Socioeconomic and clinical factors associated with traumatic dental injuries in Brazilian preschool children

Chaiana Piovesan[a]
Renata Saraiva Guedes[b]
Luciano Casagrande[c]
Thiago Machado Ardenghi[b]

[a] Department of Pediatric Dentistry, Faculdade de Odontolologia, Univ de São Paulo - FOUSP, São Paulo, SP, Brazil.

[b] Department of Stomatology, Univ Federal de Santa Maria - UFSM, Santa Maria, RS, Brazil.

[c] Department of Pediatrc Dentistry, Univ Federal do Rio Grande do Sul - UFRGS, Porto Alegre, RS, Brazil.

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Corresponding Author:
Chaiana Piovesan
E-mail: *chaiana@usp.br*

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Abstract: The aim of this paper was to assess the epidemiology of traumatic dental injury (TDI) in preschool children and its relation to socioeconomic and clinical factors. This study was carried out in Santa Maria, Brazil, during National Children's Vaccination Day, and 441 children aged 12 to 59 months were included. Data about socioeconomic status were collected through a semi-structured questionnaire administered to parents. Calibrated examiners evaluated the prevalence of TDI, overjet, and lip coverage. Data were analyzed with a Poisson regression model (PR; 95% confidence intervals). The TDI prevalence was 31.7%. The maxillary central incisors were the most frequently traumatized teeth. The most common TDI was enamel fracture. No association was found between TDI prevalence and the socioeconomic status of children. After adjustments were performed, the eldest children with an overjet > 3 mm were more likely to have TDI than their counterparts. The data indicated a high prevalence of TDI. Only overjet was a strong predictor for TDI, whereas socioeconomic factors were not associated with TDI in this age group.

Descriptors: Tooth Injuries; Socioeconomic Factors; Child.

Introduction

A high prevalence of traumatic dental injury (TDI) has been reported in many countries. However, most studies of TDI have reported its prevalence in permanent teeth.[1-4] Although several recent studies have assessed the prevalence of TDI in primary teeth and its associations with socioeconomic indicators, the results have been inconsistent and conflicting.[5-10]

In Brazil, the TDI prevalence in primary teeth ranges from 9.4% to 41.6%,[5-6] and there is evidence that TDI prevalence in deciduous teeth is increasing.[9] Moreover, it is well known that the majority of TDIs involve the anterior teeth,[6-8] and that their appearance and position have important psychological and social impacts on children's quality of life.[11-13]

Predisposing factors to TDI include physical features such as increased overjet and lip coverage. Previous studies have demonstrated that there is a tendency for children with an incisal overjet > 3 mm and inadequate lip coverage to experience more dental injuries.[8-9] However, while the association between overjet, lip coverage, and TDI is well established, the relationship between socioeconomic factors and the occurrence of dental

trauma among preschoolers is not clear.[5-9,14] Previous studies failed to demonstrate an association between TDI in primary teeth and socioeconomic factors.[6,8-9] Other studies showed a higher prevalence in the upper socioeconomic group.[7,14]

Understanding the socioeconomic and clinical factors associated with TDIs is important for planning public dental care strategies. The aim of this study was to assess the epidemiology of dental trauma in preschool children and its relationship with socioeconomic and clinical factors.

Methodology

The study protocol was approved by the Committee of Ethics in Research of the Federal University of Santa Maria.

Sample design

A cross-sectional survey of a sample of 12- to 59-month-old preschool children living in Santa Maria, a southern city in Brazil, was performed in August 2008. For the sample calculation, a standard error of 5%, a confidence interval (CI) level of 95%, and a TDI prevalence of 41.6% were adopted.[5] The minimum sample size to satisfy the requirements was estimated to be 373 children. To compensate for refusals during the data survey, the sample size was increased by 10%. Therefore, the minimum sample size was estimated to be 410 children.

Participants were selected from children attending the National Children's Vaccination Day. The vaccination program consistently has uptake rates above 97%. Systematic sampling was used to select children at health centers in the city. During the survey, every fifth child in queue for vaccination was invited to participate. If the parents of the child did not agree to participate, then the next child in the queue was selected. The same process was used for all selected health centers.

Health centers were used as sampling points because of the way that the city organized the "Vaccination Day." The city is administratively divided into 5 regions, and the major public health center in each region is responsible for the vaccination of those living in its respective area. For this study, 8 out of 20 health centers in the city were cluster selected. These centers were selected because they represent the major health centers in the city, accounting for nearly 85% of the children attending the vaccination program.

Data collection

Data were collected through clinical oral examinations and structured interviews. Only the clinical examination was used to estimate the prevalence of TDI.

