

Factors associated with malocclusion in youth in a municipality of Northeastern Brazil

Fatores associados à má oclusão em jovens em município do Nordeste brasileiro

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ABSTRACT: The aim of the study was to identify factors associated with severe malocclusion in young people in Sobral, Ceará, Northeastern Brazil. This is cross-sectional study nested in a cohort study with a sample of 569 young people aged from 17 – 21 years who participated in the survey on oral health. The rate of categorized dental aesthetics of Dental Aesthetic Index < 31 and Dental Aesthetic Index ≥ 31 was used. The independent variables were: data from the beginning of the cohort (socioeconomic conditions in childhood and exposure factors) and the last survey (sociodemographic data, use of dental services and self-perceived oral health). Poisson regression was performed to determine the best explanatory model of related factors. The prevalence of severe malocclusion was 20.0%. Private school was a protective factor, while the use of a pacifier for more than 36 months was a risk factor. Malocclusion was associated with all measures of self-perception and dental trauma. Socioeconomic factors in childhood stimulated prolonged use of harmful habits and these were risks for the components of Dental Aesthetic Index factors. Socioeconomic conditions were associated with occlusal condition of the youth.

Keywords: Malocclusion. Risk factors. Dental health surveys. Socioeconomic factors. Pacifiers. Oral health.

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Conflict of interests: nothing to declare – **Financial support:** none.

RESUMO: O objetivo do estudo foi identificar os fatores associados às oclusopatias severas em jovens em Sobral, Ceará, Nordeste do Brasil. Trata-se de um estudo transversal aninhado a uma coorte, com amostra de 569 jovens de 17 – 21 anos, que participaram do levantamento em saúde bucal. Utilizou-se o índice de estética dental categorizado em *Dental Aesthetic Index* < 31 e *Dental Aesthetic Index* ≥ 31. As variáveis independentes foram: dados do início da coorte (condições socioeconômicas na infância e fatores de exposição) e do último levantamento (dados sociodemográficos, uso de serviços odontológicos e autopercepção da saúde bucal). Foi realizada regressão de Poisson para verificar o melhor modelo explicativo dos fatores relacionados. A prevalência de oclusopatia severa foi de 20,0%. Escola privada foi fator de proteção, enquanto o uso de chupeta por mais de 36 meses foi fator de risco. Oclusopatia associou-se com todas as medidas de autopercepção e com o trauma dentário. Fatores socioeconômicos na infância estimularam o uso prolongado de hábitos deletérios e estes foram fatores de risco para os componentes do índice de estética dental. Condições socioeconômicas apresentaram relação com a condição oclusal dos jovens.

Palavras-chave: Má oclusão. Fatores de risco. Inquéritos de saúde bucal. Fatores socioeconômicos. Chupetas. Saúde bucal.

INTRODUCTION

Malocclusion is considered the third priority among oral problems by the World Health Organization and as such occlusal alterations have begun to gain more interest from researchers in the area¹. Improvements in epidemiological standards of oral diseases, with the reduction of dental caries prevalent in recent years in Brazil, have favoured the development of research into other oral problems like malocclusion².

Genetic and environmental factors are considered to be the causes of occlusal problems. Environmental factors (behavior of children and mothers, anthropometric characteristics, childhood problems, other oral problems, and socioeconomic conditions) have effective prevention measures, making them important factors to be investigated through epidemiological studies³.

However, there is no consensus in the literature on the association between environmental factors and malocclusion, especially with regard to sociodemographics characteristics^{4,5}. The lack of uniformity in studies due to the different criteria used in measuring the occlusion, as well as its associated factors, has limited the epidemiological data used in planning and interventions in occlusal problems by managers in health care systems. With regard to problems arising from malocclusion, there seems to be a consensus on the impact that these problems have on oral health, such as functional, aesthetic and psychosocial alterations^{6,7}.

With the Decree nº 718 of December 2010, the Ministry of Health included orthodontics/orthopedics procedures at Dental Specialty Centers (DSC) for all individuals⁸. Therefore, understanding the factors associated to groups with worse oral health condition, in this case severe malocclusion, will reduce inequalities in oral health and raise subsidies so that orthodontic treatment services are organized in the most equitable manner possible. The aim of the study was to identify the associated factors with the occurrences of severe malocclusion in young people in Sobral, Ceará, Northeastern Brazil.

