Prevalence of Dental Trauma and Associated Factors Among 1– to 4–year–old Children

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ABSTRACT

Purpose: The purpose of this study was to estimate the prevalence of dental trauma among 1- to 4-year-old children and test the association between dental trauma and demographic, socioeconomic, and clinical factors.
Methods: Five calibrated researchers (intra- and interexaminer kappa values=0.89 and 0.81, respectively) examined a representative sample of 407 children in the city of Matozinhos, Minas Gerais, Brazil, during the 2008 national vaccination campaign. Statistical analysis was performed via descriptive analysis, chi-square test ($P<.05$), and logistic regression.
Results: The prevalence of dental trauma was 47%; among the 407 children examined, 187 had suffered dental trauma. The most prevalent type of alteration due to dental trauma was enamel fracture (85%), followed by enamel-dentin fracture without pulp exposure (11%) and enamel-dentin fracture with pulp exposure (3%). The main location where the trauma occurred was at home (89%), with the cause reported by parents as accidents while running, playing, or crawling (79%). After adjusting for the variables, the child's age ($P>.01$) and number of siblings ($P>.01$) remained associated with the outcome.
Conclusion: Results indicate the need for public health policies that include dental trauma as one of the priorities directed at young children.
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KEYWORDS: TOOTH INJURY, PRIMARY TEETH, RISK FACTORS, EPIDEMIOLOGY

Dental trauma in the primary dentition is considered a public health problem due to high prevalence rates in Brazil and the world.[1-5] In the early years of life, children face the challenge of learning to crawl, walk, and run. In this stage, imprecise movements make children more susceptible to falls from their own height, which can lead to dental trauma. Other factors also have been associated with dental trauma, such as inadequate lip seal, open bite, caries, age, and gender.[7,10] Social and socioeconomic indicators have recently been employed in studies on dental trauma, but the results remain inconsistent and controversial.[3,8,10,11]

Dental trauma in the primary teeth in early childhood may result in serious damage to the permanent dentition, including enamel hypoplasia or complete malformation of the crown and tooth root.[15] Such malformations can cause aesthetic, physical and psychological problems for children. It is, therefore, important for dentists to know the distribution of dental trauma in primary teeth, associated factors, and the consequences to child health. Such knowledge will contribute to proper diagnoses and treatment as well as preventive social measures aimed at health promotion in effort to reduce the frequency of dental trauma in children and lessen the financial consequences. Epidemiological studies on dental

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trauma in children also enable the government to draft fairer health care plans for the population.

The purpose of the present study was to estimate the prevalence of dental trauma and identify associated factors among 1- to 4-year-old children in the city of Matozinhos, Minas Gerais, Brazil.

METHODS

A cross-sectional study was conducted during the second national poliomyelitis vaccination campaign in the city of Matozinhos in August 2008. The city is part of the metropolitan region of Belo Horizonte, the state capital of Minas Gerais, which is industrialized and has approximately 33,317 inhabitants, including 2,866 1- to 4-year-old children.[12]

Male and female 1- to 4-year-olds who participated in the National Child Vaccination Campaign were recruited in a single day. The vaccination program has a consistently high participation frequency (96%). To ensure representivity and randomization, 5 municipal health clinics were selected—one from each region of the city: east, west, south, southeast and north. The children asked to participate in the study were recruited in order of arrival by obtaining signed terms of informed consent from their parents/guardians.

The sample was calculated to give a standard error of 5%. A 95% confidence interval level and 37% prevalence of primary tooth injury were used (Granville-Garcia, et al).[11] The minimal sample size for satisfying the requirements was estimated as 358 children, based on the proportion of 1- to 4-year-olds living in the city. To compensate for the possible losses during the survey, the sample size was increased by 20%. Thus, 430 total children were selected. After losses, 407 children were examined.

Five examiners participated in training and calibration exercises. Calibration was performed with color slides on all types of dental trauma in the primary dentition as well as healthy teeth. Three slides were used for each type of trauma. The results of the exams were compared with the evaluation of a dentist experienced in dental trauma, which was considered the gold standard.

