



# Malocclusion in Brazilian Schoolchildren: High Prevalence and Low Impact

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**Purpose:** To estimate the prevalence and severity of malocclusion and test a possible association with negative impacts on quality of life of schoolchildren in Tubarão, Brazil.

**Materials and Methods:** A cross-sectional study was conducted on a representative sample (n = 389) of schoolchildren. Data on oral health-related quality of life were obtained through the Oral Impacts on Daily Performance (OIDP) scale. The malocclusion indicator was the Dental Aesthetic Index (DAI). Prevalence ratios were estimated using log-linear Poisson regression with a robust estimator.

**Results:** The prevalence of class II, III, and IV malocclusion was 57.3%. The most common dental condition was overjet greater than 3 mm. Girls and older schoolchildren showed statistically significantly higher prevalence of all classes of malocclusion. There were no statistically significant associations between the most frequent malocclusions and dimensions of the impact indicator, except for the presence of overjet greater than 3 mm that was associated the 'cleaning teeth' dimension.

**Conclusion:** The prevalence of malocclusion was high, but was not statistically significantly associated with impact on oral health-related quality of life.

**Key words:** epidemiology, impact, malocclusion, oral health, schoolchildren

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Malocclusions are considered as growth and development anomalies, mainly affecting muscles and maxillary bones during childhood and adolescence. Such abnormalities can cause aesthetic changes in the face, teeth, or in both, and functional disability in occlusion, mastication, and phonation.<sup>5</sup>

Malocclusion is considered the third largest problem in oral health by the World Health Organization (WHO).<sup>25</sup> It

may vary according to the different age and ethnic groups as well as assessment method. Its prevalence can range from 39% to 93% among children.<sup>10</sup> According to the oral health survey conducted by the Brazilian Ministry of Health in 2010 (SB Brasil)<sup>5,19</sup> using the Dental Aesthetic Index (DAI), the prevalence was 38.9% among children aged < 12 years. In southern Brazil, the prevalence was 36%. At the ages of 15 and 19 years, the prevalence was 34.9%

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**Table 1 Malocclusion severity according to the DAI rating scale\***

Malocclusion severity DAI (scores)	n	%
Class I (< 25), normal occlusion	166	42.7
Class II (26 to 30), mild malocclusion	62	15.9
Class III (31 to 35), severe malocclusion	55	14.1
Class IV ( $\geq$ 36), very severe or deforming malocclusion	106	27.2
*Tubarão/SC, Brazil, 2012.		

and 28.7%, respectively.<sup>5,19</sup> A cross-sectional study on students aged 11–14 years in the city of Osório, Brazil, found that 43.6% of the sample had severe malocclusion.<sup>11</sup>

Malocclusions can affect quality of life of individuals regarding aesthetics, speech, and mastication. In a study conducted on Indian students aged 13–19 years, Siluvai et al<sup>22</sup> showed that 46% of young people with malocclusion reported impacts on their quality of life. A study on 627 adolescents aged 12–15 years conducted in Valencia, Spain, reported that the psychosocial impact increased with the severity of malocclusion.<sup>4</sup> Peruvian children with class III malocclusion reported impacts on their quality of life in the well-being domain.<sup>21</sup> Furthermore, there were impacts of severe malocclusion on quality of life among New Zealand adolescents.<sup>24</sup> In a study conducted in the city of Santa Maria, Brazil, da Rosa et al<sup>8</sup> found an association between the presence of malocclusion and negative impact on quality of life of adolescents, especially in the emotional and social domains.

In contrast, a recent study on 843 children aged 3–5 years conducted in the city of Campina Grande, Brazil, found no statistically significant association between malocclusions and impact on quality of life.<sup>14</sup> Likewise, Abanto et al<sup>1</sup> also reported that malocclusion was not associated with an impact on quality of life among children aged 2–5 years old.

There is no consensus that malocclusions may affect quality of life, at least not in all age groups and circumstances. In order to contribute to the debate, this study described the prevalence and severity of malocclusion, and tested possible associations with negative impacts on quality of life of 10- to 15-year-old schoolchildren in the city of Tubarão in the southern Brazilian state of Santa Catarina.

## MATERIAL AND METHODS

A cross-sectional study was conducted on 10- to 15-year-old schoolchildren enrolled in public schools of Tubarão, Brazil, in 2012. The sample size calculation was based on the following parameters: a population of 6554 students enrolled in that school year, 95% confidence level, a relative error of 5%, and unknown expected prevalence of malocclusion.

