Relationship between malocclusion and behavioral, demographic and socioeconomic variables: a cross-sectional study of 5-year-olds

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Objective: *Epidemiological studies have demonstrated that the prevalence and the severity of malocclusion have increased over the years. The aim of this study was to evaluate the relationship between malocclusions, such as open bite and crossbite, and behavioral, demographic and socioeconomic variables in a sample of 5-year-old children attending preschools.* ***Methods:*** *The random sample consisted of 728 preschool children attending 22 public (n=428) and 18 private (n=300) preschools. A calibrated examiner performed the epidemiological examination outdoors, under natural light, using dental mirror and CPI probe. Information on socioeconomic status and the presence of deleterious oral habits was collected by a questionnaire sent to parents. Univariate and multiple logistic regression analyses were performed.* ***Results:*** *The deleterious oral habits were observed in 83.1% of the children and were significantly associated with social class. Pacifier use (OR=21.71), thumb sucking (OR=4.72); atypical swallowing (OR=7.35) and mouth breathing (OR=4.65) were risk indicators for open bite. Pacifier use (OR=1.59), lip interposition (OR=1.78), mouth breathing (OR=1.96) and gender (OR=1.88) were risk indicators for crossbite.* ***Conclusions:*** *Environmental factors, such as the presence of deleterious oral habits as well as social class, play an important role in identifying children with open and/or crossbite.*

Keywords: *Epidemiology; Prevalence; Malocclusion; Social class; Preschool*

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INTRODUCTION

Studies on the prevalence of malocclusion have presented distinct results in different studied populations. The examination criteria, orthodontic index for classifying maloccclusion, several levels of severity, examiner calibration, unavailability of either study models or x-rays to detect unerupted teeth, and also the presence of anomalies are the main contributory factors to the differences in data observed. Other important factors that may influence the results are the sample size and composition, gender, ethnic group and social class.[1-4] Nevertheless, epidemiological studies have demonstrated increasing prevalence and severity of malocclusion over the years.[5-9] The World Health Organization has therefore ranked the presence of malocclusion as the third public health problem in dentistry.[10] According to Brazilian epidemiological data, dental caries, periodontal disease, malocclusion, oral cancer and cleft palate-lip are the main public health dentistry problems. However, this hierarchy can be modified, depending on the area where the assessment is conducted and also the characteristics of studied population.

The last Brazilian epidemiological oral health survey conducted in 2002-2003 showed that 36.5%, 58.1% and

53.2% of 5, 12, and 15-19 year-olds, respectively, presented malocclusion.[11] On the other hand the national Public Health System focused mainly on the control and treatment of caries and periodontal diseases. Few public services develop preventive programs that target malocclusion and provision of therapy, leaving most of the people that need treatment without access to preventive procedures and complex orthodontic/orthopedic therapies.[12] Most types of malocclusion are due to breathing abnormalities and deleterious oral health habits, which makes its prevention a good alternative for public health services.[13]

The aim of this study was to assess the relationship among malocclusions, such as open bite and crossbite, and behavioral, demographic and socioeconomic variables in a sample of 5-year-old children attending preschool.

MATERIALS AND METHODS

Ethical aspects

This cross-sectional study was approved by the Research Ethics Committee of the Faculty of Dentistry of Piracicaba, State University of Campinas (UNICAMP). An informed consent form was signed by the parents before the survey began.

Sample

This study sample was composed of 5-year-old children attending public and private preschools in Piracicaba, Brazil. The sample size was calculated, based on the assumption that 50% of the 5-year-olds presented malocclusion in a cluster sampling method, admitting a sampling error of 3% and confidence level of 95%,[14,15] proportionally considering the number of public and private preschools. Twenty-two public and eighteen private preschools were randomly selected and then all 5-year-old preschool attendees (814 subjects) were invited to participate in the study. Among them, children who did not return the informed consent form and questionnaires (n=31; 3.81%), those absent on the examination day (n=55; 6.76%) or those with severe dental hypoplasia, serious systemic disease, or fixed orthodontic appliance (n=0) were excluded from the study. The final sample was composed of 728 five-year-old children of both genders, attending preschool, of which, 428 (58.8%) were from public and 300 (41.2%) from private preschools.

Examination methodology

Epidemiological examination was performed outdoors by a previously calibrated examiner, under natural light, using CPI probes ("ball point") and mirrors #5. Before examination each child performed tooth brushing supervised by a dental hygienist.

Calibration

A benchmark dental examiner ("Gold Standard"), skilled in epidemiological surveys, conducted the calibration process, which lasted 28 hours. Theoretical activities with discussions on orthodontic diagnosis criteria were performed. In the practical epidemiological examination activities, the inter- and intra-examiner reliability, assessed by percentage of agreement, were 82.0% and 95.5%, respectively.

Diagnostic criteria and codes

In this study, the detection of malocclusion, assessed by open bite and crossbite was evaluated according to the Dental Aesthetic Index.[11] Other abnormalities, such as the presence of mouth breathing, atypical swallowing, and lip interposition, were recorded in accordance with the criteria of the Brazilian oral health epidemiological survey carried out in 2002-2003.[11]

Questionnaire

All children received two pre-tested questionnaires to be answered by their parents. The goal of the first was to collect information on the socioeconomic level of the children's families (monthly family income, number of people living in the household, parents' educational level, home ownership, car ownership).[16] The second was composed of structured questions about the child's oral health habits (nursing bottle, pacifier use, thumb sucking and onicophagia).

