Epidemiology of Posterior Crossbite in the Primary Dentition

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This epidemiological survey was conducted on 2,016 children from 8 private and 12 public preschools at the city of Bauru, São Paulo, Brazil. The sample was composed of 1,032 males and 984 females in the primary dentition stage, aged 3 to 6 years.

Normal occlusion was observed in 26.74% of the sample; thus, 73.26% of children presented some type of malocclusion. Among the malocclusions, the following transverse problems were diagnosed: unilateral posterior crossbite (11.65%), anterior open bite associated with posterior crossbite (6.99%), bilateral posterior crossbite (1.19%), unilateral posterior crossbite associate with anterior crossbite (0.79%) and full crossbite (0.19%) totalizing 20.81% of the transverse problems. Mandibular functional deviation was observed in 91.91% of children with unilateral posterior crossbite, characterizing the functional unilateral posterior crossbite.

The results demonstrated that the prevalence of posterior crossbite was compatible with previous data in the literature, with predominance of functional unilateral posterior crossbite.

Key words: *Epidemiology, malocclusion, primary dentition, crossbite.*
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INTRODUCTION

There is a common belief in the literature and among professionals that malocclusion does not represent an exclusive characteristic of the permanent dentition, but can also be found in stages preceding the occlusal maturity. In fact, a concern about this matter is quite understandable, as malocclusions established in the early stages of occlusal development, in general, are not self-corrected with normal growth and development.

Initially, definition of the concept of normality of interarch relationship in the primary dentition is required: 1) The maxillary arch should entirely contain the mandibular arch, 2) The interarch sagittal relationship, as evaluated by the canines, should be Class I, in which the cusp tip of the max-

Figure 1. A and B - Unilateral posterior crossbite in the primary dentition.

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illary canine lies between the mandibular canine and the primary first molar,[4,24] and 3) The incisal relationship should assure positive overbite and overjet.

Posterior crossbites are characterized by a reverse transverse interarch relationship in response to a reduction in the transverse dimension of the maxillary arch (Figure 1).

Depending on the severity of this constriction, the posterior crossbite can vary from a single tooth involvement, the usual unilateral posterior crossbite, or full crossbite. The prevalence of posterior crossbites in the primary dentition is high and represents one of the most frequent orthodontic problems in this stage of occlusal development.[12] The epidemiologic surveys described in literature estimate that approximately 1.0% to 23.5% of children in the primary dentition show this kind of malocclusion.[2,3,4,6,8,9,10,13,17,18,22,24,28,29,30]

