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Association between psychological factors, socio-demographic conditions, oral habits and anterior open bite in five-year-old children

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ABSTRACT

Objective: The aim of the present study was to evaluate association between psychological factors, socio-demographic conditions, oral habits and anterior open bite in five-year-old preschool children.

Materials and methods: A cross-sectional study was conducted with 764 pairs of children and parents/caregivers in preschools. The parents/caregivers answered questionnaires addressing oral health-related quality of life (OHRQoL), sense of coherence, locus of control, oral habits and socio-demographic characteristics. The children answered a self-report questionnaire addressing OHRQoL and were submitted to a clinical examination for the anterior open bite by examiners. Descriptive analysis was conducted, followed by Poisson's regression analysis.

Results: The prevalence of anterior open bite was 15.2%. The following variables remained significantly associated with anterior open bite: pacifier use (PR = 7.09; 95% CI: 4.06–12.39), attending a public preschool (PR = 2.40; 95% CI: 1.68–3.43), digit sucking (PR = 2.15; 95% CI: 1.27–3.62), greater number of residents in the home (PR = 1.67; 95% CI: 1.18–2.36) and impact on OHRQoL according to child's report (PR = 1.56; 95% CI: 1.11–2.20).

Conclusions: Anterior open bite was associated with OHRQoL according to the children's reports. Moreover, attending a public preschool, a greater number of residents in the home, digit sucking and pacifier sucking were associated with this type of malocclusion.

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Introduction

Malocclusion is considered a public health problem due to its high prevalence as well as both functional and aesthetic impacts [1]. Anterior open bite is one of the most prevalent malocclusions among preschool children [2], but early diagnosis is hindered by the low percentage of children in this age group who visit the dentist [3]. This diagnosis is essential due to the fact that the characteristics of the primary dentition are the basis for the adequate development of the permanent dentition [4].

Non-nutritive sucking habits, such as digit sucking and pacifier use, are considered aetiological factors for the development of anterior open bite [5]. The frequency of these habits exerts an influence on craniofacial development in children, leading to neuromuscular alterations [2]. Cases in which oral habits persist beyond three years of age are the most evident examples of the environmental aetiology of anterior open bite [6,7]. Thus, studies involving five-year-old children are needed, as this age represents the transition to the mixed dentition phase and anterior open bite diagnosed at this time will probably not be temporary. Moreover, oral health can be moulded by different personal and environmental variables [8], which underscores the importance of evaluating socio-demographic factors.

With regard to psychosocial aspects, oral health-related quality of life (OHRQoL), sense of coherence (SOC) and locus of control (LOC) are analysed in the present investigation. The concept of OHRQoL corresponds to the impact that adverse oral conditions have on daily functioning and well-being [1]. Previous studies have explored the impact of malocclusion on OHRQoL in preschool children [1,9,10]. However, the present study analyses an inverse direction between these two aspects, whether OHRQoL exerts an influence on anterior open bite in this population. This hypothesis considers that children with an impact on OHRQoL tend to experience pain, functional limitations and aesthetic impacts due to oral problems, such as dental caries and traumatic dental injury [10,11]. Such impacts in the OHRQoL can lead to the development of harmful oral habits and consequently anterior open bite, as these habits are associated with the child's behaviour as a whole. However, this association has not yet been studied from this standpoint. Moreover, psychological factors of parents/caregivers, as SOC and LOC, have also been investigated due to its association with both general and oral health, especially the use of healthcare services, access to information and some adverse health conditions [12–15]. SOC is part of salutogenic theory and reflects the views individuals have regarding life and the ability to adapt in stressful situations [12]. LOC is an indicator of personal

perceptions regarding who or what controls events in life [14]. However, no studies have yet evaluated the association between anterior open bite and SOC and LOC. Therefore, conducting studies of this nature can help implement early treatment to impede the persistence of the diagnosed malocclusion as well as establish prevention strategies to enable the harmonious growth of the child.

The aim of the present study was to evaluate the association between psychological factors (SOC, LOC and OHRQoL), socio-demographics conditions, oral habits and anterior open bite in five-year-old preschool children.

Materials and methods

A representative, preschool-based, cross-sectional study was conducted with a sample of 764 pairs of parents/caregivers and five-year-old children enrolled in private and public preschools in the city of Campina Grande, Brazil. The study was conducted by two examiners and two research assistants.