METHODOLOGY

This is a cross-sectional study nested in a cohort initiated in 1999 in the city of Sobral, Ceará. The initial framework for the development of this research study was the epidemiologic survey of oral health during the year 2000, with the participation of 1,021 children, in which dental caries, gingival status and malocclusion were analyzed. This sample was calculated considering a prevalence of 30.0% malocclusion, error margin of 10.0%, and a confidence level of 95%.

Five years later, a new epidemiological study of oral health with longitudinal character was conducted. It evaluated the incidence of caries and associated factors. From the age group of 10 to 14 years, 688 individuals were re-examined, and the results were presented in another study⁹. In 2012, the third wave of this study, the following conditions were investigated: incidence of caries, malocclusion, periodontal disease, trauma and edentulism. The final sample consisted of 569 young people aged 17 to 21 years.

The individuals participating in the study were identified by the community health workers, who scheduled the day for the teenager to attend the Basic Health Unit nearest to their home to carry out the research. For those who did not attend on the scheduled date, the research team conducted up to three home visits. To get in touch with those who had changed addresses, a strategy was implemented to visit schools and factories, and active searches were conducted through social networks.

The examinations were performed by 7 teams comprised by an examiner, an interviewer and note taker, and a field supervisor, all properly trained and calibrated by means of the consensus technique, with Kappa index ranging from 0.69 to 0.89 (good agreement).

The malocclusion was measured using the Dental Aesthetic Index (DAI) proposed by WHO for epidemiological surveys of oral health, wherein the following criteria were assessed: the absence of upper and lower teeth, presence of diastema, crowding, maxillary and mandibular overjet, open bite and anteroposterior molar ratio¹⁰. For this study, the DAI index was dichotomized into < 31 (normal occlusion or minor malocclusion and occlusal problems with elective treatment) and ≥ 31 (severe malocclusion or very severe).

Independent variables were collected in the first wave: socioeconomic status (education of household head, income of the family head, have a bathroom at home), exposure factors associated with deleterious oral habits (time and use of pacifier, finger, and bottle in mouth) and development (malnutrition); and at the last follow-up: sociodemographics (gender, age, race, household size, student, school type, family income, work), use of dental services (already been to the dentist, time went to the dentist, has had access to a dentist denied and use of orthodontic appliance), self-perceived oral health (needs treatment, how would you rate your oral health, appearance, chewing and speech, oral health affects relationships with other people) and the occurrence of dental trauma.

A simple analysis was done between the dichotomized DAI and independent variables. DAI components were also used as an endpoint (open bite, diastema, maxillary overbite, molar relationship, and maxillary and mandibular misalignment) to verify relation to deleterious oral habits (time and use of bottle, pacifier and thumb sucking). In addition, there was the relationship of socioeconomic conditions in childhood with deleterious oral habits.

Data were analyzed using Data Analysis and Statistical Software – STATA, version 13.1. After the simple analysis, Poisson regression was then performed with the variables that presented $p < 0.20$, to see which factors from the life course remain related with severe malocclusion. The prevalence ratio (PR) and confidence interval of 95% were considered. This study was approved by the ethics committee of the *Universidade Estadual Valle do Acaraú* in Sobral, with protocol number 1019.

RESULTS

Of the total of 569 young people examined, it was observed that 20.0% had severe or very severe malocclusion. Most participants were female and black race (black or mulatto), 54.3% were students and 41.1% had some form of paid work. In relation to family income, 203 young people live on an income of up to minimum wage.

Considering the variable use of dental services, it was found that a small portion of the participants (7.6%) never went to the dentist and 24.0% of young people have had access to dental services denied at least once in their life. Most had visited the dentist for the last time less than a year prior and only 11.1% use or have used braces.

In the simple analysis between the DAI and categorized sociodemographic variables (Table 1), it was observed that the type of school is configured as a protective factor (PR = 0.30, 95%CI 0.12 – 0.80). There was no significant association with the construct variables utilization of dental services.

In relation to the variables collected in childhood, socioeconomic characteristics showed no statistically significant relationship with the DAI. In the category of exposure factors, the use of a pacifier, bottle and finger sucking independent of time of use showed no significant association to explain the severe malocclusion. It was found that only pacifier use over 36 months was configured as a risk factor for DAI ≥ 31 (PR = 1.52, 95%CI 1.08 – 2.14). Child malnutrition has not acted as a risk factor for malocclusion in this study (Table 2).