20% was added to the resulting sample of 363 subjects to compensate for losses. Thus, the minimum sample size consisted of 435 students, who were randomly selected, keeping equal proportions of students enrolled in small, medium, and large schools. The size of schools was determined by the tertile distribution of the number of enrollments. The students were randomly selected from lists provided by the sampled schools.

Data collection included an interview with students, followed by clinical examination of the oral cavity. The interviews were conducted individually at the school to obtain data on the impacts of oral health conditions on quality of life using the Oral Impacts on Daily Performance (OIDP)<sup>2</sup> scale validated in Brazil.<sup>13</sup> The instrument contained four questions related to eight daily activities: eating, speaking, cleaning teeth, sleeping, maintaining usual emotional state, smiling, performing daily tasks, and having social contact.

Oral examinations were carried out in the classroom by four dentists and four annotators. The Dental Aesthetic Index (DAI) was used to define malocclusion, and the WHO<sup>26</sup> criteria for epidemiological surveys in oral health were followed. Data on the dental condition related to caries<sup>26</sup> and dental trauma<sup>26</sup> were also collected to control for possible confounders for these disorders. Training and calibration sessions were held for the data collection team before starting the study.<sup>20</sup> Kappa values greater than 0.7 were obtained both in the inter- and intra-examiner assessment.

A pilot study was conducted on 45 students who were not participating in the main study to test the proposed methodology and point out whether adjustments would be required.

Data were entered into a spreadsheet specifically designed for this study and then exported to SPSS 18.0 software for analysis. Descriptive statistics were used to describe malocclusion prevalence and severity, other clinical conditions evaluated, and frequency of impacts on daily performance according to the OIDP scale. Malocclusion severity was rated by using the following equation: DAI = [missing teeth (x 6) + crowding + spacing + incisal diastema (x 3) + misalignment of maxillary incisors + misalignment of mandibular incisors + anterior maxillary overjet (x 3) + anterior mandibular overjet (x 4) + vertical anterior open bite (x 4) + anteroposterior molar relationship (x 3) + 13].<sup>7</sup> Overall DAI scores < 25 indicated normal occlusion or mild malocclusion (class I); scores between 26 and 30 indicated malocclusion (class II); scores between 31 and 35 indicated severe malocclusion (class III); and scores  $\geq$  36 indicated very severe or deforming malocclusion (class IV).<sup>7</sup>

The chi-squared test was used to assess the association between: 1. severity of malocclusion and gender and age; 2. impacts on daily performance according to the scale dimensions and the most common malocclusions. The significance level was set at  $p < 0.05$ . Prevalence ratios (PR) and their respective confidence intervals (95%) were estimated by using log-linear Poisson regression with a robust estimator.

This study was approved by the Ethics Committee of the University of Southern Santa Catarina (Protocol No 11.142.4.02.III).

## RESULTS

A total of 389 schoolchildren were examined, with a response rate of 89.4%. Of these, 232 (59.6%) were female. Students aged 10–12 years accounted for 67.4% of the sample.

The prevalence of malocclusion (class II or higher) was 57.3% (95% CI 52.4 to 62.2), as shown in Table 1. The most common clinical condition was maxillary overjet (more than 3 mm), as shown in Table 2.

Table 3 shows the association between malocclusion severity and gender and age. Female students showed a prevalence of malocclusion (class II) 7% higher (PR 1.07 [95% CI 1.01 to 1.17]) compared to male students. Similar scores were observed in relation to severe malocclusion (class III) and severe or deforming malocclusion (class IV). Students aged 13–15 years had a prevalence of malocclusion (class II) 31% higher than those aged 10–12 years (PR 1.31 [95% CI 1.23 to 1.41]). Slightly lower scores were observed in relation to severe malocclusion (class III) and severe or deforming malocclusion (class IV), as shown in Table 3.

The mean OIDP score was 24.16 (SD = 2.71) with a median of 25. The minimum and maximum values were 10 and 30, respectively. The most commonly reported dimension was 'eating' (28.0%), followed by 'smiling' (26.5%), as shown in Table 4.

The results of the association between the most common malocclusions in the DAI scale and OIDP dimensions revealed they were not statistically associated, except for the presence of overjet greater than 3 mm, which was associated with the 'cleaning teeth' dimension (RP 1.62 [95% CI 1.04 to 2.53]), as shown in Table 5.

## DISCUSSION

The high response rate and diagnostic reproducibility achieved in the calibration of examiners suggest a good internal validity of the study.