Eight examiners and 24 assistants participated in the study. Training and calibration exercises to assess reproducibility were performed before the survey by one benchmark examiner. Training involved a theoretical explanation, and a discussion using clinical photographs of 30 exfoliated primary teeth. After that, 15 children were examined by all examiners twice, with an interval of 2 weeks between examinations. These children were used to assess the intra- and inter-examiner reliabilities. A total of 36 hours were spent on the training and calibration sessions.

Children were examined in a dental chair. Their teeth were dried with wet gauze pads, and examined under standard illumination provided by a conventional operating light. Dental examination included only the primary maxillary and mandibular incisors. The criteria for TDI used in the Children's Dental Health Survey in the UK were adopted,[15] which include fracture of the crown involving the enamel only, enamel and dentine, and fracture of the crown involving the pulp. Moreover, they include teeth missing due to trauma. Overjet, which was measured using a millimeter ruler, was considered excessive when > 3 mm. Lip coverage was considered adequate when the lips covered the anterior teeth completely in the at-rest position, and inadequate if the majority of the crown height was exposed and visible.

Data on socioeconomic status were collected by means of a questionnaire answered by parents. We compared the education of those parents who had completed 8 years of formal schooling, which in Brazil corresponds to primary school, with those who had not. Household income was measured in terms of the Brazilian minimum wage (BMW), a

standard used for this type of assessment, which was approximately US$ 280 during the data gathering period. The feasibility of the questionnaire was previously assessed in a sample of 20 parents during the calibration process.

Data analysis

Data analyses were performed with STATA 9 software (Stata Corporation, College Station, USA). Multivariate Poisson regression models with robust variance were fitted to assess the association between predictor variables and outcome (TDI). The prevalence ratio (PR; 95% CI) was calculated to assess the associations. A backward stepwise procedure was used to include or exclude explanatory variables in the fitting of models. The explanatory variables with a p value ≤ 0.20 in the crude analyses were included in the fitting of the model; they were selected for the final models only if they had a p value ≤ 0.05 after adjustment.

Results

A total of 441 children (mean age = 34 months), 53.8% boys and 46.2% girls, were enrolled in the study. The response rate was 98% of all children invited. Reasons for non-participation were mainly due to children who were not accompanied by their parents on the day of vaccination, and only a few refused to provide their consent. The sample size was larger than the estimated minimum size to satisfy the requirements because the response rate was higher than expected. Inter and intraexaminer agreement (Kappa statistics) for dental trauma ranged from 0.74–0.91 and from 0.84–1.0, respectively.

Children were predominately white, and their caregivers had a high level of education. More than half of the mothers were unemployed with a household income ≥ 3 BMW (mean = 1.017).

Traumatic injuries were found in 31.7% of the examined children, affecting a total of 214 teeth. The maxillary central incisors were the most frequently traumatized teeth (Figure 1). A total of 65.4% of the children had experienced trauma to a single tooth (Figure 2). The most commonly observed TDI during clinical examination was enamel fracture (86.9%) (Table 1).

The older children had a higher prevalence of trauma, and this difference was significant after adjustment ($p < 0.01$) (Table 2). There was a tendency for children with an overjet > 3 mm and inadequate lip coverage to have experienced more dental injuries. However, after adjusting, only overjet remained associated with TDI. TDI was not related to socioeconomic indicators (Table 2).

Discussion

There was a high TDI prevalence (31.7%) among preschoolers in this study, consistent with other epidemiological studies on TDI in deciduous teeth in

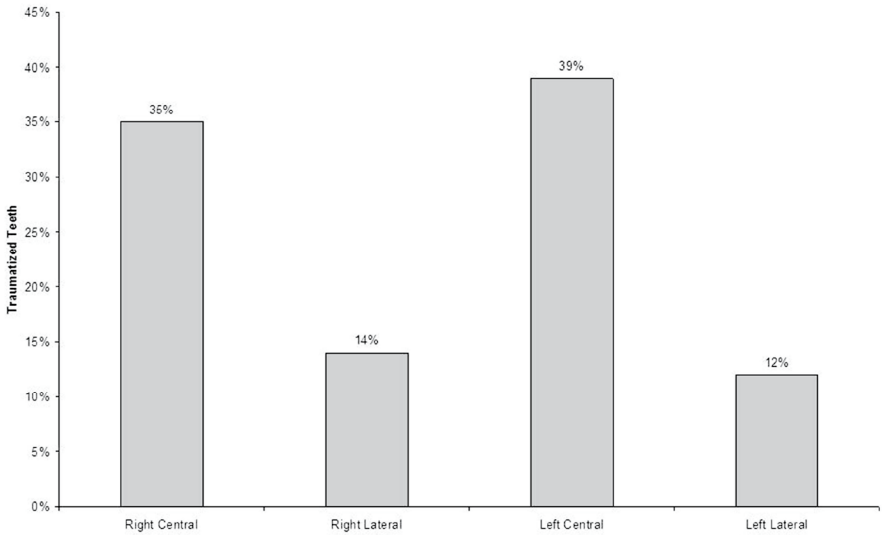

Figure 1 - Types of teeth with TDIs among preschool children (n = 214).

