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Original Article

Prevalence of anterior open bite and associated factors in schoolchildren in a municipality of southern Brazil

Prevalência de mordida aberta anterior e fatores associados em escolares de um município do sul do Brasil

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Resumo

Introdução: A mordida aberta pode gerar relevante impacto psicossocial no cotidiano do paciente, tanto do ponto de vista estético quanto funcional. **Objetivo**: Estimar a prevalência e os fatores associados à mordida aberta anterior em crianças do primeiro ano escolar de um município do sul do Brasil. **Material e método**: Estudo transversal constituído por escolares de seis anos de idade de Palhoça/SC. Foram realizadas entrevistas com as mães para obtenção de informações socioeconômicas e de hábitos de sucção não nutritivos. Exames clínicos bucais das crianças foram realizados nas escolas. Análises multivariadas foram realizadas por meio de regressão de Poisson com estimador robusto. **Resultado**: O estudo envolveu 655 crianças sendo 50,5% do sexo feminino. A prevalência de mordida aberta anterior foi de 14,1% (IC 95% 11,5; 16,7). Meninas apresentaram prevalência menor [RP= 0,96 (IC 95% 0,94; 0,99) p= 0,024] e aqueles que utilizaram chupeta apresentaram uma maior prevalência [RP= 1,04 (IC 95% 1,01; 1,07) p= 0,003]. **Conclusão**: A prevalência foi de 14,1% associada de forma estatisticamente significativa e independente com sexo e utilização de chupeta.

Descritores: Oclusopatias; mordida aberta; crianças.

Abstract

Introduction: Open bite can generate relevant psychosocial impact in the daily life of the patient, both from the aesthetic and functional point of view. **Objective**: The aim of this study was to estimate the prevalence and factors associated with the anterior open bite in children in the first school year in a municipality in southern Brazil. **Material and method**: A cross-sectional study was carried out with six-year-old schoolchildren in Palhoça/SC. Interviews were conducted with mothers to gather socioeconomic and non-nutritive sucking habits information. Children oral clinical examinations were carried out in schools. Multivariate analyses were performed using Poisson regression with a robust estimator. The study involved 655 children, 50.5% being female. **Result**: The prevalence of anterior open bite was 14.1% (95% CI 11.5; 16.7). Girls exhibited a lower prevalence [PR= 0.96 (95% CI 0.94; 0.99) p= 0.024] and those children who used a pacifier exhibited a higher prevalence of anterior open bite [PR= 1.04 (95% CI 1.01; 1.07) p= 0.003]. **Conclusion**: The prevalence was 14.1% and that it was associated with gender and the use of pacifier, in a statistically significant and independent way.

Descriptors: Malocclusion; open bite; children.

INTRODUCTION

Malocclusions affect the bone bases growth and the development of facial muscles, causing functional and aesthetic imbalances, which may interfere in the quality of life in the future[1-3]. Malocclusions have become a public health problem, surpassed only by dental caries and periodontal diseases[2].

One of the malocclusions with the greatest potential to affect the mixed dentition is the open bite[2]. When it involves the incisors and canines teeth it is called anterior open bite (AOB) and can be caused by both skeletal changes as well as changes in dental positioning. For diagnosis, the posterior teeth must be occluded and a negative vertical >2 mm overlap should be observed in the front teeth[2,4]. This is represented by the buccal position of the anterior teeth and the lack of vertical overlap between the upper and lower incisors[2,3], which can generate a relevant psychosocial impact in the daily life of the patient, both from the aesthetic and functional point of view[3]. Its etiology is multifactorial[4,5] and may be associated to genetic predisposition, deleterious oral habits such as the use of baby bottle, pacifier, thumb-sucking, oro-nasal breathing, hypertrophic tonsils, lingual interposition, onychophagy, bruxism and anomaly in the tooth eruption process. Such conditions affect the growth and development of facial structures, interfering with the morphology and functions of the stomatognathic system[2], since AOB predisposes to functional disorders of the lips and of the tongue, which in turn leads to atypical swallowing, causes chewing problems, phonation and myofascial hypodevelopment[6].

Non-nutritive sucking habits maintained for a long period of time and low breastfeeding rates are determining factors for the development of AOB[6]. On the other hand, breastfeeding, besides being nutritious and contributing to immunity, favors the development of facial muscles, stimulates breathing, swallowing, chewing and phonation, and is also considered an orthopedic stimulant for the temporomandibular joint[7]. Therefore, the breastfeeding period does not exclude the potential development of an open bite, but it can prevent malocclusions[7].