A two-stage sampling strategy was employed to ensure representativeness. In the first stage, preschools were randomly selected from each health district. In the second stage, pairs of parents/caregivers and children were randomly selected from each preschool. The sample size was calculated based on a 5% margin of error, 95% confidence level and a correction factor of 1.6 to compensate for the design effect. A prevalence rate of the anterior open bite of 50% was considered to increase the power and because this value gives the largest sample regardless of the actual prevalence [16]. Twenty of the 129 public preschools and 28 of the 134 private preschools were randomly selected. The sample size was estimated to be 615 preschool children, to which an additional 20% was added to compensate for possible dropouts, giving a total of 769 preschool children.

Eligibility criteria

Five-year-old children with no systematic diseases enrolled at public and private preschools were included in the sample. The parents/caregivers needed to be fluent in Brazilian Portuguese and spend at least 12 hours per day with the child. The exclusion criteria were the presence of one or more erupted permanent teeth and a history of orthodontic treatment.

Training and calibration exercise

The training and calibration process involved theoretical explanations and clinical examinations. The two researchers who performed the data collection and a specialist in orthodontics with more than 10 years of experience participated in this phase. The researchers first evaluated photographs of malocclusion and group discussions were held. In the clinical phase, 40 children were randomly selected from a preschool that did not participate in the main study. These children were examined twice. The first examination was used for the calculation of inter-examiner agreement (Kappa statistic) between the researchers and the experienced specialist

($K=0.86-0.91$). After a seven-day interval, the same children were examined a second time for the calculation of intra-examiner agreement ($K=0.94-1.00$). The Kappa coefficients demonstrated good reliability for the clinical examinations.

Pilot study

A pilot study was conducted prior to the data collection process of the main study to determine the applicability of the questionnaires and dynamics of the clinical examinations. In this step, the entire proposed methodology was applied to 45 children from two preschools (one public and one private) who were not selected for the main study. The findings of this pilot study revealed no need to alter any of the methods.

Non-clinical data collection

Parents/caregivers were previously contacted to attend a meeting at the preschools, during which they received clarifications regarding the objectives of the study. At the same meeting, the parents/caregivers were asked to fill out the questionnaires administered by the research assistants. The examiners did not have access to the questionnaires.

The Scale of Oral Health Outcomes for Five-Year-Old Children (SOHO-5) addresses a child's lifetime experience with oral impacts and has two seven-item scales (parent/caregiver and child). The seven items on the parent/caregiver version are difficulty eating, difficulty speaking, difficulty playing, difficulty sleeping, avoidance of smiling due to pain, avoidance of smiling due to appearance and affected self-confidence of the child. The response options are offered on a five-point scale (no = 0, a little = 1, moderate = 2, a lot = 3, a great deal = 4). The seven items on the child version are difficulty eating, difficulty drinking, difficulty speaking, difficulty playing, difficulty sleeping, avoidance of smiling due to pain and avoidance of smiling due to appearance. The response options are given on a three-point scale (no = 0, a little = 1, a lot = 2) aided by an explanation card with corresponding faces. The total score for each version is calculated as a simple sum of the response codes. The final score ranges from 0 to 28 on the parent/caregiver version and 0 to 14 on the child version [17,18]. For statistical purposes, quality of life was dichotomized as higher or lower impact on the child's OHRQoL based on the median for both the parent/caregiver and child subscales.

The Brazilian version of the SOC-13 consists of 13 items, each with five response options. Three items can be considered representative of the SOC-13: (1) 'Are you interested in what occurs around you?' (2) 'Has it happened that people on whom you counted disappointed you?' and (3) 'Do you have confusing notions and feelings?' [19]. The final score ranges from 13 to 65, with higher scores denoting a greater capacity of adaptation to stress [20]. For statistical purposes, SOC was dichotomized as strong or weak based on the median.

The Multidimensional Health Locus of Control scale was used to evaluate the LOC of the parents/caregivers [14].

