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# Traumatic dental injuries in primary dentition: epidemiological study among preschool children in South Brazil

Flávia Prietsch Wendt<sup>1</sup>, Dione Dias Torriani<sup>2</sup>, Maria Cecília Formoso Assunção<sup>3</sup>, Ana Regina Romano<sup>2</sup>, Maria Laura Menezes Bonow<sup>2</sup>, Catiara Terra da Costa<sup>1</sup>, Marília Leão Goettems<sup>1</sup>, Pedro Curi Hallal<sup>4</sup>

<sup>1</sup>Pediatric Dentistry at the Federal University of Pelotas; <sup>2</sup>Department of Social and Preventive Dentistry, Dentistry School, Federal University of Pelotas; <sup>3</sup>Department of Nutrition, Nutrition School, Federal University of Pelotas; <sup>4</sup>Department of Gymnastics and Health, Federal University of Pelotas, Pelotas-RS, Brazil

Correspondence to: Dione Dias Torriani, Faculdade de Odontologia/UFPel, Rua Gonçalves Chaves 457, 4º andar, Centro, Pelotas-RS, Brazil Tel.: +55 53 32226690 e-mail: dionedt@gmail.com Accepted 17 October, 2009 **Abstract** *Aim*: To estimate the prevalence of traumatic injury in primary dentition among children aged 12-71 months old, as well as to evaluate the distribution of traumatic injuries, type of trauma and associated factors. Material and methods: After the research project approval by the Ethics Research Committee, a cross-sectional study was carried out including 571 preschool children - both from public and private schools - in the city of Pelotas, Southern Brazil. Data were collected by means of anterior teeth examination, and by the administration of a structured questionnaire to parents. The classification proposed by Andreasen & Andreasen was used, and crown discoloration and fistula were added to this criterion. Results and conclusions: The prevalence of dental trauma was 36.6% (95% CI 32.7-40.5), with no significant differences between boys and girls. Trauma were more frequent among older children (P = 0.001). No associations were found for maternal schooling, income and type of school. The most frequent trauma was enamel fracture, and the most affected tooth was number 61. A significant statistical association was observed between the presence of dental trauma during clinical examination and parental report of trauma occurrence. The percentage of parents who looked for dental treatment was higher among children from private schools (P = 0.001). The most frequent place of occurrence was home, and the most frequently reported etiology was child's own-height fall. Conclusions: Dental trauma in primary teeth is characterized as an accident that occurs due to the children's development stage, even when they are cared for by mothers of higher schooling and income. Parents should search for assistance right after trauma occurrence to minimize sequelae.

Dental trauma are accidental injuries, which can take place in infancy, childhood, adolescence and adulthood. Dental trauma in infancy and childhood are particularly relevant in terms of public health, because of the economic costs of the treatments, the long-term consequences that trauma can have on oral health, and the possibility of prevention. They have been thought as having a potential to exceed caries and periodontal sickness (1). Approximately 40% of children have their first contact with the dentist due to a traumatic injury (2).

Epidemiological data show that about 50% of children have their primary or permanent dentition affected by traumatic injuries throughout the school period (3). In primary dentition, studies have found prevalence estimates of 10-15% (4–6), 24% (7, 8), 30% (3, 9–11) and up to around 35% (12–14). In Brazil, studies available reported a prevalence estimate over 30% (13–15).

A significant number of children in the primary dentition phase attend school, which stimulates research

among this population. In spite of this, only two papers in Brazil (14, 15) have investigated whether the type of nursery school, public or private, could be associated with dental trauma occurrence. In order to gather knowledge on aspects related to dental injury occurrence in children and to contribute to the present-day research view on dental trauma in primary dentition, this paper aimed to estimate the prevalence of dental trauma in the primary dentition of children enrolled at both public and private preschools in Pelotas, Brazil, as well as to estimate the distribution, types and the factors associated with trauma.

## Materials and methods

This piece of research integrates a cross-sectional epidemiological survey on the oral health condition of children aged 1–5 years of age, attending both private and public schools in Pelotas, a Southern Brazilian city. Pelotas is located near the border with Uruguay and Argentina and has approximately 340 000 inhabitants (16). Pelotas has 26 public schools which attend exclusively children aged 0–6 years of age. In these schools, there are 1630 students in this age range (17). In the 31 private schools, there are 1354 children.