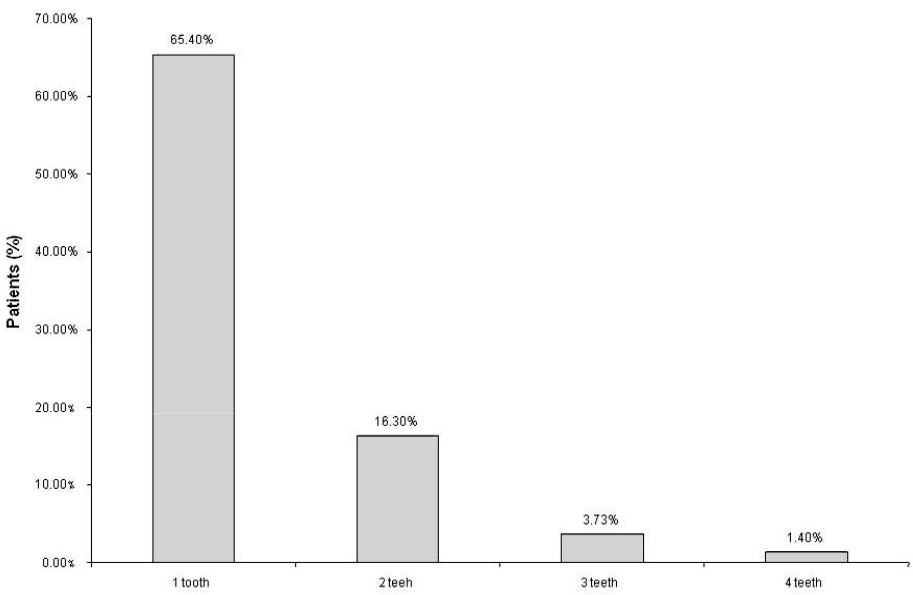

Figure 2 - Number of injured teeth among individuals with TDIs (n = 140).

Table 1 - Frequency distribution of teeth according to type of TDI; Santa Maria, Brazil, 2008 (n = 214).

Type of dental injuries	N	%
Crown fracture of enamel only	186	86.91
Crown fracture of enamel and dentin	9	4.20
Crown fracture involving pulp	7	3.27
No crown fracture but signs of involvement of the pulp	6	2.89
Missing teeth following a trauma	6	2.80
Total	214	100

Brazil.[5,8,14,16] Among these studies, careful attention should be paid to the prevalence of TDI in primary teeth, given the differences in the data collection and sampling methods and in the locations where the studies were conducted.[5,16]

As demonstrated by other studies, the majority of observations were of a single injured tooth,[5-6,8,16] and the maxillary central incisors were the most frequently affected.[5-8,16] The upper central incisors are generally more proclined than the lower central ones and tend to be the first to receive a direct blow producing a fracture.[6] Moreover, results from previous studies have demonstrated that the treatment of TDI tends to be neglected.[6,9,17] Considering that TDI could cause an impact on the quality of life of the individual, and that the appearance of anterior teeth has psychological and social impacts on children,[11-12] more attention should be paid to this type of problem.

Fractures of crowns involving only the enamel or the enamel and dentine were the most common types of injury in the sample (91.1%), which is in accordance with previous studies.[5-6,8,14,16] One may argue that minor damage does not need treatment, but the need for treatment was not assessed in this study. However, previous studies with permanent teeth showed that a large proportion of enamel and dentine fractures do need treatment.[17-20] Therefore, minor damage to enamel and dentine should be assessed with caution because an injury may appear minimal at the time of the accident, but may eventually result in pulpal necrosis.[20]

TDI are a result of a variety of factors. Different authors have found an association between an overjet > 3 mm and inadequate lip coverage and the occurrence of traumatic injuries in permanent teeth.[4,13,18] However, few studies have shown such a relationship in deciduous teeth.[6,8-9] We found that the presence of an overjet > 3 mm was significantly associated with more dental injuries. Therefore, the dental protrusion caused by overjet could increase the susceptibility of teeth to TDI.

The prevalence of TDI increased with age, as in previous reports.[5-7,14,16] It has been stated that more

Table 2 - Frequency distribution, simple and multiple analyses of gender, age, household income, mother's schooling, father's schooling, lip coverage and overjet on the presence of TDI in preschool children; Santa Maria, Brazil, 2008.

