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Non-accidental collision followed by dental trauma: associated factors

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Correspondence to: Maria Letícia Ramos-Jorge, Rua Arraial dos Forros, 215 Centro Diamantina, MG, Brazil, CEP: 39100-000 Tel.: +55 38 3532 6000, ext. 6099 Fax: +55 38 3532 6099 e-mail: mlramosjorge@gmail.com Accepted 23 May, 2011 Abstract – The aim of the present cross-sectional survey was to assess factors associated with non-accidental collision followed by dental trauma among adolescents in the city of Diamantina, Brazil. A total of 387 students from 12 to 15 years of age (mean = 14 SD = 0.9) were randomly selected. The study was carried out in two stages. Firstly, data were collected through dental examinations of permanent incisors. Secondly, a thorough interview was held with 85 adolescents who exhibited dental trauma in the dental examinations. The interview consisted of a detailed description of the incident and physical environment in which it occurred. Descriptive analysis and the chi-square test (P < 0.05) were performed. The prevalence of dental injury was 22% (n = 85). Dental trauma was more prevalent in boys (P = 0.001) and individuals with overjet > 3 mm (P = 0.007) and inadequate lip coverage (P = 0.013). Analysis of the event revealed that 22.3% of the cases of dental trauma occurred because of non-accidental collision. Non-accidental collision followed by injury occurred mainly at school (P < 0.001) and in an environment with a concrete, tiled or ceramic floor (P = 0.001). No statistically significant associations were found between non-accidental collision and gender, age or mother's schooling. It was concluded that the non-accidental collisions happened especially at school and in indoor environments with a concrete, tiled or ceramic floor.

Traumatic dental injury (TDI) is considered a public health problem (1) because of its high prevalence and physical and psychological discomfort, which can affect social relationships (2). The prevalence of trauma in the permanent dentition in different countries ranges from 6.0% to 40.0% (3–6). Epidemiological studies carried out in Brazil report a prevalence of trauma in permanent teeth ranging from 18.9% (7) to 58.6% (8).

The etiology of TDI is related to age group, culture, environmental factors and human behavior (4, 9). Studies carried out in dental clinics and hospitals demonstrate that falls, collisions and violence are the main causes of TDI worldwide (10–14). Furthermore, dental trauma is related to large incisal overjet and inadequate lip coverage (15, 16). Many incidents occur at home (17.8%) or in public areas (15.5%), especially during sports and physical leisure activities (12).

However, studies offer only a brief account of the etiology of trauma, without a thorough investigation into the circumstances leading to the incident (5, 10). Information on the physical environments in which trauma occurs and a detailed description of the event are relevant considerations for the formulation of public health policies directed at preventing and reducing the prevalence of dental trauma on both the individual and collective level (12, 17, 18).

The aim of the present study was to evaluate factors associated with non-accidental collision followed by dental trauma among adolescents in the city of Diamantina, Brazil.

Methods

A cross-sectional survey was carried out in the city of Diamantina (southeastern Brazil). The sample was made up of students between 12 and 15 years of age and regularly enrolled at four public schools. Diamantina has a total of 15 public schools (14 state schools and one municipal) with 2406 students aged 12 to 15 years.

To ensure the representativeness of the sample, distribution was determined in proportion to the actual distribution of students throughout the city. For such, lists provided by the Municipal Secretary of Education were consulted and the distribution percentage of students aged 12 to 15 years (5th to 8th grade of basic education) from each region of the city (north, south, east and center) was calculated. Using the data from the calculation of sample size, the distribution of adolescents was determined in proportion to the existing population in the respective regions. A simple random drawing by lot was used to select one public school in each region. In a second drawing, the subjects were chosen from the list of names from each school. Educational authorities received a letter explaining the aim and importance of the study and all schools agreed to participate. Parents of adolescents also received a letter asking permission for their participation in the study.

Considering a 21.0% prevalence of non-accidental collision (as determined in a pilot study), a 99% confidence interval and a standard error of 5%, a minimal sample of 255 individuals was required. A correction factor of 1.2 was applied to increase the precision (n = 306 students), as two-stage sampling was adopted. Seventy-four subjects were added to compensate for possible non-responses, totaling a sample of 387 students, who were randomly selected for the study. Adolescents using fixed appliances or those with major decay from dental caries in the upper or lower incisors were excluded.

Data collection involved dental examinations and a questionnaire administered in interview form by a single dentist (J.T.) and assistant. Prior to the fieldwork, the examiner participated in a calibration process, achieving an intra-examiner κ value of 0.91.

The selected schools were visited at least twice, and the adolescents were examined at the school. The upper and lower incisors and adjacent soft tissues were examined. For such, the student sat in a chair facing the examiner and a window to make the most of the natural light. The examiner used sterilized flat clinical mirrors, Community Periodontal Index (CPI) probes, tongue depressors and gauze in compliance with biosafety standards.