The prevalence of malocclusion in this study was 57.3%, slightly higher than those identified in the SB Brazil study, in which the 15–19 age range had a prevalence rate of 34.9% across the country and 28.7% in the southern region.<sup>19</sup> However, the prevalence of very severe malocclusion found in this study (27.2%) was lower than that indicated in another Brazilian city (43.6%),<sup>11</sup> also located in the southern region. In a different southern Brazilian city, a study on 1134 adolescents showed that 24.6% had class II malocclusion, and 17.7% had severe or deforming malocclusion.<sup>8</sup> It should be emphasised that a significant portion of the differences between these studies could be attributed to methodological aspects, such as the different age ranges that comprised the samples.

In this study, an overjet greater than 3 mm was the most common malocclusion, affecting 30.9% of students. Another study conducted in southern Brazil found increased overjet in 19.5% of youths aged 18–21 years.<sup>6</sup> A study conducted in Florianópolis, the capital of the state of Santa Catarina, revealed that the most common malocclusion was a molar relationship in mesial or distal occlusion, affecting about 57% of

**Table 2 Description of the clinical conditions according to the DAI parameters\***

Dental Aesthetic Index	n	%
Number of incisors, canines and missing premolars		
Maxillary dental arch	5	1.3
Mandibular dental arch	5	1.3
Crowding in the incisor region		
One arch	86	22.1
Two arches	84	21.6
Spacing in the incisor region		
One arch	71	18.3
Two arches	16	4.1
Maxillary anterior misalignment in mm		
1	31	8.0
2	38	9.8
3	23	5.9
4 and above	19	5.0
Mandibular anterior misalignment in mm		
1	73	18.8
2	50	12.9
3	16	4.1
4	9	2.3
Diastema in mm		
1	34	8.7
2	15	3.9
3	6	1.5
Anterior maxillary overjet in mm		
1	15	3.9
2	55	14.1
3	57	14.7
4	55	14.1
5	33	8.5
6 and above	32	8.3
Anterior mandibular overjet in mm		
1	2	0.5
3	1	0.3
Vertical anterior open bite in mm		
1	4	1.0
2	3	0.8
3	3	0.8
Anteroposterior molar relationship		
Normal	260	66.8
Half cusp: the mandibular first molar is half a cusp mesial or distal to its normal relation.	59	15.2
Full cusp: the mandibular first molar is one cusp mesial or distal to its normal relation.	70	18.0

\*Tubarão/SC, Brazil, 2012.

**Table 3 Association between different severity levels of malocclusion and gender and age\***

Variables	n (%)	Malocclusion (class II)		Severe malocclusion (class III)		Very severe or deforming malocclusion (class IV)	
		PR (95% CI)	p	PR (95% CI)	p	PR (95% CI)	p
Gender			0.04		<0.01		0.01
Male	157 (40.4)	1.00		1.00		1.00	
Female	232 (59.6)	1.07 (1.01;1.14)		1.07 (1.01;1.14)		1.06 (1.01;1.12)	
Age			<0.01		<0.01		<0.01
10–12 years	262 (67.4)	1.00		1.00		1.00	
13–15 years	127 (32.6)	1.31 (1.23;1.41)		1.15 (1.08;1.24)		1.12 (1.05;1.18)	

\*Tubarão/SC, Brazil, 2012. PR: prevalence ratio adjusted for age and gender. 95% CI: 95% confidence interval.

**Table 4 Oral Impacts on Daily Performance (OIDP) frequency according to dimensions\***

OIDP dimensions	n	%
Eating and enjoying food	109	28.0
Speaking and pronouncing clearly	23	5.9
Sleeping and relaxing	34	8.7
Maintaining a balanced emotional state without getting angry	76	19.5
Smiling, laughing and showing teeth without embarrassment	103	26.5
Carrying out major school work or playing a social role	21	5.4
Enjoying contact with other people	24	6.2
Cleaning teeth	76	19.5

\*Tubarão/SC, Brazil, 2012.

18-year-olds.<sup>23</sup> An Italian study found an overjet greater than 3 mm in 48% of adolescents.<sup>12</sup> Dimberg et al<sup>10</sup> found an increased overjet among 20% of children under 12 years of age.

The results of this study showed that both severe and very severe or deforming malocclusion were more common among young women and in older age groups than among other groups. A study conducted in northeastern Italy found a statistically significantly higher prevalence of crossbite and open bite among girls than among boys.<sup>12</sup> Laganà et al<sup>15</sup> showed that oral habits are more common among girls, and thus it could be hypothesised that malocclusions are more frequent in females than in males.

