Dental Traumatology

Dental Traumatology 2009; **25**: 198–202; doi: 10.1111/j.1600-9657.2008.00746.x

Traumatic anterior dental injuries in 7- to 12-year-old Brazilian children

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Accepted 3 September, 2008

Abstract – The aim of this study was to determine the prevalence and risk factors of dental trauma in the permanent anterior teeth of schoolchildren in Campina Grande, Brazil. A sample of 448 schoolchildren, 228 boys and 220 girls, aged 7–12 years, were randomly selected from 17 public schools in an urban area. The sample selection was carried out in two stages: first, schools were selected by simple sampling and then children were chosen using a proportionality coefficient. Data were collected through clinical examinations and interviews, after examiner calibration. Overjet (OJ) was considered a risk factor when it presented values higher than 3 mm, while lip coverage was classified as adequate or inadequate. Yates' chi-squared test verified the association between the variables and odds ratio. Significance level was set at 5%. The prevalence of dental injuries was 21%. Boys experienced more injuries than girls, 21.9% and 20%, respectively ($P > 0.05$). Falls and collisions were the main causes of dental trauma, 63.8% and 24.5%, respectively. There was a statistically significant difference between traumatic dental injuries (TDI) and OJ (95% CI 0.22–0.63) ($P < 0.001$) and between TDI and inadequate lip coverage (95% CI 9.16–34.93) ($P < 0.001$). Data indicated that boys presenting an OJ size > 3 mm and inadequate lip coverage were more likely to have TDI in Campina Grande, Brazil.

Dental trauma in children and adolescents is a serious public health problem (1–4). Frequencies of traumatic dental injuries (TDI) in the permanent dentition in children and adolescents have been reported in different parts of the world (4–6) and the prevalence of injured teeth varies in different populations and at various ages (1, 7, 8). In Brazil, at age 12, they range from 10.5 (9) to 18.9 (10).

Dental injury may have an impact on children's quality of life (11). The patients, who are exposed to trauma, are not only physically, but also psychologically affected (12). Dental trauma is also a source of distress for the parents of those children (13).

Boys experience more dental injuries than girls (5, 14–18). The majority of dental injuries involved the anterior teeth (7, 16), which may lead to restriction in biting, difficulty speaking clearly, and feeling embarrassed to show the teeth (3). There is agreement that traumatic injuries occur more often to the maxillary than the mandibular incisors (17) and that the central incisors are affected more often than the lateral incisors (5, 9).

The causes of dental injury are known. The main causes of injuries to the permanent incisors are falls and collisions (15), sporting activities, violence, and traffic accidents (4, 13, 14). All sporting activities have an associated risk of orofacial injuries due to falls, collisions, and contact with hard surface (19). Furthermore, the risk of injury to the maxillary incisors has been shown to increase with incisal overjet (OJ) and inadequate lip coverage (1, 5, 17, 20).

Information on the prevalence and severity of dental trauma in various age groups of a population has significance for planning public dental care strategies in that population. In addition, information about associations between morphologic characteristics and incisor injuries is of general significance for orthodontic treatment (17).

There is no information on the prevalence and risk factors for dental trauma in Campina Grande, Brazil, and few sound population studies on the causes of TDI exist in the literature. The aim of this study was to determine the prevalence and associated risk factors to traumatic injuries to permanent anterior teeth in 7- to 12-year-old children in Campina Grande, Paraíba, Brazil.

Material and methods

This study was conducted in compliance with the ethical guidelines issued by Resolution 196/96 of the Brazilian National Health Council/Ministry of Health on research involving human subjects. The research project was reviewed independently and approved by the Ethics Research Committee of the State University of Paraíba, Brazil.