This 18-item questionnaire is subdivided into three scales (internal, external and chance). Each subscale has six items and each item has five scored response options: totally agree = 1; partially agree = 2; neither agree nor disagree = 3; partially disagree = 4; and totally disagree = 5. The items address the internality of health (belief that internal factors of the individual determine health/illness status) and externality of health (belief that health/illness is determined by others or by chance). The total sum of each subscale ranges from 6 to 30 points, with higher scores denoting a lower degree of each factor (internal, external and chance). Thus, the LOC of the parents/caregivers was considered to be internal when the lowest score was on the internal subscale and external when the lowest score was on the external or chance subscales. Questionnaires on which more than three items were unanswered and those for which an equal balance was found among the sum totals of the subscales were discarded.

The following socio-demographic characteristics were investigated: child's gender, type of preschool, parent's/caregiver's schooling, monthly household income (categorized based on the median, which was equal to US\$280), parent's/caregiver's age and number of residents in the home. The use of dental services by the children was also investigated. The parents/caregivers were also asked about the habit of nail biting, breastfeeding, bottle feeding, pacifier use and digit sucking.

Clinical data collection

Oral examinations were performed in the knee-to-knee position with the aid of a portable lamp attached to the examiner's head (Petzl Zoom head lamp, Petzl America, Clearfield, UT). The dentists used individual protective equipment, a sterilized mouth mirror (PRISMA[®], São Paulo, Brazil) and sterilized Williams probe (WHO-621, Trinity[®], Campo Mourão, Brazil). The examination of the oral conditions was performed based on established clinical criteria. Anterior open bite was diagnosed as the lack of a vertical overlap of the incisors in the occlusal position [21].

The diagnosis of sleep bruxism was based on the reports of the occurrence of tooth grinding during sleep, as proposed by the American Academy of Sleep Medicine for preschool children [22].

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) (version 21.0, IBM Inc., Armonk, NY). The frequency distribution of the data was determined to characterize the sample. The variable dependent was anterior open bite. Poisson's regression with robust variance was performed to test associations between anterior open bite and the independent variables. The stepwise backward procedure was used for the selection of variables with a *p* value <.20 in the bivariate analysis. Variables with a *p* value <.05 in the adjusted analyses were maintained in the final regression model.

Ethical issues

This study was conducted in accordance with the Declaration of Helsinki and was independently reviewed and approved by the Human Research Ethics Committee of the State University of Paraíba, Brazil (38937714.0.0000.5187). The parents/caregivers received clarifications regarding the objectives of the study and signed a statement of informed consent.

Results

A total of 764 children and their respective parents/caregivers participated in the present study. The response rate was 99.3%. The loss of data on five children was due to incomplete questionnaires. Table 1 displays the data characterizing the sample. Among the psychological aspects, greater impact on children's OHRQoL was reported by 41.4% of the children and 37.1% of the parents/caregivers. A weak SOC and external LOC were found in 41.7% and 31.9% of the parents/caregivers, respectively.

Poisson's regression analysis was performed to determine factors associated with open bite among the preschool children. In the bivariate analysis, the associated variables to open bite were attending a public preschool, lower level of mother's schooling, lower household income, caregiver's age less than or equal to 30 years, greater number of residents in the home, bottle feeding, pacifier use, digit sucking, absence of nail biting, impact on quality of life according to parent/caregiver and impact on quality of life according to child and LOC (*p* < .05). In the multivariate analysis, however, the following variables remained associated with anterior open bite: attending public school (PR = 2.40; 95% CI: 1.68–3.43), greater number of residents in the home (PR = 1.67; 95% CI: 1.18–2.36), pacifier use (PR = 7.09; 95% CI: 4.06–12.39), digit sucking (PR = 2.15; 95% CI: 1.27–3.62) and impact on quality of life according to the child's report (PR = 1.56; 95% CI: 1.11–2.20) (Table 2).

Discussion

In the present study, anterior open bite in preschool children was associated with attending a public preschool, a greater

Table 1. Characterization of sample.

Variable	Frequency	
	N	%
Child's sex		
Male	401	52.5
Female	363	47.5
Type of preschool		
Private	469	61.4
Public	295	38.6
Monthly household income ^a		
≤R\$ 1000	366	50.1
>R\$ 1000	365	49.9
Mother's schooling ^a		
≤8 years of study	226	29.6
>8 years of study	535	70.3
Anterior open bite		
Present	116	15.2
Absent	648	84.8

^aSample less than 764 due to the failure of some interviewees to provide this information.

