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Prevalence and determining factors of traumatic injuries to primary teeth in preschool children

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Abstract – The objective of the study was to assess the prevalence of dental injuries and the influence of determining factors in preschool children from Belo Horizonte, Brazil. A cross-sectional survey was carried out through clinical examinations and the application of a questionnaire to the parents of 419 children aged 0 to 5 years attending preschool. The sample was stratified by region, type of institution and age. The eighteen preschools visited were chosen randomly. The prevalence of traumatic injury to primary teeth was 39.1%. Enamel fractures were the most common traumatic injury (49.7%). Boys were 1.62 times more likely to have dental injuries than girls. Children with inadequate lip coverage were 3.75 times more likely to have a traumatic dental injury than those with adequate lip coverage. Children attending state preschools had nearly two times greater chances of having dental trauma than children attending private preschools. It was concluded that the prevalence of dental injuries in preschool children is high in Belo Horizonte, Brazil and constitutes a public health problem.

Dental trauma in primary teeth may result in pain and loss of function. It can also adversely affect the development of the permanent teeth and the developing occlusion (1). In spite of the relevance of this subject, there are few epidemiological studies with an emphasis on dental trauma among preschool children (1–7). Biological predisposing factors for dental trauma include increased overjet and inadequate lip coverage. Among the existing studies, however, only two emphasizes the relation between overjet and trauma in primary teeth (7, 8), whereas other studies concentrate on the permanent teeth (9–11). This demonstrates the need to evaluate these aspects in the deciduous dentition, for a greater understanding of the prevalence of trauma in primary teeth is of importance to the planning of dental care service, the prevention of accidents and improvements in the quality of care.

The prevalence of dental trauma in primary teeth has varied considerably. In previous studies carried out with Brazilian preschoolers, the prevalence of dental trauma injuries ranged from 9.4 to 36.8 (1, 2, 5, 6, 8, 12). This variation may be caused by differences in data collection method, sample selection and the place where the study was conducted.

This study was carried out to evaluate the prevalence of dental trauma in the primary teeth and its relation to associated factors including gender, overjet, lip coverage, type of school and socio-economic level.

Materials and methods

Sample characteristics

A cross-sectional study was carried out on 419 children aged 0 to 5 years of both genders attending preschools and day care centres in the city of Belo Horizonte, Brazil. Participants were selected from a population of 42 040 preschool children in the same age group at 73 state schools and 811 private schools and day care centres. Belo Horizonte is the capital of the state of Minas Gerais – Brazil. It is an industrialized city with considerable economic, social and cultural disparities. It has approximately two million inhabitants and is geographically divided into nine administrative regions.

The size of the sample was calculated to give a standard error of 5%. A 95% confidence interval level and a prevalence of dental injury of 30% (1) were used for the calculation. A correction factor of 1.2 was applied to increase precision because of the fact that multi-stage sampling was adopted rather than a random sampling technique (13). The minimum sample size to satisfy the requirements was estimated at 388 children. In order to ensure representivity, the sample was stratified according to city region, the type of institution and age of the child. The choice of the institutions and children were randomized until the target number was reached.

Inclusion criteria

The following inclusion criteria were required for participation: (i) no tooth lost because of succession or reasons other than traumatic injury; (ii) absence of structural loss in anterior teeth as a result of caries.

Non-clinical data collection

Authorization was obtained from the schools and day care centres to undertake the research. After meeting with the institution directors, a letter of presentation and term of informed consent were left with the teachers to be handed to each child to give to the parents/guardians, along with a questionnaire including the history of traumatic dental injury and socio-economic classification of the family. The questionnaire was filled in by the parents/guardians at home and returned to the teachers. Socio-economic status was determined using the ABA-ABIPEME (14) criterion for socio-economic classification in Brazil, which includes a set of comprehensible questions on the possession of household items such as bathroom, radio, TV sets, washing machine, vacuum cleaner and car as well as the presence of a full-time domestic servant and the educational level of the head of household.

Clinical data collection

The children were examined at the school or day care centre. Dental examinations were carried out by one dentist (F.R.), who had participated in a training and calibration exercise for the criteria of the National Diet and Nutrition Survey (15): Code 1 – discolouration; Code 2 – fracture involving enamel; Code 3 – fracture involving enamel and dentin; Code 4 – fracture involving enamel, dentin and pulp; Code 5 – missing tooth because of trauma; Code 6 – restoration with glass ionomer, composite or stainless steel crown; Code 7 – incisor displaced by trauma.