A cross-sectional survey was performed with the sample universe population comprising children aged 7–12 years regularly attending public schools in the city of Campina Grande, state of Paraíba, located in the northeast of Brazil. The city has an estimated population of 379 871 habitants and a municipal human

development index value of 0.72. According to the data provided by the municipal Bureau of Education, there were 14 686 children regularly attending 89 public schools in 2007. For the sample calculation, a prevalence of 15% (14), a sample error of 5%, and a confidence interval of 95% were adopted. In addition, a correction factor of 1.5 was applied. The minimum sample size to satisfy the requirements was estimated to be 49 children at each age. A total of 448 children were randomly selected and invited to participate.

A multistage sampling procedure was performed. The first unit included all primary schools of Campina Grande. The second unit included all students enrolled in the selected schools. Seventeen schools were randomly and proportionally selected according to the number of students enrolled, following a sample selection scheme used (10). A random sample was obtained using a list with all students enrolled in the selected schools.

Prior to data collection, the parents were fully instructed by the examiner on the study purposes, relevance, and possible benefits arising from its development. All parents/guardians were asked to sign a written informed consent form authorizing the enrollment of their children in the trial. Negative consent was accepted without any prejudice being attached to the children who had opted not to participate. Information about pre-existing dental trauma as a result of previous accidents was also collected in this survey.

Dental examination

Dental examinations were performed by one dentist who participated in a training and calibration exercise for the criteria used to identify dental injuries. Kappa statistics were used on a tooth-by-tooth basis ($K = 0.90$). Data were recorded in study-specific forms.

The children were examined visually in a room with good natural lighting using a wooden spatula after drying the teeth and soft tissue with gauze to minimize variables. The dental examination included all permanent anterior teeth. The universal infection control precautions were followed during the examination. The questionnaire provided information about the children's sex, age, and details of the injury event. These details included location and nature of the activity performed when the incident occurred. Intra-examiner variability was checked through duplicate examinations of every 10th subject.

The classification of dental injuries was based on Andreasen and Andreasen (4), O'Brien (21) and Cortes (22). OJ, which was measured using a Community Periodontal Index probe, was considered as a risk factor when it presented values higher than 3 mm. Lip coverage was classified as adequate when the lips covered the anterior teeth completely in the at-rest position and as inadequate if the majority of the crown height was exposed and visible.

Statistical analysis

All statistical analyses were performed using the Epi Info 2007 software (Centers for Disease Control and Prevention, Atlanta, GA, USA). The absolute and percent frequencies were obtained for data analysis (descriptive statistical techniques). The existence of significant association among the variables was verified by means of bivariate analysis (Yates' chi-squared tests) considering a value of $\alpha = 0.05$ for rejection of the null hypothesis. Odds ratio was used for analysis of force and direction of association.

Results

A total of 448 schoolchildren representing 14 686 children aged 7–12 years were examined and interviewed in this cross-sectional survey; 50.9% of them were boys and 49.1% girls (Table 1). The response rate was 100%. Because all the children enrolled in the selected schools wanted to participate in the study, the sample size for the age of 7–12 years was bigger than the estimated minimum size to satisfy the requirements, 49 children of each age.

Ninety-four subjects (21%) had at least one tooth with a positive score for dental trauma, including enamel cracks. The observed prevalence was higher in boys (21.9%) than in girls (20%), but this difference was not statistically significant ($P > 0.05$) (Table 1).

The prevalence of injuries to the teeth increased with age. It ranged from 5.3% at the age of 7 years to 36.1% at the age of 12 years. A statistically significant ($P < 0.001$) trend was observed (Table 2).

The most commonly reported cause of injuries to the permanent teeth was falls (63.8%), followed by collisions with inanimate objects – doors and walls – or people (24.5%), violence (1.1%), sports-related injuries (for example, playing soccer, or jogging) (1.1%), and other causes (for example, traffic accidents – cars and motorcycle) (9.5%).