For Poisson regression, the variables of gender, school, time of pacifier use and malnutrition were included in the model. However, the type of school and the time of pacifier use remained in the explanatory model of the related factors of severe malocclusion. While the private school behaved as a protective factor, pacifier use for more than 36 months was presented as a related factor of outcome (Table 3).

Moreover, we assessed the components of DAI with deleterious oral habits and found that pacifier use for more than 36 months was a risk factor for the presence of open bite (PR = 2.88, 95%CI 1.48 – 5.6, $p = 0.002$), while finger sucking for more than 24 months was a risk factor for jaw misalignment greater than 2 mm (PR = 3.22, 95%CI 2.02 – 5.13; $p < 0.000$).

Socioeconomic conditions in childhood showed no direct relationship to severe malocclusion among young people, but it was possible to identify the relationship of these factors with damaging habits. Income of the head of the family and the education of the head showed a statistically significant association with finger sucking for more than 24 months. The household member who studied more than 11 years (OR = 0.0019, 95%CI 0.0002 – 0.017, $p < 0.0001$)

Table 1. Severity of malocclusion in adolescents according to sociodemographic characteristics. Sobral, 2012.

Sociodemographic characteristics	DAI < 31		DAI ≥ 31		PR	95%CI	p-value
	n	%	n	%			
Sex							
Man	208	77	62	23			
Female	246	82.2	53	17.8	0.77	0.56 – 1.07	0.12
Age (years)							
17	111	78.7	30	21.3			
18	93	83.7	18	16.3	0.76	0.45 – 1.29	0.31
19	80	80.0	20	20.0	0.94	0.57 – 1.56	0.81
20	87	81.3	20	18.7	0.87	0.53 – 1.46	0.61
21	83	75.7	27	24.3	1.15	0.73 – 1.82	0.54
Ethnicity							
White	124	79.5	32	20.5			
Non white	329	79.9	83	20.1	0.98	0.68 – 1.41	0.92
Household crowding							
< 1	221	80.1	55	19.9			
≥ 1	233	79.5	60	20.5	1.02	0.74 – 1.43	0.87
Student							
No	209	80.4	51	19.6			
Yes	245	79.3	64	20.7	1.05	0.76 – 1.47	0.75
School							
Public	194	76.1	61	23.9			
Private	51	92.7	4	7.3	0.30	0.12 – 0.80	0.016
Familiar income (MW)							
< 1	163	80.3	40	19.7			
1 – 2	157	75.5	51	25.5	1.24	0.86 – 1.79	0.24
> 2	132	85.2	23	14.8	0.75	0.47 – 1.20	0.23
Works							
No	271	80.9	64	19.1			
Yes	183	78.2	51	21.8	1.14	0.82 – 1.58	0.43

DAI: Dental Aesthetic Index; MW: Minimum wage; PR: Prevalence ratio.

and received more than triple the minimum wage (OR = 0.001, 95%CI 0.0002 – 0.004, $p < 0.0001$) demonstrated protection for prolonged use of finger sucking.

Variables such as “rate your oral health” and “how would you rate your looks” were statistically associated with malocclusion (Table 4). Those who rated their oral health and chewing as fair or good were those who had better occlusal condition compared with those who rated their oral health and appearance as poor. The ones who classified their speech as

Table 2. Severity of malocclusion in adolescents according to the exposure factors in childhood. Sobral, 2012.

Exposure factors	DAI < 31		DAI ≥ 31		PR	95%CI	p-value
	n	%	n	%			
Bottle							
No	66	77.6	19	22.4			
Yes	382	80.3	94	19.7	0.88	0.57 – 1.36	0.57
Pacifier							
No	183	81.0	43	19.0			
Yes	265	76.8	70	23.2	1.09	0.78 – 1.54	0.59
Finger sucking							
No	417	79.7	106	20.3			
Yes	27	84.4	5	15.6	0.77	0.34 – 1.76	0.54
Time of pacifier (months)							
< 36	335	82.3	72	17.7			
> 36	103	73.0	38	27.0	1.52	1.08 – 2.14	0.016
Time of bottle (months)							
< 36	347	80.9	82	19.1			
> 36	95	77.2	28	22.8	1.19	0.81 – 1.74	0.36
Time of finger sucking (months)							
< 36	422	79.9	106	20.1			
> 36	21	72.4	8	27.6	0.96	0.43 – 2.15	0.92
Malnutrition							
No	330	82.1	72	17.9			
Yes	116	75.3	38	24.7	1.38	0.97 – 1.95	0.07

DAI: Dental Aesthetic Index; PR: Prevalence ratio.

