

Prevalence of a posterior crossbite and sucking habits in Brazilian children aged 18–59 months

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SUMMARY This cross-sectional study aimed to assess the prevalence of posterior crossbites and non-nutritive sucking habits in 2750 Brazilian children aged from 18 to 59 months. The data were collected by 123 previously trained dental students and recorded on a response card according to the model developed by the Forsyth Institute, Boston, Maryland, USA, for optical reading. Information concerning sucking habits and family income was obtained during an interview with a parent or guardian. A clinical examination was also undertaken. Statistical analysis included chi-square and Fisher's exact tests.

A posterior crossbite was observed as early as 18 months of age. The prevalence of a posterior crossbite was 10.4 per cent and was associated with age ($P=0.00$) and with sucking habits ($P=0.01$). The prevalence of sucking habits was 43.5 per cent. A posterior crossbite was not associated with socio-economic status ($P=0.38$). While sucking habits were common among the age group studied (43.5 per cent), only a small percentage exhibited a posterior crossbite. These results suggest that further investigations into other aetiological factors, in particular genetics and respiratory problems, are necessary to provide more evidence that could clarify this issue.

Introduction

Knowledge of the aetiology of malocclusions is essential for the success of orthodontic treatment since a prerequisite for correction is the elimination of the causes. In view of the increasing interest in the early diagnosis and treatment of malocclusions and the corresponding emphasis on preventive procedures, further information is needed.

The prevalence of a posterior crossbite in the primary and early mixed dentitions has been reported to be between 8 and 22 per cent (Lindner and Modéer, 1989; Katz *et al.*, 2004). Factors involved in the aetiology of crossbite include heredity, non-nutritive sucking habits (Svedmyr, 1979; Larsson, 1983; Lindner and Modéer, 1989; Øgaard *et al.*, 1994; Adair *et al.*, 1995; Farsi and Salama, 1997; Warren and Bishara, 2002), and impaired nasal breathing caused by enlarged tonsils and adenoids (Oulis *et al.*, 1994).

The status of the primary occlusion affects the development of the permanent occlusion. Thus, a posterior crossbite is believed to be transferred from the primary to the permanent dentition and can have long-term effects on growth and development of the teeth and jaws (Proffit and Fields, 1986; Harrison and Ashby, 2001; McNamara, 2002; Thilander and Lennartsson, 2002).

A posterior crossbite is defined as an abnormal buccolingual relationship between opposing molars, premolars, or both, in centric occlusion (Moyers, 1988). It can be caused by a malposition of individual or groups of posterior teeth (dental crossbites), a malposition of posterior teeth accompanied by a functional mandibular shift (functional crossbite), or transverse disharmonies of the maxilla and mandible (skeletal crossbite). Posterior crossbite

relationships are frequently caused by a combination of the aforementioned factors (Moskowitz, 2005) and have been reported to develop between 19 months and 5 years of age, with approximately 80 per cent of unilateral posterior crossbites accompanied by functional shifts of the mandible (Thilander *et al.*, 1984).

According to a number of authors (Svedmyr, 1979; Myers *et al.*, 1980; Adair *et al.*, 1995; Warren and Bishara, 2002), a posterior crossbite is generally established during the eruption of the primary canines, when a maxillary occlusal relationship develops and the mandible undergoes functional adaptation, deviating either to the right or to the left.

Brazilian epidemiological studies in early childhood are limited due to the difficulty of access to the children. A large number of them are too young to attend day care centres or schools. In developing countries, there is limited access to dental services and patients often seek only emergency treatment.

This study aimed to assess the prevalence of a posterior crossbite and non-nutritive sucking habits in children between 18 and 59 months of age.

Subjects and methods

The present cross-sectional study was conducted in the city of Recife, which is the state capital of Pernambuco in the northeast region of Brazil. The study was approved by the Ethics in Research Committee of the University of Pernambuco.

The sample comprised children of both genders who were less than 5 years of age, examined during the National

Vaccination Campaign in Recife, Brazil for poliomyelitis. This campaign takes place during July and August. In 2005, Pernambuco was the Brazilian state with the greatest vaccine coverage.

A representative sample of children was calculated using the Epi-Info 6.0 (Centers for Disease Control and Prevention, Atlanta, Georgia, USA) software program. The following data were considered: population of 133 797 children under the age of 5 years vaccinated in Pernambuco in 2005, estimated prevalence of posterior crossbite of 10 per cent (Katz *et al.*, 2004), precision index of 2 per cent, and reliability index of 99 per cent. The calculated sample was 1477 children. Nevertheless, during the National Vaccination Campaign, 2750 children aged 18–59 months were examined.

The data were collected by 123 previously trained dental students. The training comprised lectures and clinical examinations at the University Children's Dental Clinic. The level of agreement between examiners recorded in a simulation of the examinations was over 90 per cent.

