

ARE SOCIOECONOMIC FACTORS ASSOCIATED WITH OVERBITE AND OVERJET? AN EVALUATION USING DIGITAL PHOTOGRAPHS

Condições socioeconômicas estão associadas ao overbite e overjet? Uma avaliação utilizando fotografias digitais

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ABSTRACT

Purpose: to estimate the association between socioeconomic factors and occlusal changes like overbite and overjet in students aged 7 to 15 years. **Method:** this is a cross-sectional study in 251 students of both gender regularly enrolled in the school of public and private schools in São Luís, Maranhão, Brazil. All subjects carried out the sample photos extra-oral standardized face (front resting, smiling front and profile) and intraoral (front, right side and left side in occlusion, occlusal upper and lower occlusal) for the diagnosis of changes. The photographs were evaluated by three observers under blind and disagreements were discussed to achieve consensus. Overbite and overjet were diagnosed according to criteria of Angle. **Results:** it was found that 35.4% of the children were 18.3% and overbite, overjet. There was a statistically significant association between family income and overbite ($p = 0.003$) and overjet ($p = 0.029$), noting that most children who had no overbite (69.4%) were low-income families (up to 2 minimum wage). Similarly, most people with overjet were families with higher incomes, while the majority of those without overjet had low family income. For other variables there was no statistically significant difference in frequency distribution of overjet and overbite. **Conclusion:** the prevalence of overbite and overjet among the studied population is high, especially among those with higher family income.

KEYWORDS: Malocclusion; Prevalence; Vertical Dimension; Dentition, Mixed

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■ INTRODUCTION

Malocclusions (MOCl) include a set of anomalies characterized by gaps in the tooth arrangement and/or the relationship between the maxillomandibular bones¹. MOCl have been designated as diseases of modern civilization that can have potential health impacts on humans today, including changes in

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mastication, speech, swallowing, muscle pain, and temporomandibular joint functions, as well as aesthetic problems, resulting in social, functional, and psychological consequences during adult life^{2,3}. In 2007, Suliano reported a gradual reduction in speech, swallowing, and mastication functions as the severity of the MOCl increased⁴. There are even indications that such MOCl are associated with a decreased quality of life in human populations⁵.

Overbite and overjet are among the main occlusal changes that occur in Brazilian children with mixed dentition. Overbite is defined as the overlap between the upper and lower incisors on a vertical plane and is a characteristic of the permanent dentition of contemporary humans⁶. Several authors have established normality standards for this overlap¹, but when the overbite is more pronounced than the normality standards, it is considered a type of MOCl^{1,6}. Overjet is an extensive horizontal overlap of the incisal ridge of the upper teeth over the lower teeth and of the buccal cusp ridges of the posterior teeth with respect to their lower counterparts. Such a change is usually associated with facial muscle imbalance problems, resulting in an anteroposterior dentoskeletal relationship⁷.

In a study of pronounced overjet in Brazilian children, the prevalence was 22.0%⁸. Another study conducted in eighteen Brazilian states using random sampling reported an overbite prevalence of 18.09%⁹. Although different prevalences of MOCl have been reported, the majority of studies are restricted to the more developed regions of Brazil, which makes constructing an epidemiological profile of these public health problems in the country more difficult. Moreover, these studies were conducted with different age groups and only provided numerical classification criteria, thereby neglecting evaluations of the soft tissue, facial harmony, and patient perceptions^{10,11}.

No consensus exists regarding the role of socioeconomic factors in the etiology of deleterious oral habits and dentofacial MOCl^{3,12-16}. However, it is believed that when combined with several other factors, socioeconomic factors may influence the growth and development of the maxillaries, resulting in MOCl. Nonetheless, doubts remain, specifically about the relationship between socioeconomic factors and occlusal changes (particularly overbite and overjet) because few studies have addressed this subject, and their results are contradictory^{1,13}.

Several investigations have revealed that the socioeconomic status has an influence on health, including the incidence of respiratory diseases¹⁷, breastfeeding¹⁸, and poor access to dental services¹⁹. Additionally, several investigators have noted a direct relationship between the socioeconomic

status and deleterious oral habits, which could influence the rise in MOCl²⁰.

The costs involved in curative treatments are extremely high and should also be considered. It is therefore important to adopt preventive and interceptive strategies, aiming not only to reduce financial costs but also to minimize the impact of these changes on public health.