The sample size was calculated using the following parameters and estimates: dental trauma occurrence estimated at 35% (13), margin of error of five percentage points, confidence level of 95% and extra 10% for covering non-response. Based on this calculation, 387 children were included in the sample. The number of children examined was substantially higher than the one calculated because this study was performed in association with another two pieces of research, whose outcomes required a greater sample.

The sampling strategy was stratified by type of school: private or public. In each stratum, schools were randomly sampled in a simple way within each stratum; 12 private and eight public schools were selected in order to ensure proportionality. All enrolled children from the selected schools within the age group studied were initially eligible for the study.

Before school exams were started, five dentists and a gold standard observer (a professor specialized in Pediatric Dentistry) were submitted to a calibration process in order to standardize the diagnostic criterion, minimizing variations and increasing accuracy and reliability (18). The Kappa coefficient was calculated; two examiners did not reach the 0.70 average and were thus excluded. The Kappa coefficients were 0.80 (inter-examiners) and 0.96 (intra-examiners).

Before the research was started, the selected schools were contacted, and the informed consent agreement was sent to parents. After the authorization was returned by the parents, visits were scheduled. Physical examination of the children was first performed, and afterwards, a previously tested questionnaire was sent to parents, in order to obtain sociodemographic data. The questionnaire also included specific questions on dental trauma occurrence.

Children's physical examinations were done during school hours following a preestablished routine agreement with the school authorities, in which children were led by a school clerk and a research note taker to an appropriate room; the roll card sequence was used for the examinations. Each child was seated in school chairs under natural light and the examiner was seated in front of the child. In some cases children were accompanied by their parents or a teacher, as required.

The examination inclusion criteria involved children at primary dentition stage, who were within the age range of the study. Anterior teeth bearing caries or fillings were included when the lesion involved the enamel only or, in case it had reached the dentin, when restricted to one dental surface only. Schools were visited a minimum of four times on alternate days for the purpose of examining the children who had previously been absent.

Dental examination was done by means of sterile gauzes, which were used to aid tissue spacing and tooth drying as well as to help dental plaque removal and preceded each examination. Biosafety principles established by the World Health Organization (WHO) were followed (19). All data referring to examination and children's identification were written down on a clinical chart especially devised for this epidemiological survey on oral health by a duly trained assistant. Following physical examination, parents were informed in writing on their children's oral health.

The classification criterion used followed the Andreasen & Andreasen's method (20) taking into account the occurrence of dental trauma in primary teeth, discoloration and fistula (21, 22). In order to determine diagnostic information accuracy, 5% of the sample, randomly chosen, was reexamined by the researchers during data collection. The intra-examiner Kappa coefficient was 0.90. Data were entered twice in an Epi Info 6.0 database in an attempt to prevent any errors. Analyses were performed in STATA 9.0. Descriptive statistics were used, as well as chi-square tests for heterogeneity or linear trend. The research protocol was approved by the Research Ethics Committee of the Dentistry School from the Federal University of Pelotas, registered under number 019/2006. Authorities in charge of each educational branch authorized the execution of field work.

## Results

Out of 645 children aged 12–71 months found in the sampled schools, 11% were not examined (71 children, 34 male and 37 female ones, with an average age of 40 months). Reasons for non-examination included parental or children refusals, permanent dentition presence, and absence during school visitations. More children were lost in private (56) than in public (15) schools. Three questionnaires were not returned to the schools. The total number of children examined was 571, of whom 278 were girls, and 236 (41.3%) attended public schools. The public–private ratio in our sample was very similar to the city's distribution [45.6% (26) are public schools and 54.4% (31) private].

Dental trauma was detected in 209 children, resulting in a prevalence of 36.6% (95% CI 32.7–40.5). The prevalence of dental trauma was 38.6% among boys and 34.5% among girls (P = 0.32). These figures were 38.8% among students from private schools and 33.5%among those from public schools (P = 0.19).

Table 1 describes the prevalence of dental trauma according to sociodemographic variables, stratified by school type. A positive association was observed between trauma and age in students from private schools only. All other variables were unrelated to the prevalence of trauma.