Because it has the potential to impact the future children and adolescents' quality of life and considering the possibility of prevention through public policies, such as encouraging breastfeeding and avoiding the use of milk bottles and pacifiers at the appropriate time, it is of fundamental importance to carry out epidemiological studies aimed at knowing the prevalence of AOB and its associated factors. Locally based studies can influence public policies within the framework of the Brazilian Unified Health System (*SUS – Sistema Único de Saúde*) policies, especially in settings such as family and school, through education and health promotion actions. Thus, the objective of this study was to estimate the prevalence of AOB and associated factors in 6-year-old schoolchildren in Palhoça/SC, Brazil.

MATERIAL AND METHOD

This is a cross-sectional study nested in the cohort study called "*Coorte Brasil Sul*"[8] carried out with children attending the first-year elementary school (six years old) and their families, in the municipality of Palhoça/SC.

The minimum number of the sample individuals was determined using the following parameters: total population of 1,756 children from 59 public and private schools in the municipality; 95% confidence level; expected prevalence of AOB unknown (P= 50%); 3%. relative error. Thus, the minimum sample size included 664 children and their families. The

inclusion criteria were: six-year-old children, attending the first year of elementary school, enrolled in public and private schools in Palhoça/SC; child's family residing in Palhoça/SC. The exclusion criterion was children with syndromes that prevented the clinical oral examination.

Interviews were conducted at home with mothers, or in their absence, with the child's primary caregiver, retrieving socioeconomic information and non-nutritive sucking habits. Such data were collected by a survey team composed of investigators from the *Coorte Brasil Sul*[8] and by Palhoça Community Health Agents, all formally trained for this purpose. Oral clinical examinations of the children were carried out in the school setting. Data were collected by eight dentists. All examiners underwent a calibration process to measure and minimize intra- and inter-examiner diagnostic variability, according to the methodology previously described[9]. Kappa values equal to or greater than 0.7 were considered acceptable[9].

Children's clinical examinations were carried out at school, in a classroom under natural light, in addition to the artificial light suitable for the setting. All biosafety procedures were strictly followed. AOB was measured considering the absence of contact between the upper and lower incisors when the teeth were occluded. The distance was measured in millimeters from the top of the upper central incisor to the top of the corresponding lower central incisor. The exams were collected in duplicate in 5% of the sample for later measurement of diagnostic reproducibility maintenance.

The study dependent variable was the prevalence of AOB. The independent variables were the child's gender, mother's and father's education (dichotomized in up to 8 completed school years and more than 8 years), occupation of mother and father (with or without income), stable relationship (yes or no); type of school (public or private), weaning on the fourth and sixth month of life (yes or no); thumb-sucking (yes or no), milk bottle use (yes or no), pacifier use (yes or no).

Data were analyzed using the Statistical Package for the Social Sciences (SPSS®) version 18.0. Association studies between the dependent and independent variables were performed using the chi-square test. To review potential confounding factors and also to estimate the magnitude of the associations, Poisson regression analysis was performed with a robust estimator, with estimation of the prevalence ratios and their relevant 95% confidence intervals.

The investigation project was submitted to and approved by the Research Ethics Committee of the *Universidade do Sul de Santa Catarina* through opinion 38240114.0.0000.5369. Only children who gave their assent to the oral exam and whose parents signed a Free and Informed Consent Form were examined.

RESULT

A total of 655 children were examined, providing a response rate of 98.6%. The diagnostic reproducibility measured by the Kappa test in duplicate tests ranged from 0.70 to 0.98.

Out of the children included in the study, 50.5% were female and the majority attended public schools. The sociodemographic variables of the studied population are shown in Table 1.

Table 1. Prevalence of risk behaviors for malocclusions and sociodemographic variables in 6-year-old schoolchildren. Palhoça/SC