An artificial light (Petzl Zoom head lamp, Petzl America, Clearfield, UT, USA) provided the standardized source of light for the examinations. Teeth were dried with dental gauze; a mouth mirror was used for examination; and the knee-to-knee position was adopted. The examiner used appropriate individual cross-infection protection equipment and all instruments and necessary materials were packaged and sterilized.

To measure overjet, the examiner placed a disposable tongue retractor perpendicular to and in contact with the vestibular face of the lower incisors, marking the contact edge of the upper incisors with the point of a No. 2 pencil. Using a millimetre ruler, the measurement from the tip of the tongue retractor to the pencil mark registered the overjet. Overjet was categorized as: (i) overjet less than or equal to 3 mm; (ii) overjet greater than 3 mm.

The evaluation of lip competency took place at the beginning of the clinical examination and without the child noticing the observation. Adequate lip coverage was defined as the upper lip completely covering the upper incisors in the resting position, whereas inadequate lip coverage was considered when the upper lip did not completely cover the upper incisors in the resting position (16).

Statistical analysis

Data analysis included descriptive statistics (frequency distribution and cross-tabulation). Statistical significance for the association between the occurrence of dental injuries and gender, age, degree of incisal overjet, lip coverage, socio-economic status and type of school was assessed. First, a simple logistic regression was carried out for each variable studied. Next, all variables were forced into the model to adjust for possible contribution of each explanatory variable. The socio-economic status was categorized in three groups, according to the criteria of Brazilian Association of Market Research Institute – ABIPEME (14). The level of significance set was $P < 0.05$.

Ethics considerations

The study was approved by ethics committee of Federal University of Minas Gerais.

Pilot studies

The methodology of the present study was tested in two pilot studies with the participation of 42 children in each study. The children included in the pilot studies did not participate in the main study. The results of these two pilot studies indicated the need for modifications, which improved the quality of the data collection.

Results

The sample size was larger than the minimum size estimated to satisfy the requirements, as the response rate was higher than expected. A total of 465 questionnaires were distributed to parents/guardians, 459 of which were returned, giving a response rate of 98.7%. After the evaluation of the clinical examination of the children, the final sample consisted of 419 participants, or 90.1% of the original total. Forty children were excluded who failed to fulfil the inclusion criteria. Kappa values were calculated for the presence of dental injuries on a tooth-by-tooth basis and all scores were higher than 0.90, indicating nearly perfect intra-examiner agreement.

The most commonly observed traumatic dental injury during clinical examination was enamel fracture (49.7%), followed by discolouration (33.0%). The upper central incisors were the most affected primary teeth (76.0%). Of the 164 children with a clinical diagnosis of dental trauma, 57.9% had just one tooth involved. Two years was the most prevalent age of children according to the parents' reports on the occurrence of traumatic dental injury. Among the 115 children with a history of dental trauma, 42 (36.5%) were 2 years of age at the time of the accident. Analyzing the data by gender, there was a higher prevalence of trauma among boys (59.1%) (P value = 0.013). The child's home was the location where the highest proportion of accidents occurred (60.9%) and falls (79.1%) were the principal cause of dental trauma.

The prevalence of trauma in the primary dentition as determined by the questionnaires (27.4%) was different from that found during the clinical examinations (39.1%). However, after the analysis of association between the variables, a statistically significant relationship became apparent, with 75.7% of the reports of dental trauma being clinically confirmed. On the other hand, 67 of the 164 children with a clinical diagnosis of dental trauma did not have the event reported by their parents on the questionnaire (Table 1).

The evaluation of the types of traumatic dental injury revealed that 70.1% of the children with a clinical diagnosis of dental trauma and without any reported history of the event had enamel fractures (Table 2).

A considerable group of children with a history of dental trauma (55.2%) did not receive any dental evaluation or control of the problem. No statistically significant relationship was found when the association of different types of trauma and professional dental evaluation was assessed. Therefore, the severity of dental trauma (Group 3) did not determine whether the child affected had had a dental consultation (Table 3). However, there was an association between the socio-economic level of the family and obtaining a professional dental consultation; the children from more privileged families were more frequently seen by a dentist (*P*-value = 0.004) (Table 4).