Table 2 describes the distribution of different types of trauma in anterior teeth. Some of the teeth examined were unerupted, excluded or absent because of caries, exfoliation or agenesia. The most common diagnosed trauma was enamel fracture, followed by discoloration and dentin and enamel fracture. Discoloration was present in all types of associated trauma. No cases of complicated crown fracture (CF) and complicated root were found. The prevalence of dental trauma was more closely associated to the central superior incisors (51 and

	Private		Public		
Variables	with DT ( <i>n</i> %)	<i>P</i> value <sup>a</sup>	with DT ( <i>n</i> %)	<i>P</i> value <sup>a</sup>	
Sex		0.05		0.43	
Boys	69 (40.1)		44 (35.8)		
Girls	61 (37.0)		35 (31.0)		
Age (months)		0.001		0.35	
12-24	2 (9.9)		3 (15.8)		
25-36	11 (23.4)		10 (26.3)		
37–48	37 (37.8)		17 (37.0)		
49–60	39 (43.8)		27 (37.0)		
61–71	41 (51.9)		22 (36.7)		
Maternal schooling	<b>、</b>	0.39	· · /	0.79	
Unfinished	17 (41.5)		24 (34.3)		
Elementary school			. ,		
Full elementary	6 (35.3)		13 (27.7)		
school			. ,		
Unfinished high	10 (31.2)		17 (32.1)		
school.	. ,		· · /		
Full high school	31 (33.7)		19 (41.3)		
Higher education	65 (44.8)		3 (27.3)		
Family income in qui	ntiles <sup>b,c</sup>	0.36	( -7	0.92	
1 (R\$ 58.00	10 (35.7)		29 (30.2)		
to R\$ 400.00)	. ,		. ,		
2 (R\$ 401.00	10 (29.4)		14 (33.3)		
to R\$ 600.00)	, ,		( - /		
3 (R\$ 601.00	28 (50.0)		14 (35.9)		
to R\$ 1000.00)	. ,		. ,		
4 (R\$ 1001.00	32 (40.5)		5 (35.7)		
to R\$ 2500.00)	, ,				
5 (R\$ 2501.00	36 (43.9)		-		
to R\$ 20000.00)	, ,				

*Table 1.* Prevalence of dental trauma according to sociodemographic variables, stratified by type of school (n = 571), Pelotas, Brazil, 2009

<sup>a</sup>Test for linear trend.

<sup>b</sup>17.7% missing observations in the income variable.

<sup>c</sup>R\$ 1.00 about US \$ 2.00.

61), and tooth 61 was the most frequently affected (23.1%).

Table 3 shows results of the questionnaires answered by parents on dental trauma and the search for dental care. Out of the 559 parents who responded to the question on trauma, 173 reported its occurrence. Out of the private school children who presented dental trauma, 76.3% had a consultation with a dentist, whereas only 44.4% of the public school children did so (P = 0.001).

Table 4 describes trauma etiology and place of occurrence by school type and shows the answers to the questionnaires of the 173 parents who reported trauma occurrence. Child's own-height fall was found to be the most frequent etiology for both school types. The most common trauma place of occurrence, both at private and public schools, was the child's home, and this was higher among public school students (79.7%). The most frequent etiology of trauma for all studied age groups was found to be the child's own-height fall (Fig. 1).

#### Discussion

The knowledge on trauma epidemiology in primary teeth has been inexpressive so far when compared to permanent dentition. The scarcity of data and the difficulty in comparing results due to methodological differences have contributed to this. In the systematic review on a traumatic injury classification by Feliciano & Caldas (23), 54 types were identified, and there was no suitable one that could be applied to epidemiological studies. Besides, no one was specifically at primary teeth. The classification of Andreasen & Andreasen (20) was adopted in this study because it is frequently used, is based on the classification adopted by the World Health Organization (24), and is satisfactory for epidemiological purposes. Furthermore, it is adequate for this crosssectional retrospective study.