VARIABLES	n	%	95% CI
CHILDREN'S GENDER (n= 655)			
Male	326	49.5	45.7; 53.3
Female	329	50.5	46.7;54.3
MOTHER'S EDUCATION (n= 610)			
≤ 8 years	181	29.7	26.1; 33.3
> 8 years	429	70.3	66.7. 73.9
FATHER's EDUCATION (n= 531)			
≤ 8 years	203	38.2	34.1; 42.3
> 8 years	328	61.8	57.7; 65.9
MOTHER OCCUPATION (n= 642)			
No income	246	38.3	34.6; 42.0
With income	396	61.7	58.0; 65.4
FATHER OCCUPATION (n= 599)			
No income	36	6	4.1; 7.9
With income	396	94	92.1; 95.9
STABLE COMPANION (n= 646)			
No stable companion	49	7.7	5.7; 9.7
With stable companion	591	92.3	90.3; 94.3
TYPE OF SCHOOL (n= 655)			
Public	544	84.6	81.9; 87.3
Private	101	15.4	12.7; 18.1
WEANING ON 6th MONTH (n= 586)			
Yes	296	50.5	46.5; 54.5
No	290	49.5	45.5; 53.5
WEANING ON 4th MONTH (n= 586)			
Yes	154	26.3	22.8; 29.8
No	432	73.7	70.2; 77.2
USE OF baby bottle (n= 648)			
Yes	512	79	75.9; 82.1
No	136	21	17.9; 24.1
USE OF PACIFIER (n= 654)			
Yes	323	49.4	45.6; 53.2
No	331	50.6	46.8; 54.4
THUMB-SUCKING (n= 652)			
Yes	58	8.9	6.8; 11.0
No	594	91.1	90.0; 93.2
ORAL BREATHING (n= 652)			
Yes	358	54.9	50.9; 58.9
No	294	45.1	

The presence of AOB was observed in 14.1% (95% CI 11.5; 16.7) of the sample. It was evidenced that on the fourth month of life 26.3% of the children were not breastfeeding and on the sixth month, more than half had already weaned. Regarding sucking habits, there was a predominance of bottle-feeding, but pacifiers were used by almost half of the children and the thumb-sucking habit had a low prevalence (Table 1).

Table 2 shows the results of the association between AOB and the studied characteristics. Child's gender and the use of pacifier showed a statistically significant and independent association with AOB. The female gender had a lower prevalence (PR= 0.96;

95% CI 0.94; 0.99; p = 0.024) when compared to the male gender. Children with the habit of sucking the pacifier had a higher prevalence (PR= 1.04; 95% CI 1.01; 1.07; p = 0.003).

Table 2. Results of the multivariate analysis for prevalence and factors associated with anterior open bite in 6-year-old schoolchildren. Palhoça/SC

VARIABLES	PR_c	95% CI	p value	PR_a	95% IC	p value
CHILDREN'S GENDER						
Male	1		0.046	1		0.024
Female	0.97	0.94; 0.99		0.96	0.94; 0.99	
MOTHER's EDUCATION			0.091			0.086
≤ 8 years	1			1		
> 8 years	1.03	0.99; 1.06		1.02	0.99; 1.05	
FATHER'S EDUCATION			0.985	#		
≤ 8 years	1					
> 8 years	1	0.96; 1.03				
MOTHER OCCUPATION			0.304	#		
No income	0.98	0.95; 1.01				
With income	1					
FATHER OCCUPATION			0.732	#		
No income	0.98	0.92; 1.05				
With income	1					
STABLE COMPANION			0.824	#		
No stable companion	0.99	0.95; 1.03				
With stable companion	1					
TYPE OF SCHOOL			0.687	#		
Public	0.99	0.95; 1.03				
Private	1					
WEANING ON 6th MONTH			0.812	#		
Yes	1	095: 1.03				
No	1					
WEANING ON 4th MONTH			0.623	#		
Yes	1	0.97; 1.04				
No	1					
USE OF BABY BOTTLE			0.224	#		
Yes	0.98	0.94; 1.01				
No	1					
USE OF PACIFIER			<0.001			
Yes	1.81	1.77; 1.86		1.04	1.01; 1.07	0.003
No	1			1		
THUMB-SUCKING			<0.001			
Yes	1.08	1.01; 1.16		1.04	0.97; 1.12	0.185
No	1			1		

PR_c= Crude Prevalence Ratio. PR_a = Prevalence Ratio adjusted for all variables. 95% CI = 95% confidence interval; p = value; # = not included in the final model.

DISCUSSION

High response rates, high diagnostic reproducibility values and the use of valid methods provide good internal and external validity to the study.

This investigation addressed occlusal aspects and the factors that can interfere with the growth and harmonic development of the face structures and stomatognathic functions. Malocclusion is considered a public health problem due to its high prevalence and because it causes functional and aesthetic teeth disorder[10].

AOB was present in 14.1% of the sample, a lower value when compared to other studies. In fact, an investigation carried out with 732 children in Campina Grande/PB, AOB was 21%[11]. In Espírito Santo, there was a prevalence of 16% in a sample of 388 children[12] and in Recife/PE, 19.8% of a total of 2,651 children[13]. Differences in research methods and children's age groups could, in theory, explain the heterogeneity of results.