Table 1. Prevalence of dental injuries to permanent teeth in schoolchildren ($n = 448$) aged 6–12 years, Campina Grande, Brazil, 2007

	Dental injury			
Gender	Yes, *n* (%)	No, *n* (%)	Total, *n* (%)	*P*-value
Boys	50 (21.9)	178 (78.1)	228 (50.9)	>0.05
Girls	44 (20)	176 (80)	220 (49.1)	
Total	94 (21)	354 (79.1)	448 (100)	

Table 2. Frequency distribution of dental injuries in schoolchildren ($n = 448$) according to age, Campina Grande, Brazil, 2007

	Dental injury		
Age (years)	Yes, *n* (%)	No, *n* (%)	*P*-value
7	4 (5.3)	72 (94.7)	<0.001
8	12 (16)	63 (84)	
9	16 (21.3)	59 (78.7)	
10	13 (17.3)	62 (82.7)	
11	23 (30.7)	52 (69.3)	
12	26 (36.1)	46 (63.9)	
Total	94 (21)	354 (79)	

Table 3. Frequency distribution of types of dental injuries in schoolchildren (n = 448), Campina Grande, Brazil, 2007

Types of injuries	Frequency, *n* (%)
Avulsion	4 (4.3)
Concussion	15 (16)
Concussion and discoloration	1 (1.1)
Fistulous tract	1 (1.1)
Complicated crown fracture	1 (1.1)
Root fracture	1 (1.1)
Enamel fracture	50 (53.2)
Enamel fracture and discoloration	3 (3.2)
Enamel/dentin fracture	11 (11.7)
Enamel fracture and complicated crown fracture	1 (1.1)
Intrusive luxation	1 (1.1)
Discoloration	1 (1.1)
Subluxation	3 (3.2)
Enamel cracks	1 (1.1)
Total	94 (100)

Table 4. Frequency distribution of types of tooth with traumatic dental injuries in schoolchildren (n = 448), Campina Grande, Brazil, 2007

Types of tooth	Frequency, *n* (%)
Maxilla	
Right central	47 (42)
Right lateral	6 (5.3)
Right canine	2 (1.8)
Left central	48 (42.8)
Left lateral	2 (1.8)
Mandible	
Right central	1 (0.9)
Right lateral	2 (1.8)
Right canine	1 (0.9)
Left central	2 (1.8)
Left canine	1 (0.9)
Total	112 (100)

Fractures in enamel only (57.4%), concussion (17%), and fractures in enamel and dentin (11.7%) were the most common types of injuries. Other types of TDI such as the presence of an enamel crack, discoloration, or sinus tract were rare (Table 3).

Most of the children who had experienced TDI had only one tooth damaged (71.3%) and 28.7% had two teeth damaged. The left maxillary central incisor was the most common tooth involved, which accounted for 42.8% of the injuries followed by the right maxillary central incisor with 42%. Together the maxillary central incisors accounted for approximately 84.8% of the injuries. The mandibular teeth accounted for 6.2% of the injured teeth with the central incisors being most commonly involved (Table 4).

There was a tendency for children with an incisal OJ greater than 3 mm and inadequate lip coverage to have experienced dental injuries, and the differences were statistically significant ($P < 0.001$). The results showed that children with an OJ size greater than 3.0 mm were 0.38 times (95% CI 0.22–0.63) more likely to present with a dental injury than children with an OJ size equal or lower than 3.0 mm. Finally, children with an inadequate lip coverage were 17.89 times (95% CI 9.16–34.93) more likely to have a traumatic dental injury than children with adequate lip coverage (Table 5).