Statistical analysis

Univariate analyses using the Chi-square test (x^2) at 5% significance level were performed to determine the relationship between deleterious oral habits and social class, as well to test the influence of independent variables (nursing bottle, pacifier use, thumb sucking, onicophagia, mouth breathing, atypical swallowing, lip interposition, gender and socioeconomic class) on dependent variables (open bite and crossbite). Next, multiple logistic regression analyses, using the stepwise procedure, were performed in order to identify the risk indicators for either open bite or crossbite. Only the independent variables with $p<0.15$ in the univariate analyses were selected for the regression analysis, in order to eliminate those that would make little contribution to the model. Adjusted Odds Ratios (OR), their 95% confidence intervals and significance levels were estimated. All statistical tests

Table I. Univariate analysis of the association between deleterious oral habits and social class. Piracicaba, 2005.

Social class *	Deleterious oral habits				Total		X^2	p-value
	Presence		Absence					
	n	%	n	%	n	%		
A	7	1.01	4	0.57	11	1.58	12.8713	0.0246
B	39	5.60	14	2.01	53	7.61		
C	84	12.07	25	3.59	109	15.66		
D	183	26.29	26	3.74	209	30.03		
E	200	28.74	39	5.60	239	34.34		
F	65	9.34	10	1.44	75	10.78		
Total	578	83.05	118	16.95	696	100.00		

* A and B: HIGH SOCIOECONOMIC LEVEL (SEL)
  C and D: MEDIUM SEL
  E and F: LOW SEL

Table II. Univariate analysis of the association between open bite and behavioral, demographic and socioeconomic variables. Piracicaba, 2005.

| Variable | Open bite | | | | p-value |
| | Absence | | Presence | | |
	n	%	n	%	
Nursing bottle					
yes	215	59.72	145	40.28	<0.001
no	253	75.52	82	24.48	
Pacifier use					
yes	36	18.46	159	81.54	<0.001
no	409	88.15	55	11.85	
Thumb sucking					
yes	25	51.02	24	48.98	0.0005
no	346	74.57	118	25.43	
Onicophagia					
yes	100	71.94	39	21.06	0.2377
no	342	66.67	171	33.33	
Atypical swallowing					
yes	11	15.28	61	84.72	<0.001
no	479	73.35	174	26.65	
Lip interposition					
yes	23	18.70	100	81.30	<0.001
no	467	77.57	135	22.43	
Mouth breathing					
yes	169	47.08	190	52.92	<0.001
no	321	87.70	45	12.30	
Gender					
Girls	239	66.4	121	33.6	0.4939
Boys	251	68.8	114	31.2	
Social Class *					
A	9	81.82	2	18.18	
B	41	77.36	12	22.64	
C	80	73.39	29	26.61	0.1598
D	139	66.83	69	33.17	
E	153	64.02	86	35.98	
F	45	60.81	29	39.19	

* A and B: HIGH SOCIOECONOMIC LEVEL (SEL)
  C and D: MEDIUM SEL
  E and F: LOW SEL

Table IV. Univariate analysis of the association between crossbite and behavioral, demographic and socioeconomic variables. Piracicaba, 2005.

| Variable | Crossbite | | | | p-value |
| | Absence | | Presence | | |
	n	%	n	%	
Nursing bottle					
yes	298	82.78	62	17.22	0.9280
no	279	83.04	57	16.96	
Pacifier use					
yes	142	72.82	53	27.18	<0.001
no	402	86.27	64	13.73	
Thumb sucking					
yes	44	89.80	5	10.20	0.2345
no	387	83.23	78	16.77	
Onicophagia					
yes	121	87.05	18	12.95	0.1851
no	424	82.33	91	17.67	
Atypical swallowing					
yes	52	72.22	20	27.78	0.0110
no	550	84.10	104	15.90	
Lip interposition					
yes	85	69.11	38	30.89	<0.0001
no	517	85.74	86	14.26	
Mouth breathing					
yes	274	76.32	85	23.68	<0.0001
no	328	89.37	39	10.63	
Gender					
Girls	282	78.33	78	21.67	0.0011
Boys	320	87.43	46	12.57	
Social Class *					
A	9	81.82	2	18.18	
B	44	83.02	9	16.98	
C	94	86.24	15	13.76	0.8961
D	171	81.82	38	18.18	
E	195	81.59	44	18.41	
F	64	81.33	11	14.67	

* A and B: HIGH SOCIOECONOMIC LEVEL (SEL)
  C and D: MEDIUM SEL
  E and F: LOW SEL

Table III. Stepwise logistic regression for open bite.