The clinical exams were carried out by the 5 previously calibrated dentists (intraexaminer and interexaminer kappa values=0.89 and 0.81, respectively)–one in each administrative region. Dental trauma was classified based on the criteria proposed by Andreasen and Andreasen (1994).[13] An alteration in the color of the dental crown was included among the criteria. The examiners received illustrations of the classifications of dental trauma and examples of how to fill out the clinical chart correctly. A pilot study was carried out involving 10 children and their parents/guardians at a day care center in Belo Horizonte; no need for changes to the methodology was identified. Dental caries were assessed based on the criteria proposed by the World Health Organization.[14] Lip seal was evaluated as a risk factor and considered adequate when the upper lip was in contact with the lower lip in a resting position. All clinical exams were performed under natural light, and the children were examined in the "knee-to-knee" position, with the parent/guardian on one side and the examiner on the other. The upper and lower primary incisors were evaluated.

Parents/guardians were asked to fill out a questionnaire (adapted from Cardoso and Carvalho-Rocha[15]) made up of objective questions on the child's history of dental trauma and the following information: which tooth was injured; time (in months) elapsed since the trauma; time of the day in which the trauma occurred; how long (in days) before the child was treated by a dentist; type of treatment received at the dentist's office; and where and how the trauma occurred.

Socioeconomic status was assessed based on the standard criteria of the Brazilian Economic Classification system.[16] Information was gathered on the: schooling (in years of formal study) of the heads of the family (father and mother); monthly household income based on the Brazilian minimum salary (US $197.87); and economic class of the child's family (A=US $2,792-$4,141/B=US $856-$1,480/C=US $309-$508/D=US $206/E=US $117).

This study was approved by the Ethics Committee of the Federal University of Minas Gerais, Belo Horizonte. All children with any type of dental trauma were referred to the municipal public health care service for dental care.

SPSS 15.0 (SPSS Inc, Chicago, Ill) was used for data analysis. The association between each independent variable and dental trauma was determined using the chi-square test. Variables with a *P*-value greater than 0.2 were included in the multiple regression model. Raw and adjusted odd ratios were calculated, along with their respective confidence intervals, with a significance level set at 0.5.

RESULTS

Four hundred seven (407) children were examined. The present study had a participation rate of approximately 95%. Among the total number of children who participated, 210 were between 12- and 36-months-old and 197 were between 37 and 50-months-old. The male gender corresponded to roughly half of the participants (N=205). Regarding the mothers, 220 (55%) were 27-years-old or older and 285 (72%) had more than 8 years of formal schooling. Family income equal to or less than 3 times the minimum salary was reported by 211 of the interviewees. Most families (68%) belonged to socioeconomic class C (Table 1).

Among the 407 children examined, 187 (47%) exhibited a history of dental trauma, affecting 187 total teeth. The prevalence of trauma was greater among children: between 37 and 59-months-old (51%); of older mothers (48%); of mothers with 2 children (51%); of mothers with 8 or more years of schooling (48%); and belonging

to socioeconomic classes A or B (52%). Among the 80 (20.1%) children diagnosed with caries in the anterior teeth (N=399), 33 (41%) had suffered dental trauma. Related to lip protection (N=393), 80 children (21%) had an inadequate lip seal and 42 (53%) exhibited dental trauma (Table 1).

Table 1. Association Between Dental Trauma and Risk Factors Among 1–to–4–year old Children in a Small City in Minas Gerais, Brazil, 2008 (N=407)

Variables	Distribution of sample N (%)	Dental trauma N (%)†	*P*-value
Child's age (mos) (N=400)			>.08
12-36	210 (52)	89 (43)	
37-59	197 (48)	98 (51)	
Child's gender (N=400)			>.04
Male	205 (50)	99 (49)	
Female	202 (50)	88 (45)	
Mother's age (ys)(N=392)			<.62
<27	178 (45)	80 (45)	
≥27	220 (55)	103 (48)	
Mother's schooling (ys)(N=395)			>.15
<8	110 (28)	45 (40)	
≥8	285 (72)	137 (48)	
No. of children ‡ (N=396)			>.10
1	134 (34)	64 (48)	
2	164 (41)	84 (51)	
≥3	98 (25)	37 (38)	
Household income §(N=362)			.31
<3	211 (58)	91 (44)	
3-5	139 (38)	71 (51)	
>6	15 (4)	08 (53)	
Economic class || (N=368)			>.24 *
A+B	59 (16)	32 (52)	
C	253 (68)	137 (46)	
D+E	59 (16)	23 (40)	
Caries in anterior teeth (N=399)			.26*
Absent	319 (80)	154 (48)	
Present	80 (20)	33 (41)	
Lip protection (N=393)			>.22*
Adequate	303 (79)	136 (45)	
Inadequate	80 (21)	42 (53)	
Total dental trauma	--	**187** (47)	