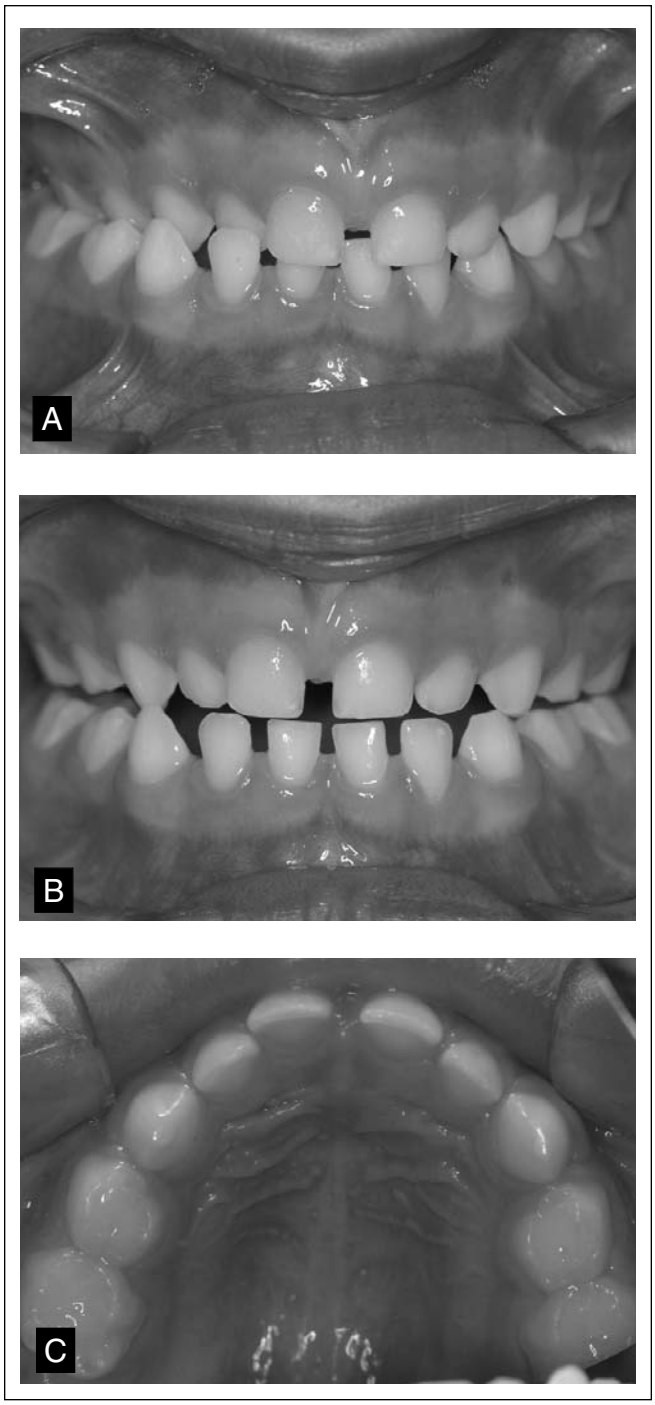


Figure 2. A - Unilateral posterior crossbite in the primary dentition, in maximum intercuspation; B - Bilateral cusp interferences in centric relationship at the primary canines. This behavior characterizes a functional unilateral posterior crossbite; C – Symmetrical constriction of superior dental arch.

Diagnosis of the posterior crossbite is performed in maximum intercuspation. The most common manifestation of the posterior crossbite is unilateral, therefore, posterior crossbite tends to manifest unilaterally and is usually characterized by a "double bite", in which the patient presents a unilateral posterior crossbite in maximum intercuspation, yet changes into another transverse relationship, with contacts almost always at the primary canines, when the mandible is guided in centric relation (Figure 2). The occlusal contact in centric relation is unstable and induces the patient to seek a stable occlusal relationship in maximum intercuspation. This characterizes the functional unilateral posterior crossbite. Nearly 80% to 97% of all cases of unilateral posterior crossbite present a functional nature in the early stages of occlusal development.[6, 9, 12, 13, 15] That is to say, constriction of the maxillary arch is usually symmetrical and the unilateral appearance is related to mandibular deviation, which produces an asymmetry in the condyle-fossa relationship.[5, 19, 26] Therefore, the most frequent inter-arch expression of the maxillary constriction is the functional unilateral posterior crossbite.

The present study aimed at assessing the prevalence of posterior crossbite in the primary dentition of preschool children at Bauru, São Paulo – Brazil, according to gender and socioeconomic level.

MATERIALS AND METHODS

The present study sample was composed of 2,016 Brazilian children aged 3 to 6 years. The children considered in the sample should have a fully erupted primary dentition without any partially or fully erupted permanent teeth and any sort of previous orthodontic treatment.

All children were regularly enrolled in teaching institutions (12 public and 8 private schools) at the city of Bauru – Brazil. The aforementioned schools were randomly selected and served as an indicator of the student's socioeconomic level. The public preschool children were rated as being of low socioeconomic level and corresponded to 1,211 children (60.07%), whereas those from private schools were considered as having a medium socioeconomic level, adding up to 805 children (39.93%). The age of children ranged from 3 to 6 years; 1,032 (51.2%) were males and 984 (48.8%) were females.

Clinical examination of all preschool children was performed by calibrated professionals attending a graduate program in Orthodontics, who investigated the presence of posterior crossbite and its aspects. Clinical examination was carried out under natural light at common dental sets available at the schools, only with aid of tongue depressors. Occlusion was evaluated in maximum intercuspation and

Table 1. Distribution of characteristics of transverse malocclusion in 2,016 children examined in the primary dentition stage. Diagnosis was performed in maximum intercuspation The Z-test of proportion was used to assess the gender dimorphism.

