

# Prevalence of malocclusion in children aged 7 to 12 years

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## Abstract

**Objectives:** To determine the prevalence of malocclusion in a group of 3,466 children aged 7 to 12 years enrolled in public schools in the cities of Lins and Promissão, in the state of São Paulo, Brazil. **Methods:** The sagittal relationships between dental arches, the transverse relationship between arches, and the vertical and horizontal relations of incisors were analyzed. The prevalence of diastemas, crowding and tooth losses were evaluated. **Results:** Among the types of malocclusion, 55.25% of the children had a Class I molar relationship, 38%, Class II, and 6.75%, Class III. The analysis of incisor relationships revealed 17.65% of open bite, followed by 13.28% of deep bite and 5.05% of anterior crossbite; 13.3% of the children had a posterior crossbite. The analysis of relationships between arches showed that 31.88% of the children had diastemas, 31.59%, crowding, and 4.65%, tooth losses.

**Keywords:** Malocclusion. Angle classification. Normal occlusion. Epidemiology.

## INTRODUCTION

Studying normal occlusion, as well as the characteristics that are part of this state is extremely important for the orthodontists.<sup>1</sup> Normal occlusion is not difficult to detect. At least three basic criteria should be met: (1) Total inclusion of the mandibular arch into the maxillary arch; (2) correct sagittal relationships between posterior teeth, that is, a Class I relationship; and (3) incisor relationships with positive horizontal and vertical overlap.

In fact, the desire to define these characteristics is over one hundred years old. Edward Hartley Angle,<sup>6</sup> in the end of the 19th century, was the first to describe the sagittal relationships between dental arches using the molar relationship as reference, and named as “Class” the type of relationship that these teeth might have. The correct sagittal relationship between molars was called Class I. The mesiobuccal cusp of the maxillary permanent first molar should occlude with the buccal groove of

**How to cite this article:** Almeida MR, Pereira ALP, Almeida RR, Almeida-Pedrin RR, Silva Filho OG. Prevalence of malocclusion in children aged 7 to 12 years. *Dental Press J Orthod.* 2011 July-Aug;16(4):123-31.

» The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.

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the mandibular permanent first molar. Angle<sup>6</sup> also described two other Classes to define the sagittal relationships between molars: Class II and Class III. In Class II, the mandibular arch has a distal relationship with the maxillary arch, whereas in Class III, the mandibular first permanent molar is positioned mesially to the maxillary first permanent molar.

Malocclusion is definitely more prevalent than normal occlusion in all populations, regardless of the stage of occlusal development.<sup>2,4,7,8,9,11,14-17,20,21,22</sup> The predominance of malocclusion is explained by its multifactorial etiology,<sup>4,5,10,13,19</sup> genetic factors<sup>23</sup> and several environmental factors<sup>3,6,16,18,23,24</sup> that, together, contribute to the occurrence of the different types of malocclusion. Epidemiological studies have demonstrated that Class I malocclusion, together with different types of transverse and vertical occlusal disorders, is the most frequent, followed by Class II and, at a lower frequency, Class III.<sup>2,7,8,9,11,14-17,20,21,22</sup>

Therefore, based on these informations, this study had the purpose to determine the prevalence of malocclusion considering the three spatial planes and of crowding, diastemas and tooth loss in children aged 7 to 12 years enrolled in public schools in the cities of Lins and Promissão, in the state of São Paulo, Brazil.

## MATERIAL AND METHODS

A total of 3,466 boys and girls aged 7 to 12 years enrolled in public schools in the cities of Lins and Promissão, Brazil, were included in the study. Sex, ethnicity and occlusal development were not recorded; whether dentition was deciduous, mixed or permanent was not evaluated because mixed dentition is prevalent in this age group. The incidence of deleterious oral habits was also not determined in this study.

Oral examinations were performed by undergraduate students in the 7<sup>th</sup> and 8<sup>th</sup> semesters of the School of Dentistry and graduate students in the Specialization Course in Orthodontics in

the School of Dentistry in Lins (FOL-UNIMEP) wearing adequate outfits (uniform, gloves, cap, goggles) and under the guidance of a professor of the orthodontics course.