The children were examined at 20 public health units distributed throughout the six administrative districts of the city. The inclusion criteria were children attending the health centres during the national immunization campaign day whose parents or guardians agreed to them taking part and who signed an informed consent. Children whose parents did not authorize participation and those with genetic syndromes or systemic diseases with manifestations in the oral cavity were excluded. Following the dental examination, those who had a treatment need were referred to the health care units or to the Dental School.

The data were recorded on a response card according to the model used by the Forsyth Institute, Boston, Maryland, USA, for optical reading. Information was obtained during an interview with a parent or guardian. Clinical examination data were also recorded.

Interviews were carried out with the parent or guardian in order to obtain information on gender, date of birth, socio-economic status, and the presence or absence of non-nutritive sucking habits, such as dummy and/or digit (thumb or finger) sucking.

The clinical examination was performed under natural light, with the child in the knee-to-knee position in the courtyard at the health unit. Caps, masks, gloves, and gauze were used to comply with infection control.

Occlusion was assessed through the manipulation of the jaws to obtain centric occlusion. A posterior crossbite was recorded when one or more of the maxillary posterior teeth occluded palatal to the buccal cusp of the opposing mandibular teeth.

After optical reading, the data were transferred to a spreadsheet on the Excel software. The Statistical Package for the Social Sciences version 11.0 (SPSS Inc., Chicago, Illinois, USA) was used for statistical analysis. To determine significant differences, chi-square and Fisher's exact tests

were used. The margin of error and significance level was set as 5 per cent.

Results

Table 1 shows the characteristics of the sample according to age, gender, non-nutritive sucking habits, and socio-economic status. It was not possible to obtain information on the gender of 887 subjects due to a data entry failure on the response card in the first phase of the study. Of the 1863 children examined in the second phase of data collection, 35.5 per cent were males and 64.5 per cent females (Table 1). The prevalence of sucking habits was 43.5 per cent. The prevalence of pacifier sucking was 34.5 per cent, and of a digit 9 per cent (Table 1).

Fifty per cent of the children examined were from families whose monthly income was at the level of the national wage, corresponding to US\$ 140, 25 per cent from families earning two to three times the minimum wage, and 25 per cent from those earning four or more times the minimum wage (Table 1).

Table 2 shows that the prevalence of a posterior crossbite was 10.4 per cent. Most unilateral crossbites occurred on the right-hand side (45 per cent). A crossbite of the canines was observed in 46.5 per cent of the children, followed by a crossbite of the first (35.7 per cent) and second (25.2 per cent) primary molars (Table 3).

The incidence of a posterior crossbite increased significantly with age, from 6.3 to 14.9 per cent in the group aged 24–59 months (Table 4).

Table 1 Distribution according to age, gender, non-nutritive sucking habits, and socio-economic status.

Variable	<i>n</i>	%
Age group (in months)		
18–23	398	14.5
24–35	757	27.5
26–47	802	29.2
48–59	793	28.8
Total	2750	100.0
Gender		
Male	978	35.5
Female	885	64.5
Total*	1863	100.0
Non-nutritive sucking habits		
No	1553	56.5
Pacifier	950	34.5
Thumb/finger	247	9.0
Total	2750	100.0
Socio-economic status (times the minimum wage)		
1	1401	51.0
2	425	15.5
3	234	8.5
≥4	690	25.0
Total	2750	100.0

*Information not available for 887 subjects.

Table 2 Assessment of a posterior crossbite according to the affected side.

Variable	<i>n</i>	%
Crossbite		
Yes	287	10.4
No	2463	89.6
Total	2750	100.0
Side		
Right	109	45.0
Left	84	34.7
Bilateral	49	20.3
Total*	242	100.0

*Information not available for 45 children.

Table 3 Assessment of crossbite according to the tooth analysed and the number of teeth in the posterior crossbite.

Side	Teeth analysed	<i>n</i>	%
Right	Canine	133	23.5
	First molar	102	18.0
	Second molar	72	12.7
Left	Canine	111	19.6
	First molar	82	14.5
	Second molar	66	11.7
	Total	566	—

According to the data available in the second phase of the vaccination campaign, a posterior crossbite was more prevalent among females (12.7 per cent) than males (8.8 per cent). This difference was statistically significant (Table 4).

There was no association between a posterior crossbite and socio-economic status.

The prevalence of a posterior crossbite was associated with pacifier sucking (Table 4).

Discussion

The current literature shows that non-nutritive sucking habits, especially pacifier sucking, are common among young children in industrialized countries (Chevitarese *et al.*, 2002; Warren and Bishara, 2002; Bishara *et al.*, 2006).