Characteristics of transverse malocclusion	Male (n=1032)		Female (n=984)		Total (n=2016)		P	z*
	(n)	(%)	(n)	(%)	(n)	(%)		
Unilateral posterior crossbite	79	7.65	156	15.80	235	11.60	p<0.001	z=5.666
Unilateral right posterior crossbite	47	4.55	91	9.25	138	6.84	p<0.001	z=4.089
Unilateral left posterior crossbite	32	3.10	65	6.60	97	4.81	p<0.001	z=3.445
Anterior open bite + posterior crossbite	44	4.26	97	9.39	141	6.99	p<0.001	z=4.496
Unilateral posterior crossbite + anterior crossbite	11	1.06	5	0.50	16	0.79	p=0.242	z=1.170
Bilateral posterior crossbite	9	0.87	15	1.52	24	1.19	p=0.254	z=1.141
Full crossbite	2	0.19	2	0.20	4	0.19	p=0.650	z=0.454

*Z-test of proportion

Table 2. Distribution of characteristics of transverse malocclusion in 2,016 children examined in the primary dentition stage. Diagnosis was performed in maximum intercuspation The Z-test of proportion was used to assess the socioeconomic dimorphism.

Characteristics of transverse malocclusion	Male (n=1032)		Female (n=984)		Total (n=2016)		P	z*
	(n)	(%)	(n)	(%)	(n)	(%)		
Unilateral posterior crossbite	80	9.93	155	12.79	235	11.65	p=0.058	z=1.893
Unilateral right posterior crossbite	45	5.59	93	7.68	138	6.84	p=0.083	z=1.733
Unilateral left posterior crossbite	35	4.34	62	5.11	97	4.81	p=0.492	z=0.687
Anterior open bite + posterior crossbite	36	4.47	105	8.67	141	6.99	p<0.001	z=3.532
Unilateral posterior crossbite + anterior crossbite	8	0.99	8	0.66	16	0.79	p=0.573	z=0.564
Bilateral posterior crossbite	7	0.86	17	1.40	24	1.19	p=0.374	z=0.889
Full crossbite	3	0.37	1	0.08	4	0.19	p=0.353	z=0.928

*Z-test of proportion

mandible was manipulated in centric relation, whenever necessary. The collected data were recorded on especially designed forms and submitted to statistical analysis by the chi-square test (X^2) and the Z-test of proportions in order to evaluate the influence of gender dimorphism and socioeconomic level on the diagnosed occlusal status. The results were considered significant with $p<0.001$.

RESULTS

The results are presented in Tables 1-4. Tables 1 and 2 show the mean percentages of the transverse problems in the 2,016 children evaluated, as well as the Z-test of proportions to check out the influence of gender and socioeconomic level, respectively.

Transverse problems were found in 20.81% of children, with predominance of unilateral posterior crossbite and the posterior crossbite associated with anterior open bite in females. The last was predominant in the low socioeconomic level (public schools).

Table 3 presents the percentage of functional deviation found in the uniteral posterior crossbite. As shown by the chi-square test (X^2), 91.91% of children exhibited a "double bite," or maximum intercuspation different from the centric relation, regardless of gender.

Table 4 shows that the asymmetric sagittal relationship between arches (canine relationship) was constantly present in cases with unilateral posterior crossbite, and that the Class II canine relationship was more prevalent at the crossbite side.

DISCUSSION

A total of 2,016 children in the primary dentition, aged 3-6 years, were evaluated within a period of 9 months, by the Orthodontic team of HRAC/USP in Bauru, Brazil. The main

Table 3. Distribution of unilateral posterior crossbite in the primary dentition, according to the presence of mandibular functional deviation. (Manipulation of the mandible in centric relationship).

Functional deviation	Unilateral right posterior crossbite		Unilateral left posterior crossbite		Total	
	(n)	(%)	(n)	(%)	(n)	(%)
Presence	123	89.13	93	95.87	216	91.91
Absence	15	10.87	4	4.13	19	8.09
Total	138	100.0	97	100.0	235	100.0

x2=3.488; p=0.062

Table 4. Distribution of interarch sagittal relationship (canine relationship) in children with unilateral posterior crossbite.