Table 3. Explanatory model of the related factors of severe or very severe malocclusion. Sobral, 2012.

Variables	PR	95%CI	p-value
Private school	0.29	0.11 – 0.77	0.013
Pacifier more than 36 months	1.59	1.12 – 2.25	0.008

PR: Prevalence ratio.

Table 4. Severity of malocclusion in adolescents according to the variables of self-perceived oral health and dental trauma. Sobral, 2012.

Self-perceived oral health	DAI < 31		DAI ≥ 31		PR	95%CI	p-value
	n	%	n	%			
Need treatment							
No	7	87.5	1	12.5			
Yes	376	78.3	104	21.7	1.65	0.93 – 2.95	0.08
Classifies oral health							
Terrible	21	63.6	12	36.4			
Bad	53	75.7	17	24.3	0.67	0.36 – 1.23	0.19
Regular	211	79.3	55	20.7	0.57	0.34 – 0.94	0.03
Good	145	84.3	27	15.7	0.43	0.24 – 0.76	0.004
Great	16	84.2	3	15.8	0.43	0.14 – 1.34	0.14
Classifies appearance							
Terrible	30	62.5	18	37.5			
Bad	48	72.7	18	27.3	0.73	0.42 – 1.24	0.25
Regular	176	78.6	48	21.4	0.57	0.37 – 0.89	0.013
Good	177	87.2	26	12.8	0.34	0.20 – 0.56	< 0.000
Great	19	79.2	5	20.8	0.56	0.23 – 1.31	0.181
Classifies chewing							
Terrible	17	77.3	5	22.7			
Bad	36	73.5	13	26.5	1.17	0.47 – 2.80	0.74
Regular	74	73.3	27	26.7	1.18	0.51 – 2.71	0.70
Good	288	83.5	57	16.5	0.73	0.32 – 1.63	0.44
Great	38	80.9	9	19.1	0.84	0.32 – 2.22	0.73
Classifies speech							
Terrible	6	66.7	3	33.3			
Bad	7	53.8	6	46.2	1.38	0.46 – 4.14	0.56
Regular	55	72.4	21	27.6	0.83	0.31 – 2.24	0.71
Good	293	79.6	75	20.4	0.61	0.24 – 1.58	0.30
Great	79	90.8	8	9.2	0.28	0.09 – 0.86	0.026
Affects relationships							
No	410	81.2	95	18.8			
Yes	36	65.5	19	34.5	1.01	0.89 – 1.15	0.87
Dental trauma							
No	364	82.4	78	17.6			
Yes	90	70.9	37	29.1	1.65	1.18 – 2.32	0.004

DAI: Dental Aesthetic Index; PR: Prevalence ratio.

“great” also demonstrated better occlusal situation compared with those who rated their speech as bad. The occurrence of dental trauma, in unadjusted analysis, was also a statistically significant factor with severe malocclusion, particularly when overjet was greater than 5 mm (PR = 1.55, 95%CI 1.0 – 2.43, $p = 0.050$) and in the presence of open bite (PR = 2.01, 95%CI 1.30 – 3.09, $p = 0.001$).

DISCUSSION

The prevalence of severe malocclusion presented in this study approached that observed in SB Brazil 2010 (16.9%) in groups aged 15 to 19 years¹¹. Other studies done on this age group found a prevalence of severe malocclusal ranging from 12.2 to 26.8%^{4,12-14}.

Authors did not find any association between severe malocclusion and gender, race, age and socioeconomic condition^{14,15}. However, another study only found statistical significance between type of school and DAI > 28, similar to this study¹³. Authors found that being younger, female, with less access to dental services, attending a public school, living in small municipalities and presenting tooth decay all indicate a higher risk for DAI > 31⁴. Others found that black or mixed and who have already lost the first permanent molar indicate a higher chance of having very severe malocclusion at 12 years old, while for adolescents 15 – 19 years, a lower income and going to the dentist for treatment increased the chance of presenting that same outcome¹⁶. Cities with the highest number of families receiving family allowance, with smaller IDSUS Index (Performance Health System), and lowest Gross Domestic Product (GDP) per capita were associated with the severity of malocclusion¹⁷.