Variables	Traumatic dental injury	No traumatic dental injury	PR_{crude} (95% CI)	$PR_{adjusted}$ (95% CI)
Gender				
Male	81 (33.61)	159 (66.39)	1	
Female	59 (29.35)	142 (70.65)	0.87 (0.66-1.15)	
Age (years)				
≤1	19 (18.81)	82 (81.19)	1	1
2	35 (34.31)	67 (65.69)	1.82 (1.12–2.96)*	2.19 (1.03–4.68)*
3	39 (32.50)	81 (67.50)	1.72 (1.06–2.79)*	2.35 (1.11–4.97)*
≥4	47 (39.83)	71 (60.17)	2.11 (1.33–3.36)**	3.49 (1.69–7.19)**
Household income				
≥2BMW	79 (33.01)	154 (66.09)	1	
<2BMW	59 (29.80)	139 (70.20)	0.87 (0.66–1.16)	
Mother's schooling				
≥8 years	98 (32.03)	208 (67.97)	1	
<8 years	37 (29.13)	90 (70.87)	0.90 (0.66–1.24)	
Father's schooling				
≥8 years	91 (32.16)	192 (67.84)	1	
<8 years	36 (30.25)	83 (69.75)	0.94 (0.68–1.29)	
Lip coverage				
Adequate	94 (28.14)	240 (71.86)	1	1
Inadequate	40 (43.96)	51 (56.04)	1.56 (1.17–2.08)**	0.98 (0.54–1.78)
Overjet				
≤3 mm	55 (25.35)	162 (74.65)	1	1
>3 mm	28 (48.28)	30 (51.72)	1.90 (1.34–2.70)***	1.63 (1.06–2.53)*

Adjusted for all variables listed above; ***p < 0.001; **p < 0.01; *p < 0.05; 2 BMW = 560 US dollars.

TDIs are recorded in older children due to their cumulative effects.[6] On the other hand, it is well documented that trauma occurs as a result of the psychomotor underdevelopment and poor motor skills of children.[14] Therefore, due to the high prevalence of dental trauma in preschool children, health care plans to prevent dental trauma in this age group are important because a TDI at an early age may result in serious damage to the permanent dentition.[2]

In the present study, socioeconomic indicators were not associated with TDI. Conflicting results of this association have been reported in recent studies.[6-9,13-14] A critical literature review suggested that such contradictory findings may be related to the different indices used to measure socioeconomic status.[21] In this study, we used household income, parents' education level, and occupation as a proxy for socioeconomic status, and none was associated with the presence of TDI. One could argue that the cut-off points chosen could have an impact on the lack of association. However, our results corroborate those of previous studies;[6,9] therefore, classification bias is unlikely. Little information is available on the prevalence of TDI relative to socioeconomic indicators in younger children. Some studies have suggested that children from low socioeconomic backgrounds are more likely to have TDI.[22] However, children from high socioeconomic backgrounds have greater access to safe leisure activities. When these activities are performed in unsafe environments, they can lead to a higher incidence of TDI.[23] Thus, the direction of the association between socioeconomic indicators and the prevalence of TDI may depend on a balance between these factors.

Our results must be interpreted with caution. A cross-sectional design was used, and it was not possible to establish a temporal relationship. However, we tried to obtain a representative sample by selecting participants at random from the health centers. This systematic process avoided bias, which might occur if the sample were collected in a clinical setting. The selected centers represent the major health centers in the city; approximately 78% of the preschool children living in the administrative areas of the city attend these health centers for vaccination. The sampled subjects did not differ from the distribution of the city's population of preschoolers in terms of race, sex, and household income (Chi-square test; data provided by Demographic Council of the City). No parent reports were used to diagnose TDI. Therefore, a possible underestimation of prevalence is likely because we focused only on visible signs of dental trauma. There is a lack of consensus on an appropriate definition and classification of dental trauma.[24-25] We used the O'Brien[15] criterion, which has been employed in previous Brazilian studies.[26-28] Thus, it allowed for proper comparisons. Notwithstanding, the accuracy of parent reports of TDI is of particular concern when using a cross-sectional design, especially due to the possibility of memory bias.

This study revealed that increased overjet was associated with TDI among preschoolers. This information must be considered with caution when tailoring public policies for dental care. Dentofacial abnormalities such as overjet play an important role in social acceptance, and can disturb an individual's daily performance.[11,29] Early intervention for overjet may influence the number of TDI and the children's oral health-related quality of life. Our finding raises important questions in the ongoing debate regarding the effectiveness of delivery of early orthodontic treatment and the prevalence of TDI and improvement of self image.

Conclusions

The prevalence of TDI, mainly enamel crown fractures, was high. Socioeconomic indicators were not associated with dental trauma.

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