Because overbite and overjet are some of the least understood MOCl² and because MOCl has endemic characteristics and is currently one of the main oral health problems, it has been hypothesized that a high prevalence of these changes exists among adolescents with a poor socioeconomic status in the evaluated city. The present study might be an important tool for characterizing the epidemiological profile of these changes in the regional population and thus facilitate the implementation of public policies aimed at controlling the problem. Therefore, the purpose of this investigation was to estimate the association between socioeconomic factors and overbite and overjet MOCl in young students with permanent dentition.

METHOD

The present study followed the requirements established by Resolution 196/96 of the National Health Council/Ministry of Health of Brazil and its complementary laws. The study proposal was approved by the Committee for Ethics in Research at the institution of origin on March 31, 2008, under Protocol No. 00136/2008. All of the participants' guardians were informed about the purpose of the research and, if they agreed to participate in the study, signed an informed consent form.

This cross-sectional study was conducted using a patient sample composed of 251 students who were 7 to 15 years of age, of either gender, and enrolled in grades 1 through 8 in public or private schools in the city of São Luís, Maranhão, Brazil, between August 2008 and May 2009.

At the time of the investigation, the city of São Luís (MA) had an estimated 998,385 inhabitants²¹ spread over an area of approximately 828 km²²². According to the school census data available during this study²³, there were an estimated 101,042 children enrolled in grades 1 to 4 in primary education and 81,334 children in grades 5 to 8 of primary education in the city of São Luís. In total, 34.6% of the students were enrolled in public state schools, 38.8% were enrolled in municipal public schools, and 25.1% were enrolled in private schools.

A multistage random cluster sampling technique was used to select students for this study. The EpiInfo program (CDC, Atlanta, GA, United States)

estimated that this study would require a sample of 251 individuals, a MOCl (overbite and overjet) prevalence of 17.2%, and a sampling error of 4.5% with a 5% alpha and 80% power.

The data were collected by previously trained staff members. The evaluations were conducted using standardized procedures in a room located in the particular school. During the examination, a dental mirror and front and side lip and cheek retractors were used in addition to a digital camera for photographic documentation.

Standardized extraoral photographs (frontal resting, frontal smiling, and profile) and intraoral photographs (frontal, right side, and left side in occlusion, upper occlusal, and lower occlusal) were taken of all of the subjects in the sample. The pictures were taken at a single location in each school, as recommended by Siécola¹⁰, using background lighting to ensure indirect light and thus decrease unwanted shadows in the photographs.

The framing of the photographs was performed in a simplified way. In the frontal view, the horizontal markings of the camera were parallel to the ground, and the vertical markings were aligned with the midline of the face. In the lateral view, the horizontal markings were also parallel to the ground, and the vertical markings were aligned with the lateral corner of the orbit and parallel to the vertical line¹⁰.

The intraoral photographs employed a standardized distance from the teeth, such that all of the teeth could be observed using sterilized retractors that were suitable for the photographs.

The photographs were evaluated by three blinded examiners, and any disagreements were discussed until a consensus was reached.

Overbite was defined as the overlap between the upper and lower incisors on a vertical plane³. An overbite was classified as follows: mild, when the incisal ridge of the lower central incisors touched the third incisal of the upper central incisors; average, when the lower incisors touched the middle third of the crown of the upper incisors; and severe, when the lower central incisors touched the cingulum of the upper incisors or gum^{1,6}.

An overjet was defined as excessive overlap of the incisal ridge of the upper teeth over the lower teeth and buccal cusps of the posterior teeth with respect to their lower counterparts¹.

A questionnaire answered by the parents and students was also used. The following data were collected for each student: name, date of birth to estimate the age ["7 to 11 years" or "12 to 15 years"], residential address, phone number, gender ["male" or "female"], color / ethnicity [self-described, based on the Brazilian Institute of Geography and Statistics criteria, 2006, and classified as "white" or "non-white"], general data regarding the school [school name, type of school funding ("public" or "private")], socioeconomic characteristics of the student and his/her family [education level of the head of household (categorized as "8 years or less" or "9 years or more"), family income in Reais ("<2", "2-5" or ">5 times the minimum wage"), who is head of household ("father," "mother," or "other"), occupational status of the head of household ("unemployed" or "no"), presence of an indoor bathroom only at the school ("yes" or "no"), grade level, and the student's history of failed grade levels ("yes" or "no")].

The photos were archived daily on a computer, which was protected, and access was limited to the team of researchers. The program Adobe Photoshop® (San Jose, CA, United States) was used to crop the photographs. No other changes or adjustments to the color, brightness, contrast, or proportions of the photos were made. The images were saved in a compressed format, using sequential numbers to identify the students and connect them to their other data.