Table 5. Frequency distribution of incisal overjet and lip coverage on the presence of traumatic dental injuries in schoolchildren (n = 448), Campina Grande, Brazil, 2007

	Traumatic dental injury			
	Yes, *n* (%)	No, *n* (%)	OR (95% CI)	*P*-value
Overjet				
≤3 mm	29 (13.1)	192 (86.9)	1	<0.001
>3 mm	65 (28.6)	162 (71.4)	0.38 (0.22–0.63)	
Lip coverage				
Adequate	11 (4.2)	249 (95.8)	1	<0.001
Inadequate	83 (44.1)	105 (55.9)	17.89 (9.16–34.93)	

Discussion

Traumatic dental injuries in the permanent dentition in children and adolescents have been reported in different parts of the world (8, 23, 24). Variation in prevalence has been related to several factors, such as type of study, trauma classification, sample and diagnostic criteria (10), limited age groups (25), and geographic and behavioral differences between study locations and countries (26).

There are few data on TDI in Brazil and they were developed in medium sized or large cities. This is important because, hypothetically, the factors associated with dental trauma and dental treatment differ according to the size of the city. Thus, large cities are more likely to have more overcrowding, urban violence and traffic accidents. In relation to school environments, large cities probably have more students in schools, more children in classrooms, and schools located in peripheral areas where hypothetically the school commitment toward health and safety at school may be at a lower level (27).

This cross-sectional survey has identified a prevalence of 21% of TDI to the permanent anterior teeth among schoolchildren aged 7–12 years in Campina Grande, Brazil. When the enamel cracks were not considered in the analysis, a prevalence of 20.8% was observed. Previous studies carried out in Brazil reported a prevalence of 10.5% in Recife (9) and of 15.3% in Jaragua do Sul (14). Another Brazilian study carried out in Belo Horizonte, in the south-eastern State of Minas Gerais, reported a prevalence of 13.6% in children aged 12 (28). Because different methodologies have been used in Latin American studies, caution should be exercised when comparing prevalence figures. It is inappropriate, for instance, to compare figures found in clinic and hospital-based studies with population-based studies (10).

As observed in previous studies (7, 13, 16, 17, 23, 29), the prevalence of dental injuries increased with age, and a statistically significant difference was observed ($P < 0.001$). The results of the present study showed that the peak incidence of injury was 11–12 years of age. The fact that the prevalence of dental injury increased with age did not mean that the oldest were the most

vulnerable. The characteristics of traumatic injuries mean that the measurement of this type of dental injury is cumulative (9).

This investigation showed that boys are more affected by trauma than girls, which corroborates the findings of other studies (7, 13–18, 23, 27, 28), but no statistical significance was observed between sex and the occurrence of trauma in the present study. The fact that the boys had suffered more traumatic injuries than girls is basically explained by behavioral factors, with boys tending to be more energetic and inclined toward vigorous outdoor activities (16, 18). However, a previous Brazilian study indicated an increasing trend of dental trauma among girls, because of their increasing participation in sports or activities formerly practiced by boys only (7). In small towns girls can be exposed to the TDI risk behaviors because they are probably involved in physical leisure activities, such as cycling, skateboarding, and playing volleyball. Also, girls could be exposed to traffic accidents and violence in the same way as boys (27).

Behavior can be very important in the occurrence of TDI among children and adolescents. This factor must always be taken into consideration in developing effective preventive strategies for preserving dental health, as behavioral risk factors frequently involve aggressive or violent attitudes (9).

Most of the children who experienced dental injuries had only one tooth damaged, as reported in previous Brazilian studies (7, 9, 10, 27, 28). Injury involving enamel only and enamel/dentin was found to be the most common, unlike other studies (7, 9, 13, 15, 16, 18, 25, 27–31). Traumatic injuries most commonly involved the maxillary central incisors, as was also seen in previous studies (7, 9, 13, 15–18, 23, 28–31).

The relationship between OJ and dental traumatic injury has been investigated by different authors (9, 14, 25, 27, 32, 33). Previous studies (1, 20, 34) showed that individuals with an OJ greater than 3 mm were two and a half times more at risk compared with individuals who had a normal OJ. The results of the present study showed a significant association between the presence of dental trauma and OJ, when it presented a value higher than 3 mm, corroborating the assertion that the frequency of dental trauma increases proportionally in relation to an increased OJ (9). Therefore, OJ is considered as an important risk factor in dental trauma (20).

