qual Life Res* 13:1297–307, 2004.