Disposable spatulas, rulers, lead pencils, pens, and the form enclosed in Figure 1 were used to perform examinations and record data of the school children. Examiners had practical and theoretical support to ensure that the survey was successful.

For the clinical examination, children were comfortably seated facing a source of abundant light. All the exams began by asking the child to open their mouth, and the examiner recorded the data previously defined. After that, the children were asked to occlude in the habitual position for maximal intercuspation to collect specific data. Some children had difficulties to occlude in the habitual position and, in these cases, they were asked to place the tip of the tongue at the most posterior position against the palate, and to occlude comfortably.

The analysis of occlusal data followed the Angle<sup>6</sup> classification, which divides malocclusion into different classes: (A) Class I: All cases of malocclusion in which the anteroposterior relation of the maxillary and mandibular first molars is normal. This means that the mandible and mandibular teeth are in correct mesiodistal relationship with the maxilla and the other facial bones. The mesiobuccal cusp of the maxillary first molar rests on the central sulcus of the mandibular first molar. Malocclusion is usually limited to the anterior teeth. (B) Class II: The mandibular arch is positioned distally in relation to the maxillary arch. The mesiobuccal cusp of the maxillary first molar rests on the space between the buccal cusp of the mandibular first molar and the distal surface of the buccal cusp of the mandibular second premolar. It has two divisions: (b.1) Class II, division 1: The maxillary incisors are protrusive and inclined buccally. The shape of the arch is similar to a "V", and this type of malocclusion is usually associated

with abnormal muscle functions, mouth breathing and finger, tongue or pacifier sucking. (b.2) Class II, division 2: Its main characteristic is the vertical or lingual axial inclination of maxillary incisors. The maxilla is usually flattened anteriorly due to the excessive lingual inclination of maxillary central incisors. There is deep overbite and the mandible often has an exaggerated curve of Spee. Muscle function and breathing are normal. (b.3) Subdivision: When the molars in one side are classified as Class I and the opposite side, as Class II. It is called as right or left subdivision according to whether Class II malocclusion is in the right or left side. (C) Class III: The mandibular first molar is mesially positioned in relation to the maxillary first molar. The mesiobuccal cusp of the maxillary first molar rests on the space between the distal cusp of the mandibular first molar and the mesiobuccal cusp of the mandibular second premolar. In this case, a subdivision is also used when one of the sides keeps the occlusal relationship. Incisors may or may not form crossbite with the buccal faces of the maxillary incisors in contact with the lingual surfaces of the mandibular incisors. Mandibular incisors and canines are excessively inclined lingually. The maxillary arch is often atretic.

The criteria for the classification of deep bite was a positive vertical overlap greater than 4 mm, and of anterior open bite, a negative vertical overlap of at least 1 mm, according to Silva Filho et al.<sup>17</sup>

Before the beginning of the study, school principals and teachers were contacted to explain the purpose of the study, which was to conduct an epidemiological study to describe malocclusions. There was 100% cooperation from study participants. An informed consent form was signed by the parents of the participating children.

## RESULTS AND DISCUSSION

The purpose of this study was to conduct an epidemiological survey to characterize malocclusions among elementary school children in the area

**PREVALENCE OF MALOCCLUSION IN THE CITIES OF  
LINS AND PROMISSÃO, BRAZIL**

NAME: \_\_\_\_\_  
 AGE: \_\_\_\_\_  
 ETHNICITY: \_\_\_\_\_  
 SEX: \_\_\_\_\_

MOLAR RELATION { CLASS I   
 CLASS II   
 CLASS III

DIVISION { 1   
 2

SUBDIVISION { R   
 L

SUBDIVISION { R   
 L

VERTICAL RELATION { OPEN BITE   
 DEEP BITE

TRANSVERSE RELATION { CROSSBITE { ANTERIOR   
 POSTERIOR

UNILATERAL  { R   
 L

BILATERAL

TOTAL

DIASTEMAS { PRESENT  UPPER   
 ABSENT  LOWER

CROWDING { PRESENT  UPPER   
 ABSENT  LOWER

TOOTH LOSS { DECIDUOUS \_\_\_\_\_  
 PERMANENT \_\_\_\_\_

FIGURE 1 - Questionnaire used in the study.