A significant relationship was observed between the prevalence of traumatic injury and gender, overjet, lip coverage and type of school. Dental trauma was not significantly related to socio-economic level (Table 5). The analysis of logistical regression revealed that boys were 1.62 times more likely to have a dental injury than girls. Children with inadequate lip coverage were 1.95 times more likely to have a traumatic injury to primary teeth than children with adequate lip coverage. Children attending state schools had nearly two times greater chances of having dental trauma than those attending private schools (Table 6).

Discussion

The present cross-sectional study offers a portrait of how the variables were related. The option was made to work with children attending day care centres and preschools to facilitate the location and contact with the children and their parents/guardians. The existence of population and school network records in Belo Horizonte permitted the proportional distribution and randomization of the sample throughout the municipality to ensure that it was representative of the general population. As 80.6% of the 520 children initially selected participated in the study, it is possible to extrapolate the results of this study to the

Table 1. Dental trauma as reported by parents in comparison to dental trauma found during the clinical examination

History of dental trauma	Clinical examination for dental trauma		
	Present *n* (%)	Absent *n* (%)	Total *n* (%)
Yes	87 (75.7)	28 (24.3)	115 (100.0)
No	67 (23.6)	217 (76.4)	284 (100.0)
Do not know	10 (50.0)	10 (50.0)	20 (100.0)
Total	164 (39.1)	255 (60.9)	419 (100.0)

P value < 0.001.

Table 2. Type of dental trauma in comparison with prevalence of dental trauma based on reports by parents and confirmed by clinical examination; and prevalence of dental trauma found by clinical examination without reported confirmation from parents

Dental trauma	Prevalence of dental trauma		
	Clinical examination and reports from parents *n* (%)	Clinical examination without reports from parents *n* (%)	Total *n* (%)
Group 1	16 (18.4)	7 (10.5)	23 (14.9)
Group 2	26 (29.9)	47 (70.1)	73 (47.4)
Group 3	7 (8.0)	1 (1.5)	8 (5.2)
Group 4	25 (28.8)	11 (16.4)	36 (23.4)
Group 5	13 (14.9)	1 (1.5)	14 (9.1)
Total	87 (100.0)	67 (100.0)	154 (100.0)

P value < 0.001.
GROUP 1 – discolouration; GROUP 2 – fracture involving enamel; GROUP 3 – fracture involving enamel and dentin, fracture involving enamel, dentin and pulp, missing tooth because of trauma, restoration with glass ionomer or resin composite, dislocation because of trauma; GROUP 4 – two types of trauma in the same tooth; GROUP 5 – three or more types of trauma in the same tooth.

Table 3. Dental consultation in relation to prevalence of dental trauma, sequelae and treatment

Dental trauma	Dental consultation		
	Yes *n* (%)	No *n* (%)	Total *n* (%)
Group 1	7 (43.8)	9 (56.2)	16 (100.0)
Group 2	7 (26.9)	19 (73.1)	26 (100.0)
Group 3	3 (42.9)	4 (57.1)	7 (100.0)
Group 4	14 (56.0)	11 (44.0)	25 (100.0)
Group 5	8 (61.5)	5 (38.5)	13 (100.0)
Total	39 (44.8)	48 (55.2)	87 (100.0)

P value = 0.187.
GROUP 1 – discolouration; GROUP 2 – fracture involving enamel; GROUP 3 – fracture involving enamel and dentin, fracture involving enamel, dentin and pulp, missing tooth because of trauma, restoration with glass ionomer or resin composite, dislocation because of trauma; GROUP 4 – two types of trauma in the same tooth; GROUP 5 – three or more types of trauma in the same tooth.

Table 4. Socio-economic level of the family in relation to visit to dentist in case of dental trauma

Socio-economic level of the family	Dental consultation		
	Yes *n* (%)	No *n* (%)	Total *n* (%)
High	14 (29.8)	8 (11.8)	22 (19.1)
Medium	17 (36.2)	16 (23.5)	33 (28.7)
Low	16 (34.0)	44 (64.7)	60 (52.2)
Total	47 (100.0)	68 (100.0)	115 (100.0)

P value = 0.004.