Of all the clinical conditions examined through the DAI scores, the presence of overjet revealed having impacts on daily performance in the 'cleaning teeth' dimension, which may perhaps be explained by toothbrushing difficulty due to the position anomaly of the anterior maxillary dental elements.

However, except for the association mentioned above, the results of this study differ from the majority of the results found in the literature that reveal psychosocial impacts due to the presence of malocclusions.<sup>4,22</sup> Nevertheless, two systematic reviews suggested that the association was modest.<sup>9,16</sup>

Some possible reasons could explain this discrepancy. The age range of the surveyed sample (10–15 years) may have influenced the results. Malocclusion prevalence rates

differed between younger and older age groups, and their perception was perhaps different as well. Thus, the use of a single index to express the impact on quality of life of such an age range should have a compensation factor. A special measure of quality of life should be designed for younger children, whereas the OIDP scale would be more appropriate for older children. In fact, studies have pointed out that malocclusions have proved to be associated not with poorer quality of life in very young children<sup>1,14</sup> but with the severity of malocclusion. The more severe the malocclusions, the greater the impacts on quality of life,<sup>4</sup> which was not supported by the findings of this study. On the other hand, some authors have argued<sup>3,17,18</sup> that the majority of oral health-related quality of life measures should not be applied directly to orthodontic patients, as such measures focus on pathological conditions, disease, pain and discomfort. According to those authors, the majority of orthodontic treatment is not related to disease, but to correct malocclusion against a perceived need according to social norms.

## CONCLUSION

In contrast to most published works, this study concluded that there was no association between different types of malocclusion and impacts on oral health-related quality of life. These conflicting results indicate that additional studies need to be conducted to generate more solid scientific knowledge on the relationship between these variables, including more appropriate designs to establish a cause-and-effect relationship. Further studies should establish clinical protocols that include assessment of malocclusion perception by individuals and their families, and develop appropriate public policies to address these disorders. Clinical and regulatory assessments cannot underestimate the subjective perceptions of health. Instead, they should be associated with them in order to propose a more rational treatment, taking into account people's subjective experiences related to their functional, social, and psychological well-being. Therefore, sociodental indicators are fundamental in treating malocclusions to capture their impact and the need perceived not only by orthodontists, but by the children themselves and their families.



**Table 5 Dental Aesthetic Index (DAI) and Oral Impacts on Daily Performance (OIDP) dimension\***

Variables	Eating		Speaking		Cleaning teeth		Sleeping		Maintaining emotional state		Smiling		Performing tasks		Social interaction	
	PR (95% CI)	p	PR (95% CI)	p	PR (95% CI)	p	PR (95% CI)	p	PR (95% CI)	P	PR (95% CI)	p	PR (95% CI)	p	RP (IC 95%)	p
Diastema	1.16 (0.69; 1.96)	0.56	0.49 (0.20; 1.25)	0.13	1.77 (0.80; 3.89)	0.15	1.04 (0.41; 2.66)	0.94	1.61 (0.75; 3.41)	0.21	0.94 (0.98; 1.54)	0.81	0.76 (0.23; 2.51)	0.65	3.57 (0.52; 24.59)	0.19
Spacing	1.09 (0.73; 1.64)	0.66	0.51 (0.21; 1.24)	0.13	1.08 (0.64; 1.82)	0.78	0.72 (0.34; 1.50)	0.37	0.35 (0.79; 2.33)	0.27	0.96 (0.63; 1.45)	0.84	0.61 (0.24; 1.54)	0.30	1.92 (0.58; 6.38)	0.28
Crowding	0.83 (0.61; 1.14)	0.26	0.86 (0.37; 1.99)	0.72	1.27 (0.83; 1.94)	0.27	0.60 (0.31; 1.15)	0.12	0.85 (0.57; 1.29)	0.45	0.89 (0.63; 1.24)	0.49	0.68 (0.29; 1.60)	0.37	0.73 (0.33; 1.61)	0.44
Overjet > 3 mm	1.04 (0.75; 1.45)	0.82	1.18 (0.51; 2.72)	0.70	1.62 (1.04; 2.53)	0.03	1.20 (0.56; 2.17)	0.78	1.22 (0.80; 1.87)	0.39	1.15 (0.80; 1.87)	0.44	0.83 (0.34; 2.00)	0.68	0.76 (0.34; 1.69)	0.50

\*Tubarão/SC, Brazil, 2012. PR: prevalence ratio adjusted for gender, age, dental caries, and dental trauma. 95% CI: 95% confidence interval. Reference groups: without clinical disorder.

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