of the cities of Lins and Promissão in the State of São Paulo, Brazil. Malocclusion is found in considerable percentages in all communities, regardless of ethnicity, race, sex or age.<sup>2,7,8,9,11,14-17,20,21,22</sup> In fact, malocclusion is the third public health problem according to the World Health Organization. Epidemiological surveys conducted in Brazilian cities and in other countries revealed an important incidence of malocclusion. These findings have been reported for all age groups, even for those that have a deciduous dentition.<sup>7,8,9,11,14,15,20,21,22</sup>

In the city of Bauru, Brazil, two epidemiological surveys were conducted by orthodontists to evaluate children.<sup>15,17</sup> The first, published in 1990, included 2,416 children in the mixed dentition and found malocclusion in 88.53% of the sample.<sup>17</sup> The second epidemiological survey, conducted at a more recent date, complemented the first and defined the characteristics of occlusion in deciduous dentition. The incidence of malocclusion was about 73%.<sup>15</sup> Therefore, the prevalence of malocclusion in the mixed dentition, 73%, was higher than that found for children with deciduous dentition, 88%. This cross-sectional comparison showed the early onset of morphological abnormalities, at a time when the dentition is still deciduous, and the absence of self-correction of poor occlusion already established, at least as it progresses from deciduous to mixed dentition.

When these data are compared with those reported in a previous survey conducted in the 1970s also in Bauru but with individuals with permanent dentition, malocclusion was about 90%, which confirms that malocclusion does not self-correct from deciduous to mixed dentition, nor from mixed to permanent dentition. According to cross-sectional epidemiological data, malocclusion is predominant in the three stages of occlusal development with no epidemiological changes along time. Therefore, the prevalence of malocclusion among children in the city of Bauru is 73%, 88% and 90% in deciduous, mixed and permanent dentition (Fig 2). These data indicate that most of the populations under study had some type of occlusal abnormality. The severity of malocclusion, which might define the actual need for orthodontic treatment, was not assessed. All morphological abnormalities, regardless of their magnitude, were classified as malocclusion, which, therefore, justifies the high incidence of malocclusion. The second reason for a high incidence of malocclusion was the fact that orthodontists use very detailed methods of examination.

The general distribution of malocclusion in the cities of Lins and Promissão, in decreasing order, was: Class I, 55.25%; Class II, 38%; and Class III, 6.75% (Table 1 and Fig 3).

Data found in the literature confirm this distribution of malocclusion according to the sagittal relationships between dental arches. According to Silva Filho et al<sup>15,17</sup> and their surveys conducted in Bauru in 1990 and 2002, the results among the population with deciduous dentition were 50% Class I, 45.0% Class II, and 4% Class III.

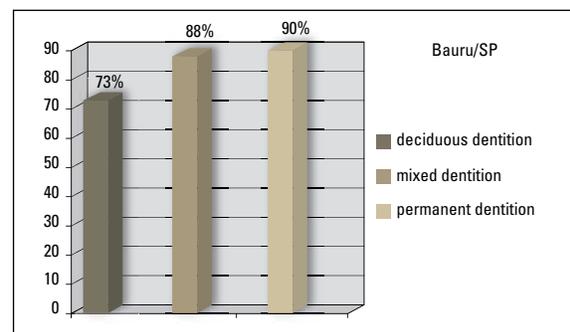


FIGURE 2 - Percentage of malocclusion found in the different occlusal development stages (deciduous, mixed and permanent dentitions) in the city of Bauru, Brazil (Silva Filho et al.<sup>15,17</sup>).

TABLE 1 - Molar relationship in malocclusions.

Malocclusion	n	%
Class I	1,915	55.25
Class II	1,317	38
Class III	234	6.75
Total	3,466	100

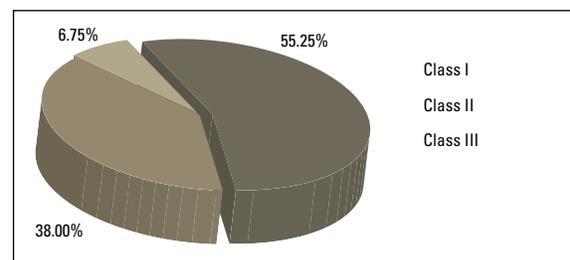


FIGURE 3 - Molar relationship in malocclusions.