All of the information was stored in a database that was generated using the program Microsoft Office Excel for Windows® (Redmond, WA, United States). Bivariate descriptive analyses were subsequently done to determine the frequency distribution of the demographic, socioeconomic, behavioral, and biological data as a function of the presence of an overjet or overbite. At this stage, possible differences were identified between the proportions of students with a MOCl and their categorical variables using Pearson's chi-square test (X^2), considering a significance level of 5% ($\alpha = 0.05$). The software Statistica version 7.0 distributed by StatSoft Inc® (Tulsa, OK, United States) was used to perform these calculations, draft the tables and graphs, and test the hypotheses.

■ RESULTS

In the present study, the prevalence of an overbite in students between 7 and 15 years of age was 35.4%, and the prevalence of an overjet was 18.3%. The sociodemographic characteristics of the students are listed in Table 1.

There was a statistically significant association between the family income and the presence of an

overbite ($p = 0.003$). There was a higher prevalence of overbite among students whose families earned between 2 and 5 times the minimum wage (55.6%). Most of the students without this MOCl were from families that earned the lowest wages (2 times the minimum wage or less). There were no statistically significant differences in the frequency distribution between the other variables and the presence of an overbite (Table 2).

Table 1 – Characteristics of the 251 students between 7 and 15 years of age who were included in the study. São Luís. Maranhão, Brazil. 2008-2009

	n	%	95% CI
Gender			
Male	113	45.0	38.9-51.2
Female	138	55.0	48.8-61.1
Age			
7 to 11 years	151	60.2	54.1-66.2
12 to 15 years	100	39.8	33.8-45.9
Color			
White	64	25.5	20.1-30.9
Non-white	187	74.5	69.1-79.9
Failed a grade level in school			
No	196	78.1	73.0-83.2
Yes	55	21.9	16.8-27
Family income			
More than 5 MW	27	10.8	6.9-14.6
Between 2 and 5 MW	54	21.5	16.4-26.6
Less than 2 MW	170	67.7	61.9-73.5
Head of household			
Father	121	48.2	42.0-54.4
Mother	88	35.1	29.2-41.0
Other	42	16.7	12.1-21.4
Education level of the head of household			
9 years or more	84	33.5	27.6-39.3
8 years or less	167	66.5	60.7-72.4
Total	251	100.0	

MW = minimum wage in Reais (R\$ 415.0).

95% CI = 95% Confidence Interval.

Table 2 – Frequencies of *overbite* as a function of socio-economic and demographic variables in 251 students between 7 and 15 years of age. São Luís, Maranhão, Brazil. 2008-2009

Variables and categories	<i>Overbite*</i>				p †
	Yes		No		
	n (%)	95% CI	n (%)	95% CI	
Gender					
Male	45(39.8)	30.8-48.8	68(60.2)	51.2-69.2	0.185
Female	42(30.4)	22.8-38.1	9(69.6)	61.9-77.2	
Age					
7 to 11 years	53(35.1)	27.5-42.7	98(64.9)	57.3-72.5	0.647
12 to 15 years	34(34.0)	24.7-43.3	66(66.0)	56.7-75.3	
Color					
White	22(34.4)	22.7-46.0	42(65.6)	54.0-77.3	0.957
Non-white	65(34.8)	27.9-41.6	122(65.2)	58.4-72.1	
Failed a grade level in school					
No	71(36.2)	29.5-43.0	125(63.8)	57.0-70.5	0.604
Yes	16(29.1)	17.1-41.1	39(70.9)	58.9-82.9	
Family income					
More than 5 MW	10(37.0)	18.8-55.3	17(63.0)	44.7-81.2	0.003
Between 2 and 5 MW	30(55.6)	42.3-68.8	24(44.4)	31.2-57.7	
Less than 2 MW	47(27.6)	20.9-34.4	123(72.3)	65.6-79.1	
Head of household					
Father	48(39.7)	31.0-48.4	73(60.3)	51.6-69.0	0.110
Mother	32(36.4)	26.3-46.4	56(63.6)	53.6-73.7	
Other	7(16.7)	5.4-27.9	35(83.3)	72.1-94.6	
Education level of the head of household					
9 years or more	36(42.9)	32.3-53.4	48(57.1)	46.6-67.7	0.050
8 years or less	51(30.5)	23.6-37.5	116(69.5)	62.5-76.4	

MW = minimum wage in Reais (R\$ 415.0). 95% CI = 95% Confidence Interval.

(*) Five (5) students who were not evaluated were excluded.

(†) Pearson's chi-squared test ($\alpha = 5\%$).