The variable type of school is considered a marker of socioeconomic status in Brazil since individuals who are in private schools belong to a higher socioeconomic stratum¹⁸. Although factors in childhood do not show a direct relationship to the presence of severe malocclusion in the current age, it was found that these showed significant relationships with the prolonged occurrence of harmful habits, which shows the interaction of distal and proximal factors of outcome. Studies showed that low level of education, mothers working and manual occupation of the family member with higher income have a negative effect on the prolonged occurrence of harmful habits, due to lack of information for parents and the emotional compensation developed by the child in absence of their mothers^{19,20}.

Authors reveal the importance of knowing the distal conditioning factors of health problems, not only proximal factors but also to investigate the relationship between different factors from a theoretical model based on the life course of the individual, and thereby understand the different paths taken by the individual throughout life so that from this it is possible to identify groups most vulnerable^{4,21,22}. This study identified characteristics of childhood as having influence on the future life of the individual, and it also observed that socioeconomic factors in childhood were not directly related to malocclusion in the young, but conditioned to the prolonged use of deleterious oral habits in childhood which in turn are associated with malocclusion in youth.

Authors⁴ claim that when using the DAI as the outcome it is not possible to identify association to proximal factors, i.e., only when using the DAI components for specific occlusal disharmony is that association of proximal and distal factors is observed. However, in this study, we verified the presence of distal (type of school) and proximal factors (pacifier use for more than 36 months) associated with DAI.

Pacifier use for more than 36 months was presented as a risk factor for open bite, and finger sucking for more than 24 months configured as a risk factor for jaw misalignment. Distal and proximal factors may behave differently according to the outcome used to measure the occlusion, as the DAI index is the result of a combination of deviations of different etiologies. There is a consensus that oral habits are related to malocclusion in deciduous and mixed dentition²³. In the permanent dentition, a study²⁴ identified that deleterious oral habits in synergic effect with short duration of breastfeeding during infancy are a predictor for parafunctional oral habits at the adolescence, which are associated with malocclusion among adolescents. In addition, no treatment of early malocclusion can cause malocclusion in permanent dentition²⁵. Even deleterious oral habits in infancy did not show direct effect in the permanent dentition, they are considered risk factors for malocclusion in permanent dentition because they can trigger other risk factors.

Another important fact observed was the lack of association between the use of braces and the presence of severe malocclusion, which was also observed in one case-control study¹⁵. This fact arouses the need to investigate the orthodontic treatment and to evaluate to what extent braces use is actually a normative need or is seen as a fad and even associated with social status.

Studies also have found that parental dissatisfaction with appearance aesthetics of the children, as well as dissatisfaction with their appearance, obtained significant statistical association with the presence of malocclusion and the necessity of orthodontic treatment, similar to this study^{6,7,14,17,26}. Authors have suggested considering subjective aspects of the disease as fundamental, and not just using the normative criteria for clinical decision making in orthodontic treatment due to the possibility of overestimating the problems when compared with the perception of individuals. This being in addition to preventing problems self-esteem and social interaction of these young people, so as to interfere with their quality of life^{7,26,27}.

In the present study, dental trauma was also associated with severe malocclusions greater than 5 mm, particularly when observed in the presence of overjet and open bite. It's not possible to affirm that dental trauma is a consequence of severe malocclusion, because they were analysed at the same time, in the third wave. Studies^{28,29} also noted that above a 3mm overjet was a strong factor in the occurrence of dental trauma, although other¹⁷ did not observe this association.

Longitudinal studies are methodologically adequate to identify the determinants of disease, to assess the association between risk factors and outcome at different times and in this way allowing to temporally contemplate the assumptions regarding the relations of cause and effect. This makes this study relevant because few have performed longitudinal studies that assess malocclusion. Furthermore, understanding how socioeconomic factors in childhood affect future outcomes was another important aspect of this study.

CONCLUSIONS

In this study, better socioeconomic status in childhood is presented as a protective factor for long-term use of deleterious oral habits, however the only actual indicator of current socioeconomic status that presented malocclusal relationship to their condition was the public school attended by individuals. Prolonged deleterious oral habits were recognized as a risk factor for severe malocclusion and occlusal specific conditions independent of the type of school. Dental trauma also was associated with severe malocclusion, without the adjustment of others factors. With respect to the consequences of occlusal problems, it was possible to identify the occurrence of negative self-perception of oral health in their aesthetic and functional dimensions. Knowing the factors associated with malocclusion allows for developing policy in a more equitable manner and enables the reduction of health inequities.

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Received on: 01/22/2015

Final version presented on: 06/29/2015

Accepted on: 07/29/2015