| Variable | Presence of open bite | | Odds Ratio | 95% Confidence Level | p-value |
	n	%			
Pacifier use					
yes	159	81.54	21.71	11.48-41.04	0.0001
no	55	11.85	1.00		
Thumb sucking					
yes	24	48.98	4.72	1.81-12.27	0.0009
no	118	25.43	1.00		
Atypical swallowing					
yes	61	84.72	7.35	2.55-21.16	0.0001
no	174	26.65	1.00		
Mouth breathing					
yes	190	52.92	4.65	2.52-8.57	<0.0001
no	45	12.30	1.00		

Table V. Stepwise logistic regression for crossbite.

| Variable | Presence of crossbite | | Odds Ratio | 95% Confidence Level | p-value |
	n	%			
Pacifier use					
yes	53	27.18	1.588	0.99-2.56	0.0558
no	64	13.73	1.00		
Lip interposition					
yes	38	30.89	1.777	1.04-3.03	<0.0001
no	86	14.26	1.00		
Mouth breathing					
yes	85	23.68	1.960	1.21-3.17	0.0016
no	39	10.63	1.00		
Gender					
Boys	320	87.43	1.88	1.23-2.86	0.0030
Girls	282	78.33	1.00		

were performed using the SAS software[17] at 5% significance level.

RESULTS

The prevalence of deleterious oral habits was 83.1% among the examined children. Of these, the most prevalent were nursing bottle (51.7%), followed by mouth breathing (49.3%), pacifier use (29.5%), and onicophagia (21.3%). The presence of open bite was observed in 32.4% of the examined children whereas 17.1% presented crossbite.

Table I shows a statistically significant association between deleterious oral habits and social class. Table II demonstrates that the variables nursing bottle, pacifier use, thumb sucking, atypical swallowing, lip interposition and

mouth breathing were statistically associated with open bite at p<0.05. In the logistic regression, the children that presented pacifier use, thumb sucking, atypical swallowing, mouth breathing were statistically more prone to having open bite (Table III).

Table IV demonstrates statistically significant associations (p<0.05) between crossbite and pacifier use, atypical swallowing, lip interposition, mouth breathing, and gender. They were selected for the logistic regression, in which the following variables remained in the model as risk indicators: pacifier use, presence of lip interposition, mouth breathing and gender (Table V). No statistically significant association was observed between gender and deleterious oral habits (p>0.05).

DISCUSSION

This cross-sectional study showed that there was a prevalence of 83.1% of deleterious oral habits, which is much higher than that found by Kharband et al. (2003),[18] who observed that 25.5% of the children aged 5-13 years presented deleterious oral habits. This difference could be explained by cultural factors as well as examination of different age groups. Among the assessed habits, the nursing bottle use (51.72%) was the most prevalent. Other studies have found greater prevalence of this habit among children aged up to 6 years.[19,20]

According to Table I, social class presented significant association with deleterious oral habits, corroborating some studies[21-23] and contradicting data from others.[24,25] Generally speaking, the prevalence of deleterious oral habits tended to increase as the social class of the child's family became lower. A possible explanation for this result is that families with low socioeconomic status and lack of oral health education commonly do not know the consequences of the deleterious oral habits. However, studies on understanding the influence of socioeconomic determinants on the oral health as well as on the prevalence of deleterious oral habits are scarce and contradictory, which makes the real role of social class in oral habits unclear.

Open bite was detected in 32.41% of the children, being similar to other findings.[26,27] Table III shows that among pacifier users, 81.54% presented open bite with an Odds Ratio of 21.71, therefore being the strongest risk indicator. Thus, dentists are encouraged to instruct parents to discontinue pacifier use by the age of 3 years, because after this age the habit may cause dentofacial anomalies.[13] On the other hand, open bite may not be self-corrected even when suction habits stop, especially if it is secondary to open bite, such as lip interposition and mouth breathing,[28] atypical swallowing, thumb sucking and mouth breathing. The results shown in Table III also revealed that the presence of atypical swallowing or mouth breathing were indicators of open bite. If these habits were secondary to open bite and were not discontinued they would probably favor the advance of dentofacial anomalies.

The prevalence of crossbite was 17.08%, which is in line with other studies.[26,27,29] The main etiologic factors for cross-

bite have been described as thumb sucking and/or pacifier use, mouth breathing, lip interposition and undesirable postural habits.[30-33] Indeed, in the present study the pacifier users presented 1.59 more probability of presenting crossbite; a result also found by others.[13,34] It is important to mention that crossbite is not self-corrected during growth, even when the deleterious oral habits cease.[35] Therefore it must be treated as soon as diagnosed so that functional balance is restored, and normal dentofacial development is produced.[32,36,37]

In spite of undesirable effects of deleterious oral habits on occlusion, not all children that present one or several of them develop malocclusion. This will depend on the influence of the "Triad of Graber" or, in other words, the frequency, intensity and duration of deleterious oral habits, as well as the facial growth of each child.[38]

Finally, one can suggest that preventive and interceptive orthodontic programs must be implemented early,[39] with the goal of keeping the balance of orofacial development and/or reestablishing the normality of growth patterns.

It may be concluded that environmental factors, such as the presence of deleterious oral habits and social class, played an important role in identifying children with open and/or crossbite. Great attention should be given to the presence of deleterious oral habits that can interfere in normal occlusal and orofacial development.

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