Sagittal relationship	Crossbite at right side				Crossbite at left side			
	Right side		Left side		Right side		Left side	
	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)
Class I	37	26.82	127	92.04	72	74.24	23	23.71
Class II	101	73.18	9	6.52	20	20.61	72	74.23
Class III	0	0.0	2	1.44	5	5.15	2	2.06
Total	138	100.0	138	100.0	97	100.0	97	100.0
	x^2=128.336; p<0.001				x^2=55.951; p<0.001			

goal was to determine the occlusal characteristics of this population. The following criteria were set for selection of children: 1) Brazilian origin, 2) Dental age corresponding to full primary dentition, and 3) No history of previous orthodontic treatment.

The incidence of normal occlusion in the primary dentition was 26.74%, thus implying that malocclusion was predominant at this stage of occlusal development (Graph 1) and demand cautious attention from professionals.

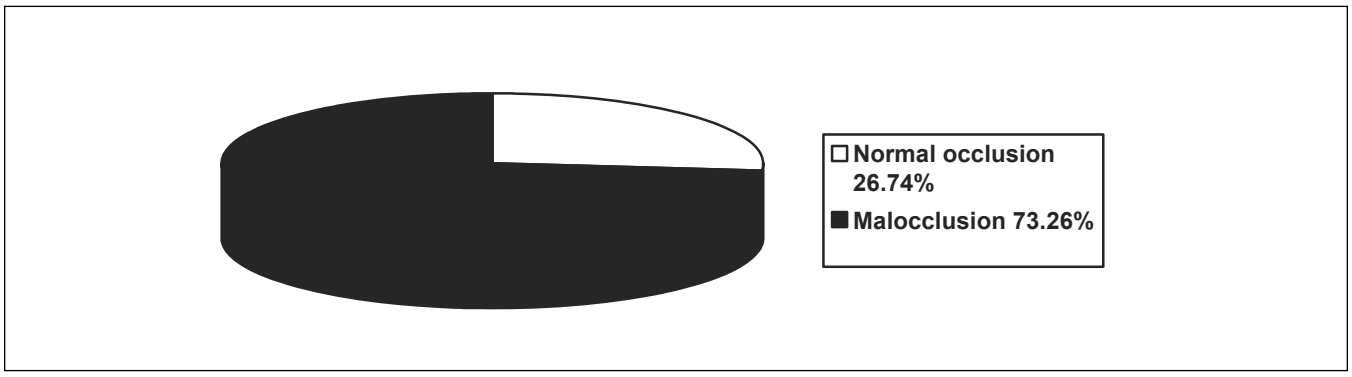
Among the children with malocclusion, 20.81% exhibited interarch problems in response to constriction of the maxillary arch, resulting in any type of posterior crossbite. This is a high incidence, which was only surpassed by the anterior open bite, diagnosed in 34.96% of children. Such incidence of transverse discrepancies (20.81%) is in agreement with another survey conducted in Brazilian children, namely 20%.[23] In fact, it is also close to high percentages found in the Swedish literature, such as 19%,[6] 22%[10] and 23.3%.[12]

It is quite possible that the high incidence of constriction of the maxillary arch in the primary dentition has a strong etiologic relationship with frequently present sucking habits in this developmental stage, either thumb or dummy sucking, as suggested by some authors,[12, 18, 23] associated or not to respiratory problems. Among the 2,016 children examined in the present study, 48% showed some type of sucking oral habit. Among the children presenting posterior crossbite (263), 70.73% had a sucking habit. The prevalence of this habit in children with posterior crossbite associated with anterior open bite (141) was even higher, namely 73.34%. Because the children were in the primary dentition, anterior open bite is related to oral habits and, thus, has possibly a dentoalveolar characteristic.