For mixed dentition, the distribution of malocclusion was similar, with 55% Class I, 42% Class II and 3% Class III (Table 2). Although the study population was smaller than in previous surveys, results were very similar. The greatest variation was found for the incidence of Class II malocclusion in the population of Lins and Promissão. Some difference in methods should be discussed. In the present survey, the sagittal relationship was defined according to the molar relationship, whereas in the two surveys conducted in Bauru it was based on the deciduous canine or premolar relationship and depended on the presence of the premolar in occlusion.

Open bite was found in 17.65% of the children evaluated in Lins and Promissão (Fig. 4). Anterior open bite is usually associated with sucking habits and atypical lingual pressures.<sup>3,4,18,24</sup> As sucking habits are more prevalent in childhood, the incidence of anterior open bite tends to be greater in this age group. The incidence of anterior open bite in the group of children with deciduous dentition in the Bauru study was 27.97%. This incidence decreased to 23% in the mixed dentition, close to the prevalence of anterior open bite found for children in the present survey. As the survey in mixed dentition excluded complete permanent dentition, children were younger than the ones evaluated in the present survey. This may have affected statistical results. Therefore, the incidence of anterior open bite in Bauru, Lins and Promissão may be expressed as 28% in deciduous

dentition, 23% in mixed dentition in Bauru and about 17% in the population of children aged 7 to 12 years in Lins and Promissão. These findings seem to reflect the spontaneous sucking behaviors in childhood as suggested in Figures 5 and 6 which show the incidence of sucking habits along time for groups with deciduous dentition. Sucking tends to decrease as deciduous dentition changes into permanent.<sup>10</sup> It is advisable to approach such habits therapeutically at the end of the deciduous dentition to prepare muscles and the alveolar environment for the eruption of permanent incisors, that is, to create favorable morphological conditions for a correct incisor relationship during the eruption of permanent incisors.

Deep bite, or overbite, was found in 13.28% of the study sample (Fig. 4). The analysis of transverse and horizontal crossbite showed that the position of 5.04% was anterior and of 13.7%, posterior in Lins and Promissão (Table 4, Fig 7). The analysis of anterior crossbite revealed that its incidence

TABLE 2 - Distribution of molar relationship in epidemiological surveys conducted in the city of Bauru (Silva Filho et al.<sup>15,17</sup>) for deciduous and mixed dentitions and in the survey conducted in Lins and Promissão.

Malocclusion	Deciduous dentition in Bauru	Mixed dentition in Bauru	6-12 years of age in Lins and Promissão
Class I	50.0%	55.0%	55.25%
Class II	46.0%	42.0%	38.00%
Class III	4.0%	3.0%	6.75%

TABLE 3 - Vertical relation of occlusion.

Type	n	%
Open bite	612	17.65
Deep bite	460	13.28
Normal	2,394	69.07
Total	3,466	100

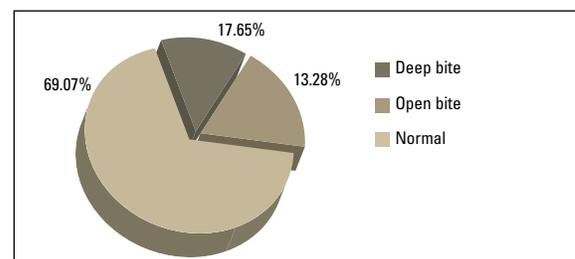


FIGURE 4 - Vertical relation of occlusion.

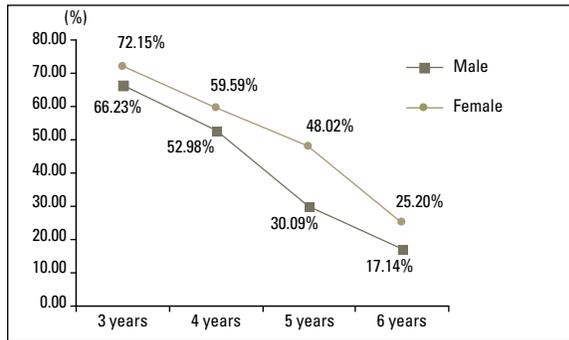


FIGURE 5 - Cross-sectional study of sucking habits in 2,016 children evaluated during the deciduous dentition stage at 3 to 6 years of age according to sex (percentages). (Silva Filho et al<sup>15</sup>).  $X^2_{(girls)} = 80.94, p < 0.001^*$ ;  $X^2_{(boys)} = 124.59, p < 0.001^*$