The criteria of the Children's Dental Health Survey (19) were used for the determination of TDI: enamel fracture alone or enamel/dentin fracture; crown fracture with pulp exposure; discoloration of the crown; and missing tooth because of trauma. The following aspects were recorded: type of traumatic injury; size of incisal overjet; and adequacy of lip coverage. Lip coverage was considered adequate when the upper lip touched the lower lip while at rest.

The interview was used to gather information on age, gender, mother's schooling, location and type of incident that resulted in traumatic injury, including a detailed account of the event. Information on the time elapsed since the trauma, the location of the TDI occurrence (school, home or street) and activity performed during the incident was gathered to determine whether the TDI was because of an accidental or nonaccidental collision. Collision with another person or object was considered accidental when the traumatic injury occurred during the practice of a sport, a fall from a bicycle or a stumble or slip followed by a fall. Collision with another person or object was considered non-accidental when the traumatic injury was because of a push followed by a fall or physical violence. The type of ground in the environment in which the traumatic event occurred was recorded (concrete, stone, asphalt, grass, sand, tile or ceramic).

Data analysis was performed using SPSS for Windows 18.0 and involved frequency distribution and association tests. Association between the type of incident (accidental or non-accidental collision) and the independent *Table 1.* Frequency distribution of traumatic injuries to permanent incisors in 387 adolescents by gender, age, type of lip coverage, size of incisal overjet and mother's schooling in Diamantina, Brazil, 2007

	Traumatic dental in	njury (TDI)	
	No dental injury n (%)	Dental injury n (%)	P*
Gender			
Female	175 (84.5)	32 (15.5)	0.001
Male	127 (70.6)	53 (29.4)	
Age (year)			
12	98 (79.0)	26 (21.0)	0.067
13	107 (82.3)	23 (17.7)	
14	81 (76.4)	25 (23.6)	
15	16 (59.3)	11 (40.7)	
Lip coverage ¹			
Adequate	202 (82.4)	43 (17.6)	0.013
Inadequate	98 (71.5)	39 (28.5)	
Incisal overjet (mm)	. ,		
≤3	232 (81.4)	53 (18.6)	0.007
>3	70 (68.6)	32 (31.4)	
Mother's schooling ²	()	. ,	
More than 5 years	159 (85.5)	27 (14.5)	0.001
5 years or less	143 (71.9)	56 (28.1)	
*Chi-square (χ^2) test. ¹ Three data were not reco ² Two mothers did not an	orded. swer.		

variables (location of TDI occurrence, type of ground, age, gender and mother's schooling) was determined using the chi-square (χ^2) test. Additional analysis involved the evaluation of factors associated with TDI (gender, age, lip coverage, overjet and mother's schooling) using the chi-square (χ^2) test. The study received approval from the Ethics Committee of the Federal University of Minas Gerais (Brazil).

Results

A total of 387 adolescents were evaluated, among which the prevalence of dental injury (TDI) in permanent incisors was 22.0%. TDI was significantly associated with gender (P = 0.001), lip coverage (P = 0.013), overjet (P = 0.007) and mother's schooling (P = 0.001; Table 1).

Enamel fracture alone and enamel/dentin fracture were the main types of injury, with permanent upper incisors more often affected than lower incisors. Other types of injury were less common (Table 2). No association was found between the type of collision (accidental or non-accidental) and gender, age or mother's schooling. A statistically significant association was found between the type of collision and location of TDI occurrence (P < 0.001). Most cases of accidental collision followed by TDI occurred outdoors (50.8%). The types of ground most often associated with non-accidental collision were concrete, tiled and ceramic floor (Table 3).

A large portion of the students reported a stumble followed by a fall (29.4%) and push and fight

Table 2.	Frequency	/ distribution	of differ	ent types o	of dental	l injuries	in 680	permanents	s incisors	of 85	adolescents.	Absolute	number
(rate per	thousand	incisors)											

	Tooth 12	Tooth 11	Tooth 21	Tooth 22	Tooth 32	Tooth 31	Tooth 41	Tooth 42	Total
Enamel fracture alone	4 (5.9)	20 (29.4)	23 (33.8)	2 (2.9)	6 (8.8)	1 (1.5)	3 (4.4)	0 (0)	59
Enamel/dentin fracture	1 (1.5)	10 (14.7)	14 (20.6)	3 (4.4)	0 (0)	2 (2.9)	2 (2.9)	0 (0)	32
Crown fracture with pulp exposure	2 (2.9)	2 (2.9)	3 (4.4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7
Discoloration	0 (0)	1 (1.5)	1 (1.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2
Missing tooth due to trauma	0 (0)	2 (2.9)	1 (1.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3
Total	7	35	42	5	6	3	5	0	