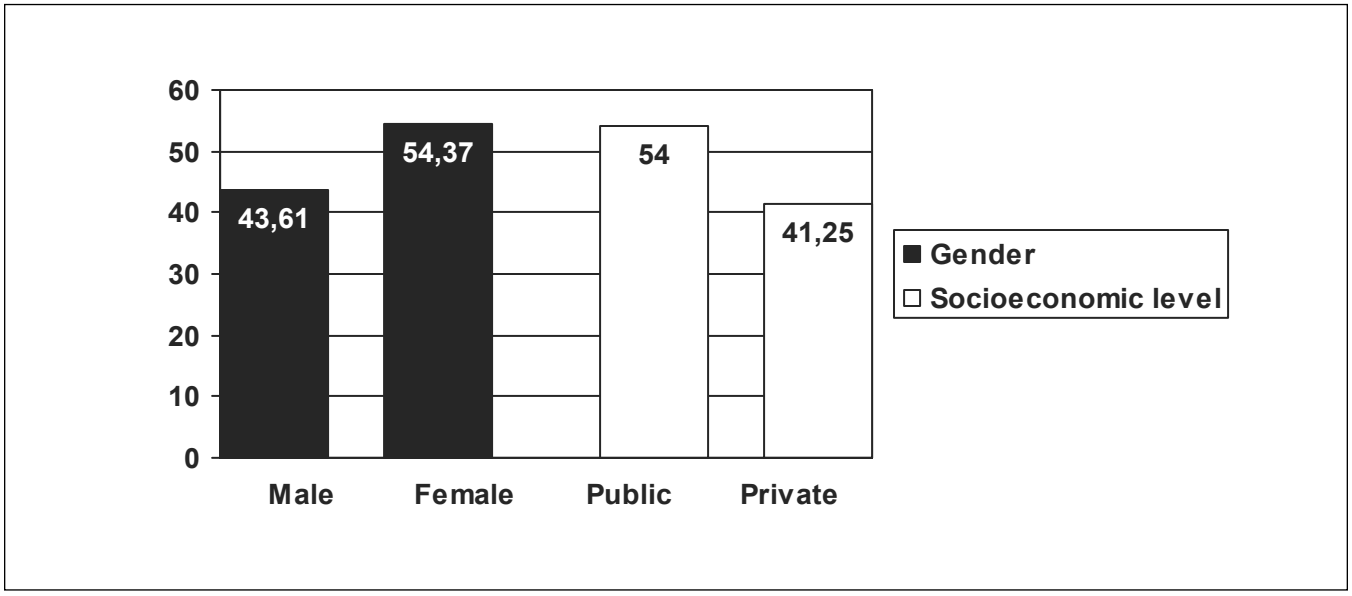
In Tables 1 and 2, the sample of 2,016 children in the primary dentition was classified according to the clinical feature of the crossbite and some of its associations. Diagnosis of these occlusal conditions was performed in maximum intercuspation. In decreasing order of prevalence, the following transverse malocclusions were quantified: unilateral posterior crossbite (11.6%), 6.8% at the right side and 4.8% at the left side, anterior open bite associated with posterior crossbite (6.99%), bilateral posterior crossbite (1.19%), unilateral posterior crossbite associated with anterior crossbite (0.79%) and full crossbite (0.19%). As diagnosis was performed in maximum intercuspation, posterior crossbite was considered unilateral when it manifested in one side, whilst it was considered bilateral when both sides were in crossbite. The difference between unilateral and bilateral posterior crossbite is related to the gravity of the maxillary constriction. Total crossbite was diagnosed in Class I and Class III malocclusions.

Gender dimorphism was statistically significant in unilateral posterior crossbite and association of anterior open bite with posterior crossbite (Table 1). These malocclusions were more prevalent in females; some authors have suggested an etiologic linkage with harmful oral habits.[23, 27] The presence of harmful oral habits in children influences the intra- and interarch relationships. Graph 2 shows that thumb sucking habits were more likely found in girls (54.37%) than in boys (43.61%). These results are in agreement with some authors.[7, 14, 20, 21]

The morphologic status of occlusion in the primary dentition was also influenced by the socioeconomic level, as demonstrated in Table 2. In the present study, the socioeconomic level was determined by public and private preschools, which respectively represented the low and the



Graph 1: Prevalence of normal occlusion and malocclusion in 2,016 Brazilian children aged 3 to 6 years, in the primary dentition stage.