There were also statistically significant differences in the frequency distribution between an overjet and the various family-income categories ($p = 0.029$). Among the students who had this MOCl, the majority (29.6%) had a family income of more than 5 times the minimum wage, whereas the

majority of students (84.1%) without an overjet were from families with incomes that were 2 times the minimum wage or less. No significant differences existed between the distribution of overjet and the other investigated variables (Table 3).

Table 3 – Frequencies of *overjet* as a function of socioeconomic and demographic variables in 251 students between 7 and 15 years of age. São Luís. Maranhão, Brazil. 2008-2009

Variables and categories	<i>Overjet*</i>				p †
	Yes		No		
	n (%)	95% CI	n (%)	95% CI	
Gender					
Male	26(23.0)	15.2-30.8	87(77.0)	69.2-84.8	0.099
Female	19(13.8)	8.0-19.5	119(86.2)	80.5-92.0	
Age					
7 to 11 years	25(16.6)	10.6-22.5	126(83.4)	77.5-89.4	0.496
12 to 15 years	20(20.0)	12.2-27.8	80(80.0)	72.2-87.8	
Color					
White	17(26.6)	15.7-37.4	47(73.4)	62.6-84.3	0.112
Non-white	28(15.0)	9.9-20.1	159(85.0)	79.9-90.1	
Failed a grade level in school					
No	36(18.4)	12.9-23.8	160(81.6)	76.2-87.1	0.935
Yes	9(16.4)	6.6-26.1	46(83.6)	73.9-93.4	
Family income					
More than 5 MW	8(29.6)	12.4-46.9	19(70.4)	60.3-84.2	0.029
Between 2 and 5 MW	15(27.8)	15.8-39.7	39(72.2)	60.3-84.2	
Less than 2 MW	22(12.9)	7.9-18.0	148(87.1)	82.0-92.1	
Head of household					
Father	25(20.7)	13.4-27.9	96(79.3)	72.1-86.6	0.763
Mother	12(13.6)	6.5-20.8	76(86.4)	79.2-93.5	
Other	8(19.1)	7.2-30.9	34(80.9)	69.1-92.8	
Education level of the head of household					
9 years or more	21(25.0)	15.7-34.3	63(75.0)	54.7-84.3	0.040
8 years or less	24(14.4)	9.1-21.4	143(85.6)	80.3-92.6	

MW = minimum wage in Reais (R\$ 415.0). 95% CI = 95% Confidence Interval.

(*) Five (5) students that were not evaluated were excluded.

(†) Pearson's chi-squared test. Statistically significant association between the variables ($p < 0.05$)

■ DISCUSSION

There was a high prevalence of overbite and overjet among the 251 children sampled, affecting 35.4% and 18.3% of the students, respectively. In addition, both overbite and overjet were significantly associated with the household income and the education level of the head of household, in which the highest prevalence of these MOCl occurred among the students with a higher family income and more education.

The prevalence of overbite in this study (35.4%) was similar to those reported in other investigations, which revealed prevalence ranging from 5% to 40%²⁴⁻²⁸. The lowest prevalence was recorded in a study that included 201 Aboriginal children and

adolescents from the Peruvian Amazon who were 2-18 years of age²⁸. The highest prevalence was observed in a study that included 1,024 adolescents between 13 and 15 years of age from Jeddah, Saudi Arabia²⁶. The variation between the studies may be due to their methodological differences, especially the cutoff points used to classify the overbites, the sample size, and the study design, which were usually convenience-sampling designs. In Brazil, the prevalence of overbite was 9% in 84 soccer players who were between 13 and 20 years of age²⁴. The frequency of overbite that was most similar to that found in the present study was reported by Borzabadi-Farahani et al.²⁵, who reported that the prevalence of MOCl was 39.6% in 502 adolescents between 11 and 14 years of age in the city of Isfahan, Iran.

The prevalence of overjet observed in the present study (18.3%) was similar to the prevalence reported in similar surveys: 15.6%⁷ and 16.2%²⁷. Data from the SB Brazil study indicated that the prevalence were 17.5% and 22.7%, respectively, in 2003 and 2010 for adolescents between 15 and 19 years of age in Brazil⁸. However, these data were different from the values observed in other international studies, namely, 8.5%²⁸, 29%²⁹, and 31.7%²⁵. These results may also be attributed to the methodological differences between the investigations. Some studies only analyzed children with deleterious oral habits, which contribute to the increase in the estimated frequency of dental MOCl. Other studies used cutoffs for defining overjet that were less than those adopted in the present investigation. For example, Bhardwaj et al.²⁹ considered an overjet to be >2 mm in 622 adolescents between 16 and 17 years of age in the city of Shimla, India.