** Selected for multiple logistic regression model (theoretical plausibility).*

† Percentage of investigated children with dental trauma.

‡ No. of siblings living in the same house.

§ In no. of minimum salaries (1 minimum salary=US $197.87) .

|| Social classification according to the Brazilian Institute of Geography and Statistics, based on number of minimum salaries (A=US $2.79–$4.14/B=US $856–$1.48/C=US $309–$508/D=US $206/E=US $117).

In reports by parents/guardians regarding the children's history of dental trauma and aspects related to the occurrence, 105 (26%) said their child had suffered some form of dental trauma prior to the interview. Most traumas occurred in the home (89%), followed by on the street (8%) and at school (3%). Regarding the causal situation of the trauma, approximately: 79% stemmed from running, playing, or crawling; 12% were due to falls, toy cars, bicycles, sitting on laps; and 6% were due to losses of balance or slipping (Table 2).

The most common type of dental alteration due to trauma was enamel fracture, which affected 159 teeth (85%). Enamel-dentin fracture without pulp exposure and enamel-dentin fracture with pulp exposure accounted for 21 (11%) and 5 (3%) of the dental alterations due to trauma, respectively. Color alteration was found in 16 (9%) of the total number of affected teeth (Table 3).

After adjusting for investigated variables, the child's age remained associated with dental trauma (*P*>.01). Twelve-to-24-month olds had a greater chance of having dental trauma than 37- to 59-month-olds. The number of children a mother had was associated with dental trauma (*P*>.01). Mothers with 3 or more children had a 2-fold greater chance that one of their children had experienced dental trauma (Table 4).

DISCUSSION

The present study revealed a high prevalence of dental trauma among 1- to 4-year-olds (47%). This finding agrees with other Brazilian studies, such as one conducted by Bijella et al, who evaluated 576 newborn to 72-month-old children and found a prevalence of approximately 30%.[1] Kramer et al also reported a high rate of dental trauma (36%) in 1- to 6-year-olds.[2] In a recent study conducted in Belo Horizonte, Jorge et al investigated dental trauma among 1- to 3-year-olds and found the prevalence to be 42%.[3] Prevalence values in other studies carried out on similarly aged children, however, have been low, not surpassing 11%.[8,17]

In the international scientific literature, studies have also found different results from those of the present investigation.[10] Comparisons between studies should be performed with caution due to differences in the methods employed, age of the participants, diagnostic criteria, and geographical cultural differences.

The prevalence of dental trauma reported by the parents/guardians was lower (26%) than that determined though the clinical exam (47%). This difference may be due to the fact that parents perceived dental trauma only in cases in which the dental alterations are esthetically visible and the most frequent type of trauma in the present study

was enamel fracture (85%). Compromised esthetics is reported in the literature as the main reason for seeking treatment in cases of dental trauma.[18] In the present study, despite the high prevalence of trauma diagnosed, only 14% of the children had undergone dental care following the injury. Delays in seeking care after dental trauma are common in all types of countries, including Brazil and Belgium.[3,19] It is likely that many parents/guardians do not identify enamel fractures or, when they do, are unaware of the possible consequences of this condition.[3]

Table 2. Distribution of 1-to-4-year-old Children According to Reports from Parents/Guardians Regarding History of Dental Trauma and Related Variables in a Small City in Minas Gerais, Brazil, 2008 (N=407)