Table 5. Frequency analysis and simple logistic regression of the association between the variables studied and dental trauma in children from 0 to 5 years

	Trauma at clinical examination				
Variables	Present *n* (%)	Absent *n* (%)	Total *n* (%)*	OR (CI 95%)	*P*
Gender					
Male	67 (33.0)	133 (67.0)	203 (100)	1.00	
Female	97 (44.9)	119 (55.1)	216 (100)	1.65 (1.1–2.5)	0.013
Overjet					
≤3 mm	83 (29.1)	202 (70.9)	285 (100)	1.00	
>3 mm	81 (60.4)	53 (39.6)	134 (100)	3.72 (2.4–5.7)	<0.001
Lip coverage					
Adequate	138 (36.9)	236 (63.1)	374 (100)	1.00	
Inadequate	26 (70.3)	11 (29.7)	37 (100)	3.81 (1.9–7.8)	<0.001
School					
Private	127 (36.9)	217 (63.1)	344 (100)	1.00	
State	37 (49.3)	38 (50.7)	75 (100)	1.66 (1.0–2.7)	0.047
Socio-economic level					
High	129 (60.6)	84 (39.4)	213 (100)	1.00	
Medium	75 (62.0)	46 (38.0)	121 (100)	0.94 (0.6–1.5)	0.798
Low	51 (60.0)	34 (40.0)	85 (100)	1.02 (0.6–1.7)	0.928

*Eight 1-year-old children did not participate in this analysis.

Table 6. Analysis of multiple logistical regression between the independent variables and dental trauma

Variables*	Adjusted OR (CI 95%)†	*P*
Gender		
Female	1.00	
Male	1.62 (1.1–2.4)	0.021
Lip coverage		
Adequate	1.00	
Inadequate	3.75 (1.8–7.7)	<0.001
School		
Private	1.00	
State	1.95 (1.1–3.4)	0.019

*Overjet and Lip Coverage were risk factors for dental trauma. However, the similarity of their effects on the trauma (high co-linearity) determined that only one variable (Lip Coverage) was necessary for the multiple logistic analysis.
†Adjusted for socio-economic level.

entire preschool population from 0 to 5 years of age in Belo Horizonte and as well in the other cities with similar socio-economic characteristics.

The overall prevalence of trauma observed in the study was 39.1%. Considering that children with tooth loss because of dental caries were excluded of the sample, this result could be underestimated. This result was similar to other studies carried out on preschool children in both Brazil (1, 12) as well as in other countries (3, 17). In agreement with other authors (10, 16–18), the present study found that the most common dental trauma was enamel fracture. However, others (3, 6, 19) found luxation and fractures involving dentin and pulp as the most prevalent dental trauma injury in primary teeth. Most of these studies were carried out in paediatric hospitals increasing the possibility of finding more severe cases of trauma. The upper central incisors were the most frequently affected teeth. There was a higher prevalence of one tooth being involved at the time of the accident.

Parents may lack information concerning the consequences of trauma to the primary teeth, as 55.2% of the traumatic injuries did not result in a professional dental consultation to assess the problem. The questionnaire responded by parents was not formally tested for validity and reliability, which we recommend for future researches. Paediatric dentists, general practice dentists and even schools should more actively provide information and guidance to parents concerning care for traumatic dental injury. The lack of a relationship between the severity of dental trauma and the act of seeking dental care brings into question the importance given to the primary dentition on the part of parents/guardians. As the primary dentition is eventually replaced, there may be the belief that care is not necessary. An association was found between the socio-economic level of the family and the act of seeking dental care. From an economic standpoint, the children from more privileged families were more frequently seen by dentists. This result shows the influence of the social component regarding access to health services (20).

As the mechanism of protection provided by the lips is similar for primary and permanent anterior teeth by avoiding excessive exposure, the findings of the present study reinforce the results found for the permanent dentition by Côrtes et al. (9), Forsberg and Tedestam (10) and O'Mullane (16). Their conclusion was that lack of lip coverage infers a greater risk of the child to traumatic dental injury.

Despite the large number of accidents that take place in the home as a consequence of falls, children attending state preschools had a greater chance of having traumatism than those attending private preschools. Therefore, parents/guardians should be informed regarding child-care both at home and at school with respect to what measures can be taken to prevent accidents including close observations of the child's physical environment. The results of this study corroborate work carried out by other researchers (19–21), which state that boys are more prone to dental trauma. Because of the increased probability of boys at state schools with an inadequate lip coverage suffering trauma to the primary teeth, there is a need for investment in information and guidance for parents/guardians to promote the importance of the primary dentition and reduce the incidence of traumatic dental injury.