Table 3. Frequency distribution of different types of dental injuries by location of traumatic dental injury (TDI) occurrence, types of ground, age, gender and mother's schooling

	Type of inc		
	Accidental collision n (%)	Non-accidental collision n (%)	P*
Location of TDI occurrence			
Home	15 (68.2)	7 (31.8)	< 0.001
School	16 (57.1)	12 (42.9)	
Street (outdoors)	32 (100)	0 (0.0)	
Type of ground			
Concrete	16 (55.2)	13 (44.8)	0.001
Stone	26 (100)	0 (0.0)	
Tiled or ceramic floor	12 (70.6)	5 (29.4)	
Other (sand, asphalt, grass)	9 (90.0)	1 (10.0)	
Age (years)			
12	20 (80.0)	5 (20)	0.560
13	16 (72.7)	6 (27.3)	
14	17 (70.8)	7 (29.2)	
15	10 (90.9)	1 (9.1)	
Gender			
Female	22 (71.0)	9 (29)	0.327
Male	41 (80.4)	10 (19.6)	
Mother's schooling			
More than 5 years	18 (75.0)	6 (25)	0.863
5 years or less	42 (76.8)	13 (23.2)	
*Chi-square (χ^2) test.			

Table 4. Frequency distribution of activities related to the traumatic dental injury event

Activity	Traumatic dental injury <i>n</i> (%)
Does not remember	3 (3.5)
Play fighting	10 (11.8)
Biting hard food	1 (1.2)
Fall from bicycle	15 (17.6)
Accidental collision with another person	12 (14.1)
Push, fight	19 (22.4)
Stumble	25 (29.4)
Total	85 (100)

(non-accidental collision; 22.4%) as activity performed during the incident (Table 4). Accidental collision was a common occurrence, especially among the 12 year olds, whereas non-accidental collision was reported most by the 14 year olds.

Discussion

The present study focused on a detailed description of the time and location at which TDI occurred. There was a high prevalence of trauma resulting from non-accidental causes, mainly in the school and home environment. According to Glendor (9), intentional collision (nonaccidental collision) may characterize a form of violence. The assessment of intention during trauma suggests that these events stem from bullying or episodes of physical aggression (9). In the present study, the high number of dental injuries resulting from non-accidental collisions, especially at school, suggests that bullying may be an aggravating factor in the prevalence of dental and facial injuries.

Strategies for preventing bullying in the school environment should be adopted as a public health measure. Such measures may include the establishment of rules in the classroom, meetings with parents and teachers and conferences with the parents of the students involved. This approach is not a routine in schools, the directors of which are often even unaware of the practice of this kind of violence (20, 21).

Fractured teeth constitute one of the main signs of physical abuse, which could explain the high incidence of non-accidental collision in the home environment found in the present study (22, 23). Dentists should be able to recognize signs of domestic violence. Nelms et al. (24) found that 76% of schoolchildren who had suffered domestic violence said they had experienced an abusive head, neck or mouth injury. According to the authors, the dentist failed to investigate the causes of injury in 88.6% of cases.

The detailed description of the incidents revealed that non-accidental collision occurred especially in school buildings or in the home on concrete, tiled or ceramic floors. Only one case of intentional collision occurred on gravel, grass or sand, which are common in soccer fields and recreational areas of the school, thereby prevailing in the external environment of homes and schools. Thus, the cases of TDI occurring in these environments were mostly caused by accidental collision. Paving stones are a characteristic of the city; however, there were no cases of non-accidental collision occurring on the street.

As in most previous studies (4, 7, 9, 25–27), the following factors were associated with the occurrence of TDI: overjet >3 mm, male gender and inadequate lip coverage. There was a statistically significant association between mother's schooling and the occurrence of TDI. Few studies address mother's schooling or socioeconomic status as possible factors associated with TDI.

Moreover, the heterogeneity in the methods for estimating these variables hinders comparisons of the results (28).

In general, physical activities accounted for most traumatic injuries, which occurred as a result of falls and collisions. A similar result was found in a study by Traebert et al. (7), in which most cases of TDI were related to falls and collisions. However, the lack of a detailed description of the incidents in most studies may mask the true cause of trauma, thereby underestimating the role of violence (29).

Information regarding predisposing factors for TDI is of particular importance to the formulation of preventive strategies. Besides the type of floor, other factors should be considered for the improvement of school and home environments to reduce the likelihood of TDI, such as lighting, adjustment of handrails on stairs and trashcans and installing rubber flooring. The adoption of programs to prevent violence at home and school is also a valid approach to reducing the occurrence of TDI (20, 21).

Conclusion

The prevalence of TDI was high in schoolchildren between 12 and 15 years of age and was associated with gender, mother's schooling, overjet and lip coverage. Moreover, non-accidental collisions happened especially at school and in indoor environments with a concrete, tiled or ceramic floor.

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