AOB prevalence was associated with gender. Males had a higher frequency; a similar result was found by Miotto et al.[12] (OR= 3.52; 95% CI 1.30-9.43; p= 0.008), however diverging from the study by Bauman et al.[14] where they observed a higher prevalence in females. In contrast, Boeck et al.[15] did not find any difference between genders. As well as the age group, sociodemographic and behavioral aspects may interfere with occlusion, but in general, the female gender has been identified as a protective factor against oral health problems[16].

Regarding breastfeeding, it was observed that 49.5% of the sample had been breastfed for six months. It is known that breast milk is superior to any other food until six months of age and offers long-term benefits[17]. In addition, breastfeeding favors the development of the stomatognathic system and craniofacial growth functions[17]. When premature breastfeeding interruption occurs, the child discontinues exercising certain muscle groups, compromising the position of the lips and tongue and favoring the appearance of deleterious habits and malocclusions[17,18]. However, in the present study, no association between AOB and weaning date was observed, which implies the need for further studies involving this and other similar populations, since the etiology of AOB is complex and multifactorial.

On the other hand, it was found that bottle-feeding was used in 79% of the children in the sample, which may have contributed to the early weaning. Studies by Zapata et al.[3] and Miotto et al.[12] also found a high prevalence of baby-bottle use, 75.6% and 69.3% respectively. It is important to note that when the child is bottle-fed, there is less oral motor stimulation, which can alter the tongue's position and the swallowing pattern, in addition to changing the flow of ingested fluid[6]. However, in the present study we did not observe a statistically higher prevalence of AOB in children who were bottle-fed. In contrast, Miotto et al.[12] observed statistical significance between bottle use and AOB.

Non-nutritive sucking habit directly influences the determination of the maxillomandibular occlusion ratio[15,19]. It impairs the muscle tone of the lips, tongue and face, changes swallowing, chewing, breathing pattern, phonation and dental positioning. The use of pacifier limits the upper arch growth, the laterolateral mandibular growth and the lack of lip sealing provides antero-posterior growth of the maxilla, favoring the development of AOB[20].

Of the total number of children included in the present study, 49.4% used a pacifier and exhibited a statistically higher prevalence of AOB when compared to those who did not. This result corroborates other findings[2,12,21]. Culturally, a pacifier is accepted, mainly to calm down the crying child and many parents end up giving in to this tool to minimize their anguish and discomfort caused by their children’s cry. However, when the pacifier is offered before the suction pattern is adjusted, damage to the breastfeeding process may ensue contributing to the development of AOB.

As for the thumb-sucking habit, the prevalence in this investigation was 8.9%, lower than what was found in the study by Matos et al.[22] with 15.2%. The literature reports the development of

this habit when there is an emotional need, especially in moments of tension, thus increasing the risk of AOB development[23]. This study found no statistical difference between AOB and thumb-sucking or mouth breathing. On the other hand, associations between thumb-sucking and the occurrence of AOB were observed in different studies[2,24]. Milanesi et al.[25] found an association of oral breathing pattern with AOB occurrence.

The findings of this study, especially the high prevalence of AOB, point out that malocclusion is a problem that needs more attention from health professionals and health services, especially regarding aspects related to family guidance concerning the importance of breastfeeding for the development of the stomatognathic system that will prevent harmful oral habits that could jeopardize the child's functional, aesthetic and psychological aspects.

Among the limitations of the study, we can mention the number of investigators involved in the collection of field data, which could impact the results with the possible introduction of measurement biases. However, care was taken to avoid them, such as the formal training of all professionals involved in the collection process, both in the clinics and at home. A total of 30 hours of theoretical-practical activities were devoted to improve the data collection skills in the households, collection which is fundamental for this investigation. Likewise, dentists and their assistants were formally trained in the collection of epidemiological data on oral health, seeking to obtain diagnostic uniformity, measured before and after data collection, and both were considered adequate. Another important aspect to be considered is that, since children are in the transition phase from deciduous to permanent dentition, typical of the age studied, there is the possibility of AOB measurement bias, which demands caution in interpreting the results.

It can be concluded that the prevalence of AOB in children attending the first school year at Palhoça/SC was 14.1%. Such prevalence was shown to be associated with gender and pacifier use. The knowledge of these results highlights the importance of health strategies aimed at controlling non-nutritive habits, considered risk factors for AOB.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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