In this study, overjet and overbite were problems most commonly observed in students belonging to groups with higher family incomes. However, investigations of the influence of living conditions on the occurrence of orthodontic problems often yield contradictory results.

Although several authors have reported that the necessity for orthodontic treatment varies significantly between different socioeconomic strata, indicating that individuals who belong to families with better indicators have less need for treatment compared with individuals from families with a low socioeconomic status^{13,30}, other researchers are opposed to this idea^{31,32}.

In the present study, both income and higher education were associated with an increased prevalence of MOCl. It is speculated that this finding may be related to the increased access to consumer goods, such as pacifiers and bottles, for children whose families have higher incomes. In these families, the mother is customarily absent because of work outside the home, which would theoretically result in a reduction in the duration of breastfeeding, a higher frequency of deleterious habits, and consequently, a higher frequency of MOCl^{3,7,18}. Another study that evaluated the contextual influence of the socioeconomic level on MOCl reported no association between MOCl and factors such as family income and maternal education. However, the age range of the children and the type of assessment used to identify MOCl might have influenced these results. Notably, orthodontic treatment is becoming increasingly accessible to people of lower socioeconomic status and less purchasing power^{19,33}, which could obscure such associations.

Another plausible explanation for this study's results stems from the hypothesis that early tooth loss, which is most commonly reported among the poorest individuals²⁰, could influence the arrangement of the teeth, thereby increasing the free space in the arch and reducing the occurrence of overjet. By contrast, the differences may be obscured by variables not included in the analysis.

The main limitations of the present study include the cross-sectional design, which limits the inferences of association and potential measurement biases, especially for socioeconomic variables such as income and education, which can result in bias due to the constraint and omission of reality. Other difficulties, especially in appropriately performing the photographic technique in a standardized manner and the lack of cooperation from the children, made finding information on the prevalence of overbite and overjet more challenging. To minimize these problems, the income and education information were collected using an interval scale, while explaining to the students the importance and confidentiality of the information. In addition, thorough training was implemented regarding using the data collection instruments and taking the standardized photographs, thereby achieving compliance levels exceeding 80% for the study variables. Another strategy adopted to reduce measurement bias was the use of three blinded evaluators to classify the MOCl. Finally, the random sampling also reduced potential selection biases³⁴.

Moreover, the lack of orthodontic treatment provided by public services in the State of Maranhão (the second poorest state in the federation) and the lack of research characterizing the prevalence of these occlusal changes in students 7 to 15 years of age in São Luís, the state capital, make this study an important tool for characterizing the epidemiological MOCl profile of the population in this region and thus support the planning of public policies aimed at reducing oral health inequality.

■ CONCLUSION

The prevalence of overjet and, particularly, overbite in the mixed dentition of students examined in the municipality of São Luís, MA are high. Moreover, these orthodontic problems were related to socioeconomic factors and were more common among students whose families have higher incomes and more education.

RESUMO

Objetivo: estimar a associação entre fatores socioeconômicos e más oclusões do tipo *overbite* e *overjet* em escolares em fase de dentição permanente jovem. **Método:** trata-se de um estudo transversal realizado em 251 escolares de sete a 15 anos, de ambos os sexos, regularmente matriculadas no ensino fundamental de escolas públicas e privadas do município de São Luís, Maranhão, Brasil. Todos os sujeitos da amostra realizaram fotografias extrabucais padronizadas de face (frontal em repouso, frontal sorrindo e perfil) e intrabucais (frontal, lateral direita e lateral esquerda em oclusão, oclusal superior e oclusal inferior), para o diagnóstico das alterações. As fotografias foram avaliadas por três examinadores em regime cego e as discordâncias foram discutidas até a obtenção de consenso. *Overbite* e *overjet* foram diagnosticados segundo critérios de Angle. **Resultados:** constatou-se que 35,4% das crianças apresentaram *overbite* e 18,3%, *overjet*. Houve associação estatisticamente significativa entre a renda familiar com *overbite* ($p=0.003$) e com *overjet* ($p=0.029$), observando-se que a maioria das crianças que não possuíam *overbite* (69,4%) era de famílias com baixa renda (até 2 salários mínimos). De modo semelhante, a maioria dos portadores de *overjet* era de famílias com renda mais elevada, ao passo que a maioria daqueles sem *overjet* tinha renda familiar baixa. Para as demais variáveis não houve diferenças estatisticamente significante na distribuição de frequência de *overjet* e *overbite*. **Conclusão:** a prevalência de *overbite* e *overjet* nos escolares estudados é alta, especialmente entre aqueles com maior renda familiar.

DESCRITORES: Má Oclusão; Prevalência; Dimensão Vertical; Dentição Mista

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