Variables	Categories	N	(%)
History of trauma	Yes	105	26
	No	302	74
	Total	**407**	**100**
Visited dentist due to trauma	Yes	14	14
	No	86	86
	Total	**100**	**100**
Went to dentist after how long?	Same day	04	31
	≥2 days later	09	69
	Total	**13**	**100**
Procedure preformed by dentist	Control/cleaning	08	62
	Restoration	02	15
	Exodontia	02	15
	Other (medication)	01	8
	Total	**13**	**100**
Place where trauma occurred	Home	82	89
	School	03	3
	Street	07	8
	Total	**92**	**100**
Situation in which trauma occurred	Running/playing/crawling	72	79
	Fighting	02	2
	Fall/toy car/bicycle/lap	11	12
	Loss of balance/slipping	05	6
	Other (eating, etc)	01	1
	Total	**91**	**100**

Table 3. Distribution of Children According to Type of Dental Alteration Due to Trauma in a Small City in Minas Gerais, Brazil, 2008 (N=187)

Type of dental alteration due to trauma*	N	%
Enamel fracture	159	85
Enamel-dentin fracture without pulp exposure	21	11
Enamel-dentin fracture with pulp exposure	05	3
Lateral luxation/intrusion/extrusion	08	4
Avulsion	04	2
Color alteration	16	9

** Some dental elements exhibited more than 1 alteration and, therefore, contributed to more than 1 category of this variable.*

In the present study in particular, the limited offer of specialized dental treatment through municipal public health care services also may have discouraged parents/guardians from seeking treatment. Dental care for infants is currently undergoing a development process on the level of primary care in public health policies in Brazil. The chances of successful treatment of dental trauma are directly related to the time elapsed between the trauma and dental care. It is, therefore, fundamentally important for parents/guardians to be informed regarding the importance of immediate dental treatment for a good prognosis. Furthermore, there is a need for periodic follow up to avoid pulp or periodontal complications and avoid compromising the permanent successors.[10]

Most accidents occurred in the child's home (89%), followed by accidents on the street (8%); these findings agree with previous studies.[10,20,21] It is, therefore, desirable for parent/guardians and caregivers to be orientated regarding care, ways of preventing accidents that may culminate in dental trauma and risks to the child. Turning the home into a safe, healthy place for the growth and development of children is important to avoid dental and other forms of trauma.

Based on this study's findings, falls were the most prevalent cause of dental trauma, which agrees with other investigations.[15,20,22] In this phase of life, children are learning to walk, which, together with physiological and behavioral factors such as a lack of motor coordination, places them at risk for trauma.[1] It is also important to consider that physical abuse, assaults, and torture also are reported as plausible etiological factors of traumatic dental injuries among children. Violence has increased in severity, and its role has been underestimated when looking at intentional vs unintentional traumatic dental injuries.[23]

The most prevalent dental alterations due to trauma were enamel fracture (85%), which agrees with other studies,[3,5,8,24] and enamel-dentin fracture without pulp exposure (11%). Cardoso et al, however, found luxation to be more prevalent (85%) than enamel fractures (15%) in children treated at a pediatric dentistry clinic at the Federal University of Santa Catarina, Florianópolis, Brazil.[15] This difference in results may be due to the different data collection sites.[15,19,25] In studies carried out in dentistry reference centers or hospitals, it is possible to record trauma closer to its time of occurrence, which is not possible in epidemiological studies carried out at public health care service facilities in communities.[2,8]

After adjusting for the variables, the age of the child remained associated with dental trauma. The younger children (12-36 months old) had a greater chance of pertaining to the group with dental trauma than the

older children (37-59 months old). In a study carried out in Norway involving 20,000 1- to-8-year-olds, the prevalence of trauma was greater among children with a mean age of 3½ years.[10] Cardoso and Carvalho Rocha examined children from 10 months to 6-years-old and concluded that the prevalence of trauma was greater among younger children.[15] Age may be related to trauma in an inversely proportional manner, especially due to the fact that child development (perception, reflexes, balance, awareness of risks, etc.) diminishes the chances of incidents that may culminate in dental trauma.