Table 2. Poisson's regression analyses of anterior open bite in preschool children and associated factors.

Variable	Anterior open bite		Bivariate		Multivariate	
	Present, <i>n</i> (%)	Absent, <i>n</i> (%)	Unadjusted PR ^b		Adjusted PR ^c	
			<i>p</i> value	(95% CI)	<i>p</i> value	(95% CI)
Child's sex						
Female	61 (16.8)	302 (83.2)	.236	1.22 (0.87–1.71)	–	–
Male	55 (13.7)	346 (86.3)		1.00	–	–
Type of preschool						
Public	71 (24.1)	224 (75.9)	<.001	2.50 (1.77–3.53)	<.001	2.42 (1.68–3.49)
Private	45 (9.6)	424 (90.4)		1.00		1.00
Mother's schooling ^d						
≤8 years of study	47 (20.8)	179 (79.2)	.004	1.63 (1.16–2.29)	–	–
>8 years of study	68 (12.7)	467 (87.3)		1.00	–	–
Monthly household income ^d						
≤R\$ 1000	75 (20.5)	291 (79.5)	<.001	1.96 (1.37–2.82)	–	–
>R\$ 1000	38 (10.4)	327 (89.6)		1.00	–	–
Caretaker's age ^d						
≤30 years	59 (18.4)	261 (81.6)	.040	1.43 (1.01–2.01)	–	–
>30 years	53 (12.9)	358 (87.1)		1.00	–	–
Number of residents in home ^d						
<6	89 (13.6)	567 (86.4)		1.00		1.00
≥6	26 (26.0)	74 (74.0)	.001	1.91 (1.30–2.81)	.004	1.65 (1.17–2.34)
Visit to dentist ^d						
Yes	42 (12.6)	292 (87.4)		1.00	–	–
No	74 (17.2)	355 (82.8)	.077	1.37 (0.96–1.94)	–	–
Breastfeeding ^d						
Yes	97 (14.3)	580 (85.7)		1.00	–	–
No	19 (22.1)	67 (77.9)	.052	1.54 (0.99–2.38)	–	–
Bottle feeding ^d						
Yes	107 (16.6)	538 (83.4)	.008	2.72 (1.30–5.70)	–	–
No	7 (6.1)	108 (93.9)		1.00	–	–
Pacifier use ^d						
Yes	101 (23.2)	334 (76.8)	<.001	5.34 (3.11–9.16)	<.001	7.17 (4.00–12.86)
No	14 (4.3)	308 (95.7)		1.00		1.00
Digit sucking ^d						
Yes	15 (24.6)	46 (75.4)	.022	1.74 (1.08–2.80)	.015	2.05 (1.15–3.67)
No	97 (14.1)	591 (85.9)		1.00		1.00
Nail biting ^d						
Yes	23 (9.7)	214 (90.3)		1.00	–	–
No	91 (17.6)	425 (82.4)	.007	1.81 (1.18–2.79)	–	–
Bruxism ^d						
Absent	87 (15.7)	467 (84.3)	.535	1.13 (0.76–1.68)	–	–
Present	28 (13.9)	174 (86.1)		1.00	–	–
Impact on quality of life according to parental report ^a						
Yes	54 (23.4)	177 (76.6)	<.001	2.01 (1.44–2.79)	–	–
No	62 (11.6)	471 (88.4)		1.00	–	–
Impact on quality of life according to child's report ^a						
Yes	68 (21.5)	248 (78.5)	<.001	2.00 (1.42–2.82)	.007	1.62 (1.14–2.30)
No	48 (10.7)	400 (89.3)		1.00		1.00
Sense of coherence						
Strong	59 (13.3)	386 (86.7)		1.00	–	–
Weak	57 (17.9)	262 (82.1)	.080	1.34 (0.96–1.88)	–	–
Locus of control ^d						
External	52 (21.5)	190 (78.5)	.001	1.79 (1.28–2.50)	–	–
Internal	62 (12.0)	455 (88.0)		1.00	–	–

^aVariables dichotomized by median.^bCrude Poisson's regression of anterior open bite and independent variables.^cVariables incorporated into multivariate model ($p < .20$): type of school, mother's schooling, monthly household income, caretaker's age, number of residents in home, visit to dentist, breastfeeding, bottle feeding, pacifier use, digit sucking, nail biting, impact on quality of life according to parental report, impact on quality of life according to child's report, sense of coherence and locus of control.^dSample less than 764 due to the failure of some interviewees to provide this information.

number of residents in the home, digit sucking, pacifier use and a greater impact on OHRQoL according to the child's report. The prevalence of anterior open bite was 15.2%, which is within the range reported in previous studies [2,23]. Anterior open bite is one of the most prevalent types of malocclusion in the age group analysed [5] and is due to the presence of oral habits, among other factors [6].