As to cross-sectional studies, an accurate procedure in data collection and comparison must be followed, once occurrence of type of trauma can vary according to the environment studied (14). Besides being careful to select the sample studied, additional information was collected by means of a questionnaire applied to the parents. The cultural and socio-economic characteristics of the populations in the different countries can also influence on dental trauma occurrence and its associated factors (25), as well as their attitude and knowledge towards trauma. Epidemiological surveys on dental trauma in primary dentition demonstrate prevalence variation ranging from

Table 2. Distribution of trauma by type (n = 571), Pelotas, Brazil, 2009

	Examined teeth, n (%)											
Dental trauma type	53	52	51	61	62	63	71	72	73	81	82	83
EF	-	18(3.1)	65(11.4)	55(9.6)	26(4.5)	2(0.3)	5(0,9)	8(1.4)	-	3(0.5)	8(1.4)	-
DF	1(0.2)	-	8(1.4)	22(3.8)	4(0.7)	-	-	3(0.5)	-	1(0,2)	- '	-
Lu	-	-	1(0.2)	1(0.2)	- '	-	-	- 1	-	-	-	-
A	-	-	4(0.7)	2(0.3)	-	-	1(0.2)	-	-	1(0.2)	1(0.2)	-
D	-	3(0.5)	9(1.6)	18(3.1)	2(0.3)	-	- '	-	-	- '	- 1	-
Fi	-		1(0.2)	-	- 1	-	-	-	-	-	-	-
AT	-	3(0.5)	7(1.2)	10(1.6)	-	-	-	-	-	-	1(0.2)	-
Total	1(0.2)	24(4.1)	95(16.7)	108(18.6)	32(5.5)	2(0.3)	6(1.1)	11(1.9)	-	5(0.9)	10(1.8)	-
WT	547	536	450	439	525	546	560	555	550	562	553	550

EF, enamel fracture; DF, dentin and enamel-dentine fracture; Lu, intrusive, extrusive or lateral luxation; A, avulsion; D, crown discoloration; Fi, fistula; AT, associated trauma (more than one injury on the same tooth); WT, without trauma.

	Private	Public		
	Bearing DT 77 %	Bearing DT 11 %		
Hit teeth/mouth at least once <sup>a</sup>	<i>P</i> < 0.001			0.40 <sup>b</sup>
Yes	68 (63.5)	32 (48.5)	100	
No	62 (27.8)	45 (27.8)	107	
Total	130 (39.4)	77 (33.8)	207	
Visited the dentist upon DT occurrence	P = 0.05			0.001 <sup>b</sup>
Yes	29 (76.3)	4 (44.4)	33	
No	39 (57.3)	28 (49.1)	67	
Total	68 (64.2)	32 (48.5)	100	

*Table 3.* Distribution of children with dental trauma (n = 209) according to parental report and search for dental care by school type, Pelotas, RS, Brazil, 2009

*Table 4.* Distribution of children bearing dental trauma according to etiology and place of occurrence by school type (n = 173), Pelotas, Brazil, 2009

	Type of school						
	Private	e	Public				
Variables	п	%	п	%			
Etiology <sup>a</sup>							
Child's own-height fall	51	53.1	30	51.7	0.45 <sup>°</sup>		
Height fall	19	19.8	16	27.6			
Collision	26	27.1	12	20.7			
Total	96	100	58	100			
Trauma place of occurrence	b						
Home	64	61.5	51	79.7	0.03		
School	14	13.5	1	1.6			
Outside	11	10.6	5	7.8			
Others	15	14.4	7	10.9			
Total	104	100	64	100			

12 missing observations in the two variables (n = 571).

<sup>a</sup>19 parents did not remember etiology.

<sup>b</sup>Five parents did not remember site.

<sup>c</sup>Chi-square.



Fig. 1. Trauma etiology by child's age (Pelotas, Brazil, 2009).

10 to 36% (3–14, 26). In this study the dental trauma percentage was 36.6%, a similar result to that found by Brazilian studies (13–15). It is important to mention there is a lack of papers on this outcome nationwide with reference to primary teeth.

The results of variables associations were categorized by type of school. Private school children presented a higher trauma percentage when compared to the public school ones, although these differences were not

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significant (P = 0.19). A study by Granville-Garcia et al. (14) revealed a difference between the two types of school in a similar evaluation (P < 0.001). A possible explanation is that children from private school usually stay for one period only and there may be lack of supervision, no restrictions as to schedules, games or sports and attitudes in the others periods at home. However, Robson et al. (15) found out that children attending state preschools had a greater chance of having traumatism than those attending private preschools.