The industrialization and modernization of society, which requires the participation of females in the labour force, has led to a reduction in breastfeeding, which makes children more likely to adopt the habit of sucking fingers and pacifiers (Øgaard *et al.*, 1994; Farsi and Salama, 1997; Katz *et al.*, 2004). Thus, the high prevalence of pacifier sucking in the present study can be explained by the fact that the Brazilian population has cultural habits similar to those of other developing countries.

The prevalence of a posterior crossbite was low among the investigated sample (10.1 per cent). This is in agreement

with other Brazilian studies (Chevitarese *et al.*, 2002; Katz *et al.*, 2004).

A posterior crossbite was noted as early as 18 months of age. This coincides with the eruption of the primary canines and agrees with the finding of Myers *et al.* (1980) and Lindner and Modéer (1989) that a functional posterior crossbite begins with the eruption of these teeth.

At 24 months of age, the prevalence of a posterior crossbite increased significantly, reaching 14.9 per cent in the 48- to 59-month age group. This significant increase with age has also been observed in another Brazilian study (Katz *et al.*, 2004) and can be explained by the establishment of the primary occlusion which occurs at approximately 30 months of age.

According to Myers *et al.* (1980), most cases of posterior crossbite are manifested unilaterally. In the present study, the most prevalent type of crossbite was also unilateral, as found by Lindner and Modéer (1989) and Katz *et al.* (2004), with the right-hand side the more often affected. It should, however, be borne in mind that posterior crossbites in the primary dentition are generally functional.

The highest prevalence of a crossbite was for the canines, followed by the first and second primary molars, which is in agreement with Myers *et al.* (1980). A posterior crossbite was more prevalent among females (12.7 per cent), which is in agreement with Øgaard *et al.* (1994) and Chevitarese *et al.* (2002), suggesting that the early establishment of occlusion among females could account for this finding.

The prevalence of a posterior crossbite was associated with non-nutritive sucking habits, especially pacifier sucking. This is in agreement with most studies (Svedmyr, 1979; Larsson, 1983; Lindner and Modéer, 1989; Øgaard *et al.*, 1994; Adair *et al.*, 1995; Farsi and Salama, 1997; Warren and Bishara, 2002; Katz *et al.*, 2004). However, this finding should be analysed with caution, as non-nutritive sucking habits are common among this age group and only a small proportion of the children develop a posterior crossbite.

It is important to point out that the association between non-nutritive sucking habits and posterior crossbites does not necessarily signify a cause and effect relationship (Kennedy and Osepchok, 2005). What it does suggest is that factors other than sucking habits may be responsible for this type of malocclusion. There are a limited number of studies in the literature on genetic factors in the development of malocclusions. Thus, further research is required to provide evidence that could clarify this issue.

Conclusions

1. A posterior crossbite was observed as early as 18 months of age.
2. The prevalence of non-nutritive sucking was higher for pacifier than for thumb or finger sucking.

Table 4 Assessment of posterior crossbite according to age, gender, socio-economic status, and non-nutritive sucking habits.

Variable	Posterior crossbite						<i>P</i> value	Odds ratio (95% confidence interval)
	Yes		No		Total			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
Age group (in months)								
18–23	11	2.8	387	97.2	398	100.0	0.00*	1.00
24–35	48	6.3	709	93.7	757	100.0		2.38 (1.22–4.64)
36–47	110	13.7	692	86.3	802	100.0		5.59 (2.97–10.52)
48–59	118	14.9	675	85.1	793	100.0		6.15 (3.27–11.55)
Group total	287	10.4	2463	89.6	2750	100.0		
Gender								
Male	86	8.8	892	91.2	978	100.0	0.00*	1.00
Female	112	12.7	773	87.3	885	100.0		1.50 (1.12–2.02)
Group total†	198	10.6	1665	89.4	1863	100.0		
Socio-economic status								
1	150	10.7	1251	89.3	1401	100.0	0.38	1.00
2	43	10.1	382	89.9	425	100.0		0.94 (0.66–1.34)
3	17	7.3	217	92.7	234	100.0		0.65 (0.39–1.10)
≥4	77	11.2	613	88.8	690	100.0		1.05 (0.78–1.40)
Group total	287	10.4	2463	89.6	2750	100.0		
Sucking habits								
No	142	9.1	1411	90.9	1553	100.0	0.01*	1.00
Pacifier	122	12.8	828	87.2	950	100.0		1.46 (1.13–1.89)
Thumb/finger	23	9.3	224	90.7	247	100.0		1.02 (0.64–1.62)
Group total	287	10.4	2463	89.6	2750	100.0		

**P* < 0.05.

†Information not available for 89 subjects.

- The prevalence of a posterior crossbite was higher in females, but not associated with socio-economic status.
- A posterior crossbite was associated with non-nutritive sucking habits and is common among the target age group.

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