Graph 2. Distribution of thumb sucking habits according to gender and socioeconomic level in 2,016 Brazilian children aged 3 to 6 years, in the primary dentition stage.

medium socioeconomic levels. The prevalence of association of anterior open bite and posterior crossbite was found to be statistically significant in public preschool children of low socioeconomic level. This result was also obtained by Calisti *et al.* (1960),[1] but differs from those found in the epidemiologic survey conducted in the city of Araraquara, Brazil,[16] where the influence of the socioeconomic level was not detected on the occlusal status in the primary dentition. On the other hand, a research conducted by Infante (1975)[8] showed that children of medium socioeconomic level exhibited a higher incidence of posterior crossbite associated with anterior open bite than those of a lower socioeconomic level.

In the present work, the persistent thumb sucking habit was predominant in children of low socioeconomic level (Graph 2), explaining the prevalence of association of anterior open bite and posterior crossbite in this group (Table 2).

Table 3 shows that 91.91% of children with unilateral posterior crossbite exhibited, in fact, a "double bite". This diagnosis was possible after identifying a centric relation (CR) different from maximum intercuspation (MI). This condition justifies the term "functional unilateral posterior crossbite." Kurol and Berglung (1992)[12] found 80% of functional deviation in Swedish children with posterior crossbite, whereas Lindner and Modeer (1989)[15] detected it in 97% of all cases of crossbite.

The mandibular functional deviation can be regarded as a typical demonstration of symmetry in the constricted of the maxillary arch, and asymmetry in the condyle-fossa geometric relationship. This symmetric constriction of either skeletal or dentoalveolar origin, with a mandibular deviation to escape the unstable centric intercuspation, is beyond the academic boundaries, as it demands a symmetric transverse mechanics for correction of maxillary constriction.[25]

The condyle at the side of functional posterior crossbite is displaced upwards and backwards[19, 26] or is rather maintained in its normal position into the glenoid fossa.[5] On the other hand, the condyle at the normal occlusion side moves downwards and forwards.[5, 19, 26] This reveals the need of early orthodontic intervention to favor the immediate symmetry of condyles into their respective glenoid fossae. This asymmetry in the geometric relationship between condyles and fossa produces a frequent asymmetry in the sagittal interarch relationship when the mandible is in maximum intercuspation (Table 4). The sagittal asymmetry observed in the functional unilateral posterior crossbite is related to functional mandibular deviations, which changes the interach relationship and is identified by the canine relationship. In fact, this asymmetric Class II relationship does not indicate a sagittal problem; rather, it is a consequence of the transverse problem. The Class II interarch relationship was predominant at the posterior crossbite side, thus demonstrating the functional nature of unilateral posterior crossbite.

CONCLUSIONS

After clinical occlusal evaluation of 2.016 Brazilian children in the primary dentition stage aged 3 to 6 years, it was possible to conclude that:

1. The incidence of normal occlusion in the primary dentition was 26.74%.
2. The incidence of all different types of posterior crossbite in the primary dentition was 20.81%.
3. The following transverse malocclusions were quantified: unilateral posterior crossbite (11.6%, being 6.8% at the right side and 4.8% at the left side), anterior open bite associated with posterior crossbite (6.9%), bilateral posterior crossbite (1.19%), unilateral posterior crossbite associated with anterior crossbite (0.79%) and full crossbite (0.19%).
4. Mandibular functional deviation was present in 91.91% of children with unilateral posterior crossbite, thus justifying the term "functional unilateral posterior crossbite".

5. The sample demonstrated gender dimorphism with regard to the unilateral posterior crossbite and association of posterior crossbite and anterior open bite, both being more prevalent in females.
6. With regard to socioeconomic level, there was a statistically significant difference only in the association of posterior crossbite and anterior open bite, being more prevalent in public schools (8.67%) than in private schools (4.47%).
7. The gender and socioeconomic dimorphisms were believed to be due to thumb sucking habits, which were more prevalent in females and in public preschools children.
8. At the unilateral posterior crossbite side, a sagittal Class II interarch relationship (canine relationship) prevailed, whereas a Class I relationship was more prevalent at the opposite side. Such asymmetry in interarch sagittal relationship confirms the mandibular functional deviation in the unilateral posterior crossbite.

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