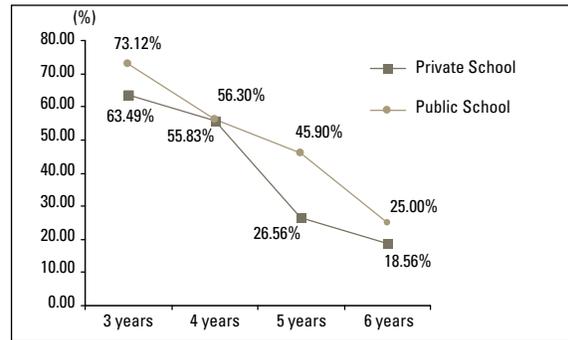


FIGURE 6 - Cross-sectional study of sucking habits in 2,016 children evaluated during the deciduous dentition stage at 3 to 6 years of age according to socioeconomic status (percentages). (Silva Filho et al<sup>15</sup>).  $X^2_{(public\ school)} = 85.69, p < 0.001^*$ ;  $X^2_{(private\ school)} = 113.69, p < 0.001^*$

was greater than that found for the groups with deciduous dentition,<sup>15</sup> which was 3.57%, and lower than the 7.6% found for the group with mixed dentition in Bauru.<sup>17</sup> The incidence of posterior crossbite in Lins and Promissão was a value between the ones found for the deciduous and mixed dentition samples in Bauru, which were 11.65% and 18.2%.

Diastemas were found in 31.88% of the participants (Table 5, Fig 8). A diastema may be defined as the absence of contact between two or more consecutive teeth. It is classified as abnormal and esthetically undesirable in the permanent dentition, but has very little deleterious effect on masticatory efficiency.

Dental crowding results from the difference between the dental arch perimeter and tooth size, either due to environmental or genetic factors. In deciduous dentition, its prevalence is very small, and affects about 10% of the children. However, at the beginning of the mixed dentition, it gains epidemiological significance because its incidence increases considerably. From a therapeutic perspective, it is at this stage of occlusal development that treatment should be initiated. The percentage of children with crowding was 31.59% in the present survey (Table 6, Fig 9). This number is much lower than that found in

TABLE 4 - Horizontal and transversal relation of crossbite.

Crossbite	n	%
Anterior	175	5.05
Posterior	461	13.3
Normal	2,830	81.65
Total	3,466	100

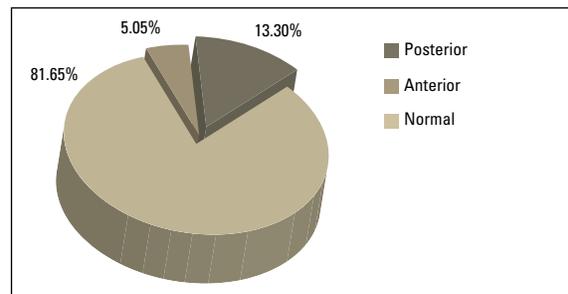


FIGURE 7 - Horizontal and transversal relation of crossbite.

the 1990 mixed dentition survey, which found about 50%.<sup>17</sup> This may be partially explained by the fact that some crowding may have spontaneously resolved in the children of Lins and Promissão because some of them already had permanent dentition. Mixed dentition crowding, known as temporary primary crowding, may resolve spontaneously during the stage of mixed dentition.<sup>10</sup>

TABLE 5 - Diastemas.

Diastemas	n	%
Yes	1,105	31.88
No	2,361	68.12
Total	3,466	100

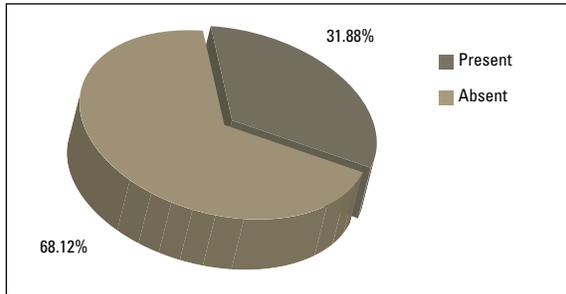


FIGURE 8 - Diastemas.