The number of children reported by mothers had remained associated with dental trauma after adjusting for variables (P>.01). Mothers with 3 or more children had a 2-fold greater chance that one of their children pertained to the group diagnosed with trauma than mothers with only 1 child. It appears that a greater number of children increases the difficulty mothers have regarding care. Furthermore, in homes with a larger number of children, body-to-body games are common and children take greater risks when competing with one another. There also are occasional fights that can lead to dental trauma. In contrast, in homes with only 1 child, playing alone may minimize the chance of an incident.

Table 4. Test of Dental Trauma and Associated Factors in 1–to–4–year–old Children in a Small City in Minas Gerais, Brazil, 2008 (N=350)*

Variables	Raw odds ratio	95% confidence interval	Raw *P*-value	Adjusted odds ratio	95% confidence interval	Adjusted *P*-value
Child's age (mos)			0.029			>.01
12-36	1.0			1.0		
37-59	0.7	0.5-1.0		0.6	0.4-0.9	
Child's gender			0.520			.47
Male	1.0			1.0		
Female	1.2	0.8-1.7		1.2	0.8-1.8	
Mother's schooling (ys)			0.241			<.62
<8	1.0			1.0		
≥8	0.7	0.5-1.2		0.9	0.6-1.6	
No. of children			0.029			>.01
1	--	--		1.0		
2	--	--		0.9	0.5-1.5	
≥3	--	--		2.0	1.1-3.6	
Economic class			0.225			>.49
A+B	--	--		1.0		
C	--	--		1.3	0.7-2.4	
D+E	--	--		1.5	0.7-3.3	
Caries in anterior teeth			0.565			>.45
Present	1.0			1.0		
Absent	1.3	1.8-2.2		1.2	0.7-2.2	
Lip protection			0.169			<.07
Adequate	1.0			1.0		
Inadequate	0.7	0.5-1.2		0.6	0.3-1.0	

** Univariate and multivariate analyses.*

The present study did not find an association between socioeconomic condition and dental trauma, which corroborates findings described by Oliveira et al.[8] Other authors, however, have found an association between dental trauma and a greater level of mothers' schooling, non-nuclear family structure, type of school, social vulnerability index, etc.[3,9,26] One limitation of the present study was the use of items on the standard criteria of the Brazilian Economic Classification system.[16] It is possible that this index was not sensitive enough to detect peculiarities in the socioeconomic condition of the parents/guardians interviewed. Jorge et al and Moysés et al found an association between socioeconomic condition and dental trauma, probably because the authors used more robust indices, such as the social vulnerability index (which considers 5 dimensions: environmental; cultural; economic; legal; and survival security) or the grouping of factors related to the physical environment, public policies, and social cohesion.[3,27] The city studied does not offer an indicator such as the social vulnerability index. Studies on dental trauma and socioeconomic conditions remain inconstant and inconclusive, which demonstrates the need for further research on this issue.

As the prevalence of dental trauma among the children studied was high, and the results may be extrapolated to the 1- to 4-year-old population in the city. Consequently, public health policies—specifically oral health policies—should include dental trauma on the list of priorities. Also, the Brazilian public health care system does not yet offer dental services directed at infants.

If we consider the tendency of public policies to combat risk factors that are common to particular conditions and disease, it is easy to see that the efficacy of health promotion and prevention measures could be enhanced. In the particular case of infants and small children, parents/guardians and caregivers should receive information regarding the risks the home environment itself offers to the general health and well-being of children. Another important aspect is to hear the principal questions parents/guardians and caregivers have regarding the prevention of dental trauma and the best conduct to adopt in cases of the occurrence of this event. For such, the establishment of discussion groups at day care centers and basic health care units among professionals, parents, and caregivers appears to be a viable option.

CONCLUSION

The prevalence of dental trauma among children between 1 and 4-years-old in Matozinhos, Minas Gerais was high (47%). Most parents did not seek immediate dental care for their children following a case of trauma. The age of the child and number of children the mothers had were associated with dental trauma. No statistically significant association was found between socioeconomic condition and dental trauma. These findings may help dentists understand traumatic dental injuries and aid politicians involved in health fields in developing preventive strategies and providing the general population with information regarding seeking care when trauma occurs.

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