In light of the results concerning the considerable number of parents who either failed to take measures to minimize possible sequelae following a dental injury or had no knowledge about the accident that caused the dental trauma, it is necessary to raise awareness through campaigns that stress the importance of the primary teeth. It is also necessary to improve access to dental care services. The demands for health care services are due to the desire of the public to have their perceived needs recognized. Simply assessing the normative needs may not be enough to assess the actual needs of the people. This requires the participation of paediatric and general practice dentists as well as the involvement of the state and private sectors connected to education and health in

the city of Belo Horizonte. Much needs to be done to change the misconception many have regarding primary teeth that 'They will be replaced and, therefore, do not require great care'.

In conclusion, there was a high prevalence of traumatic injury to the primary dentition in the population studied (39.1%). Particularly, boys with inadequate lip coverage and who attended state schools had a greater chance of suffering traumatic injury to primary teeth.

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References

1. Bijella MFTB, Yared FNFG, Bijella VT, Lopes ES. Occurrence of primary incisor traumatism in Brazilian children: a house-by-house survey. J Dent Child 1990;57:424–7.
2. Caldas-Junior AF, Burgos ME. A retrospective study of traumatic dental injuries in a Brazilian dental trauma clinic. Dent Traumatol 2001;17:250–3.
3. García-Godoy F, Morbán-Laucer F, Corominas LR, Franjul RA, Noyola M. Traumatic dental injuries in preschoolchildren from Santo Domingo. Community Dent Oral Epidemiol 1983;11:127–30.
4. Hargreaves JA, Cleaton-Jones PE, Roberts GJ, Williams S, Matejka JMl. Trauma to primary teeth of South African preschool children. Endod Dent Traumatol 1999;15:73–6.
5. Kramer PF, Zembruski C, Ferreira SH, Feldens CA. Traumatic dental injuries in Brazilian preschool children. Dent Traumatol 2003;19:299–303.
6. Mestrinho HD, Bezerra ACB, Carvalho JC. Traumatic dental injuries in brazilian preschool children. Braz Dent J 1998;9:101–4.
7. Mortellity GM, Needleman HL. Risk factors associated with atypical root resorption of the maxillary primary central incisors. Pediatr Dent 1991;13:273–7.
8. Oliveira LB, Marcenes W, Ardenghi TM, Sheiham A, Bonecker M. Traumatic dental injuries and associated factors among Brazilian preschool children. Dent Traumatol 2007;23:76–81.
9. Côrtes MIS, Marcenes W, Sheiham A. Prevalence and correlates of tramatic injuries to the permanent teeth of schoolchildren aged 9–14 years in Belo Horizonte, Brazil. Dent Traumatol 2001;17:22–6.
10. Forsberg CM, Tedestam G. Etiological and predisposing factors related to traumatic injuries to permanent teeth. Swed Dent J 1993;17:183–90.
11. Nguyen QV, Bezemer PD, Habets L, Pral-Andersen B. A systematic review of the relationship between overjet size and traumatic dental injuries. Eur J Orthod 1999;21:503–15.
12. Granville-Garcia AF, de Menezes VA, de Lira PIC. Dental trauma and associated factors in Brazilian preschoolers. Dent Traumatol 2006;22:318–22.
13. Kirkwood BR, Stern J. Essentials of medical statistics. London: Blackwell; 2003.
14. Gil AC. Methods and techniques of social research. Sao Paulo: Atlas; 1999.
15. Hinds K, Gregory JR. National diet and nutrition survey: children aged 1½ to 4½ years. Volume 2: Report of dental survey. London: HMSO; 1995.
16. O'Mullane DM. Injured permanent incisor teeth: an epidemiological study. J Ir Dent Assoc 1972;18:160–73.
17. Al-Majed I, Murray JJ, Maguire A. Prevalence of dental trauma in 5-6 and 12-14-year old boys in Riyadh, Saudi Arabia. Dent Traumatol 2001;17:153–8.
18. Yagot KH, Nazhat NY, Kuder SA. Traumatic dental injuries in nursery schoolchildren from Baghdad, Iraq. Community Dent Oral Epidemiol 1988;16:292–3.
19. Llarena del Rosario ME, Acosta Alfaro VM, Garcia-Godoy F. Tramatic injuries to primary teeth in México city children. Endod Dent Traumatol 1992;8:213–4.
20. Silver DH. A comparison of 3-year-olds' caries experience in 1973, 1981 and 1989 in a Hertfordshire town, related to family behavior and social class. Br Dent J 1992;172:191–7.
21. Harrington MS, Eberhart AB, Knapp JF. Dentofacial trauma in children. J Dent Child 1988;55:334–8.