Anterior open bite was associated with socio-demographic factors, such as attending a public preschool and having a

greater number of residents in the home. These factors are associated with a lower economic power. Social factors can exert a strong influence on the adoption of harmful sucking habits and other behaviours that can compromise child development [24].

The present findings demonstrate associations between non-nutritive sucking habits and anterior open bite, which are well-established associations in previous investigations [2,5]. Malocclusion is believed to be caused by a combination

of hereditary and environmental factors acting in conjunction [5]. Oral habits are the most evident examples of the environmental aetiology of malocclusion, especially when persisting beyond three years of age [6,7]. Some children may not develop anterior open bite despite having non-nutritive sucking habits, probably due to differences in the frequency/intensity of habit as well as variations in the facial growth pattern. Thus, prevention strategies directed at these habits that incorporate a psychological approach should be integrated into a national public health policy in an attempt to diminish the possibility of progression. The persistence of non-nutritive sucking habits may be associated with psychological aspects in children and increase the prevalence of this malocclusion. Thus, psychosocial aspects and anterior open bite may have an indirect relationship.

With regard to psychosocial aspects, impact on OHRQoL according to the children's reports was associated with anterior open bite. A previous study demonstrated that children at this age are able to answer questions related to psychological aspects either alone or accompanied by a parent/caregiver [25]. Thus, children who report an impact on OHRQoL tend to experience pain due to an oral condition [11] and the occurrence of pain may prolong oral habits, such as digit sucking and pacifier use, as a comforting mechanism, which could result in anterior open bite. On the other hand, no association was found between this type of malocclusion and the impact on OHRQoL according to parental reports, perhaps because sucking habits provide comfort and help a child calm down [26] and parents/caregivers believe that this is a hereditary problem [27]. Thus, it is important to educate parents/caregivers so that they can perceive the functional limitations associated with anterior open bite, such as difficulty eating and speaking, as well as its possible transition to the mixed dentition [4]. Contrary to expectations for this age group, only one previous study found this inverse association between anterior open bite and OHRQoL [1]. The authors suggest that such an association was due to the functional, aesthetic and social limitations that this type of malocclusion can cause [1]. It should be pointed out that the study cited only used a proxy measure, as the parents/caregivers also answered for the children, which was not the case in the present investigation.

Parent's SOC and LOC were not associated with anterior open bite among the children. The study of SOC enables an understanding of the social aspect that may be involved in seeking a better health status and healthy habits [12,13]. Regarding LOC, individuals with a high internal LOC believe that the causes of life events are related to personal ability, effort and power of control, that is, that their health depends on their own actions [14]. Previous studies have found associations between a strong SOC on the part of mothers and visits to the dentist, a lower prevalence rate of dental caries and greater knowledge regarding health issues [12,13]. The lack of an association between psychological factors of parents/caregivers (SOC and LOC) and anterior open bite in the present study may be because this is a particular psychological condition of a parent/caregiver and may not affect the emotional state of the child.

The present study has limitations, such as the cross-sectional design and the possibility of memory bias. However, steps were taken to minimize these limitations, such as the use of validated questionnaires and the execution of a pilot study. Another limitation was the occurrence of missing data for some variables, such as parent's/caregiver's schooling and household income. The establishment of oral healthcare strategies to encourage early visits to oral health services is an important measure for the prevention of malocclusion in the primary dentition.

In conclusion, the prevalence of anterior open bite among preschool children was 15.2%. Regarding the associated factors, children with more impact on OHRQoL according to their own reports, those attending a public preschool, those living in homes with a larger numbers of residents, and those with digit sucking and pacifier sucking habits have greater probability of being diagnosed with anterior open bite.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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