Tooth losses were seen in 4.65% of the 3,466 school children included in the study in the present survey (Table 7, Fig 10). Early tooth losses are primarily associated with caries and oral habits, and are a public health problem<sup>12</sup> that has been fought by means of prevention and the participation of dental healthcare workers in schools and healthcare systems, as well as by the action of schools of dentistry that conduct preventive studies and social dentistry actions in their communities. Data obtained in the present survey are encouraging when we consider that tooth losses are now less frequent than in the last decade (1990s),<sup>17</sup> which suggests that the prevention systems have been efficient.

Moreover, data in this study seem to corroborate the results found by Almeida et al<sup>2</sup> in the analysis of a decrease in the incidence of malocclusion in cities where fluoride is added to the water supplied by the public system. This decrease is not associated with genetic factors that affect growth and are responsible for facial patterns, but directly associated with a decrease in tooth losses and a reduction in the areas of interdental contacts resulting from extensive interproximal carious lesions.

TABLE 6 - Crowding.

Crowding	n	%
Yes	1,095	31.59
No	2,371	68.41
Total	3,466	100

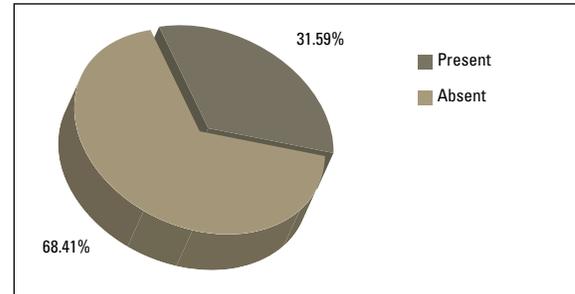


FIGURE 9 - Crowding.

TABLE 7 - Tooth losses in relation to total number of participants.

Description	n	%
Tooth loss	161	4.65
Preserved dentition	3305	95.35
Total	3466	100

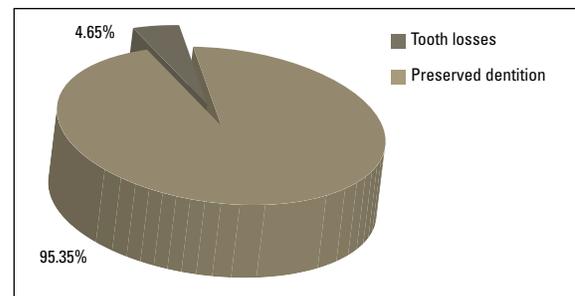


FIGURE 10 - Tooth losses.

Malocclusion has a multifactorial etiology, and tooth loss and the reduction of interdental contacts are only one of the environmental etiological factors responsible for malocclusion.

## CONCLUSION

This epidemiological survey defined the morphological characteristics of malocclusion in children in

the cities of Lins and Promissão in the state of São Paulo, Brazil. A total of 3,466 children aged 7 to 12 years were enrolled. Our findings suggest that:

- » The analysis of the sagittal relationship of malocclusion revealed a prevalence of 55.25% for Class I, followed by 38% for Class II, and 6.75% for Class III.
- » The analysis of the vertical dimension revealed that 17.28% of the children had an open bite, whereas 13.28% had a deep bite.
- » Posterior crossbite was found in 13.3% of the total study sample.
- » Anterior crossbite was found in 5.05% of the total study sample.

- » Diastemas were found in 31.88%, and crowding, in 31.59% of the children.
- » Tooth losses were seen in 4.65% of the study sample.

#### **ACKNOWLEDGEMENTS**

We thank our former undergraduate Dentistry students Fabiana Babosa Silva, Patrícia Del Grossi and Ricardo Humberto Artioli Grassi and the former graduate orthodontics students Luiz Fábio Silva Ferrato and Paulo Roberto Miranda, all from the School of Dentistry of Lins, FOL/UNIMEP, for their collaboration and participation in sample selection.

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Submitted: January 31, 2008

Revised and accepted: August 30, 2008

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