The association between trauma and sex showed no differences. These findings are in agreement with most school-based studies (4, 5, 10, 11, 13, 14). It could be accounted for by the fact that both boys and girls aged 1-5 years old are exposed to the same risk factors, once they have similar social activities and there is no difference among the games and sports they play. In this study, the mean age was 51 months, and there is a tendency of a linear trauma increase as they grow old. This confirms that dental trauma is cumulative, especially when it affects hard tissues (4, 9, 13, 27). Dental trauma injuries were not frequent in children below 24 months, possibly because of the child movement restrictions at this stage. From the moment these children become independent, though, they may become more dental trauma prone. However, the occurrence of these injuries was directly associated to age (P < 0.001) only in private schools.

The relationship between dental trauma and socioeconomic conditions has not been sufficiently investigated in studies on primary dentition and calls for close attention. Victora et al. (28) consider maternal schooling and family income to be the most frequently used variables to measure socio-economic status in child health studies. In this study, maternal schooling was not found to be a decisive factor in trauma occurrence, although children from private schools whose mothers had higher education presented more traumatic injuries. If we take for granted that higher schooling results in a better socio-economic status, Brazilian private school children probably have a greater access to consumer goods that can offer greater trauma risks, such as playgrounds, bicycles, swimming pools and toys (18, 29).

This study demonstrates that income did not influence trauma prevalence in the two school types, which has also been reported by Zadik (6). Fonseca et al. (30), upon investigating risk factors in accidental injuries in preschool children, did not find meaningful associations between accidental injury occurrence and family income or maternal schooling. As to trauma type, enamel fracture and crown discoloration were the most frequent, and this is in agreement with other scholars' studies (4, 7, 10, 13, 14). An interesting aspect is that discoloration was present in all associated trauma, and for this reason this was the second most diagnosed alteration type.

Upon evidence of dental trauma, parents of those children that attend private schools have a higher perception of what has happened. Hargreaves at al. (31) stated that 50% of children's parents reported being conscious of trauma occurrence when the child presented trauma clinical signs. In this study, more trauma history was reported in children who did not show any trauma clinical signs. This was probably due to the fact that support tissue trauma evolve back to normality in most cases, which causes them to go unnoticed at the physical exam. Considering the search for dental care upon dental trauma occurrence, in private schools it was higher (76.3%) than in county schools (44.4%). Garcia-Godoy et al. (32) reported the posttrauma search for dental care varies according to the type of injury. In the case of crown fractures, this is due to aesthetics, while for support tissue trauma, the search is due to bleeding.

Among the etiological factors of dental trauma, the child's own-height fall prevailed regardless of type of school. At 12-24 months old group, when the children have not yet fully developed motor skills, and at 51 months, when they are becoming active and independent, children are more prone to their own height fall. Regarding the trauma occurrence place, the child's home prevailed, and its percentage was higher for public schools. When trauma occurred at school, a higher percentage occurred at private ones. The social and physical school environment can be associated to trauma occurrence (33), once traumatic injuries are directly related to the school commitment to child safety. Some schools may offer less safe leisure facilities, like staircases and cemented floors (34). Thus an investigation of the structure of the physical school environment for both school types is necessary.

According to Andreasen & Andreasen (20), epidemiological data can serve as the basis for treatment and prevention concepts development. Thus, in order to enable the adoption of preventive and educational programs which can reduce dental trauma cases, a more comprehensive knowledge on the characteristics of the aimed population is of utmost importance. Most epidemiological studies on primary dentition are retrospective and report diverging prevalences. For this reason, incidence studies to verify the real condition of dental trauma in the preschool population would be ideal; by doing so, due to the fact that they would be collected the moment the injury occurred; also, the diagnosis criteria and the classifications used would be more accurate, and the estimated trauma frequency would correspond to the trauma-bearing children population reality (35).

The present study concluded that dental trauma in primary teeth is characterized as an accident that occurs due to the children's development stage, even when they are cared for by mothers of higher schooling and income. Because of this, trauma exposure occurred independently of age group, in spite of the fact this variable was a decisive factor in the occurrence of these traumatic injuries. Parents do not seem to realize trauma events with their children. Also, though they reported search for dental care, this is unsatisfactory, and they need to be aware of the importance of searching for assistance as well as of the way they should act face any trauma, avoiding treatment negligence, regardless of injury aspect. Therefore, health education strategies are necessary in the prevention of accidents, mainly because high dental trauma prevalence in preschool children was observed, and the family nucleus was directly involved, inasmuch as most injuries occurred in the home environment.

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