Information on the prevalence and severity of dental trauma in various age groups of a population has significance for planning public dental care strategies in that population. There is a need to institute a preventive educational program in Campina Grande, directed at parents and school teachers to inform them about TDI and the benefit of immediate attention to dental treatment. Also, local campaigns should increase social awareness about dental injury.

Further studies are required to investigate the personal and social factors that increase the risk of damage to the permanent anterior dentition. Such information is necessary to develop and implement effective preventive strategies for reducing the prevalence and costs of this condition.

References

1. Petti S, Tarsitani G. Traumatic injuries to anterior teeth in Italian schoolchildren: prevalence and risk factors. Endod Dent Traumatol 1996;12:294–7.
2. Uji T, Teramoto T. Occurrence of traumatic injuries in the oromaxillary region of children in a Japanese prefecture. Endod Dent Traumatol 1988;4:63–9.
3. Marcenes W, Beiruti N, Tayfour D, Issa S. Epidemiology of traumatic dental injuries to permanent incisors of schoolchildren aged 9 to 12 in Damascus, Syria. Endod Dent Traumatol 1999;15:117–23.
4. Andreassen JO, Andreasen EM. Textbook and color atlas of traumatic injuries to the teeth, 3rd edn. St. Louis, MO: Mosby; 1994. 771 pp.
5. Zaragoza AA, Catala M, Colmena ML, Valdemoro C. Dental trauma in schoolchildren six to twelve years of age. J Dent Child 1998;65:492–4.
6. Tapias MA, Jiménez-Garcia R, Lamas F, Gil AA. Prevalence of traumatic crown fractures to permanent incisors in a childhood population: Móstenes, Spain. Dent Traumatol 2003;19:119–22.
7. Rocha MJC, Cardoso M. Traumatized permanent teeth in Brazilian children assisted at the Federal University of Santa Catarina, Brazil. Dent Traumatol 2001;17:245–9.
8. Zerman N, Cavalleri G. Traumatic injuries to permanent incisors. Endod Dent Traumatol 1993;9:61–4.
9. Soriano EP, Caldas AF Jr, Diniz de Carvalho MV, Amorim Filho HA. Prevalence and risk factor related to traumatic dental injuries in Brazilian schoolchildren. Dent Traumatol 2007;23:232–40.
10. Traebert J, Peres MA, Blank V, Böell Rda, Pietruza JA. Prevalence of traumatic dental injury and associated factors among12-year-old school children in Florianópolis, Brazil. Dent Traumatol 2003;19:15–8.
11. Cortes MIS, Marcenes W, Sheiham A. Impact of traumatic injuries to the permanent teeth on oral health related quality of life of 12–14 year old in Brazilian schoolchildren. Community Dent Oral Epidemiol 2002;30:193–8.
12. Gutmann JL, Gutmann MSE. Cause, incidence and prevention of trauma to teeth. Dent Clin North Am 1995;39:1–11.
13. Zuhal K, Semra OEM, Seyin K. Traumatic injuries of the permanent incisors in children in southern Turkey: a retrospective study. Dent Traumatol 2005;21:20–5.
14. Marcenes W, Alessi ON, Traebert J. Causes and prevalence of traumatic injuries to the permanent incisors of school children aged 12 year in Jaragua do Sul, Brazil. Int Dent J 2000;50:87–92.
15. Çelenk S, Sezgýyn B, Ayna B, Atakul F. Causes of dental fractures in the early permanent dentition: a retrospective study. J Endod 2002;28:208–10.
16. Rajab LD. Traumatic dental injuries in children presenting or treatment at the Department of Pediatric Dentistry, Faculty of Dentistry, University of Jordan, 1997–2000. Dent Traumatol 2003;19:6–11.
17. Årtun J, Behbehani F, Al-Jame B, Kerosuod H. Incisor trauma in an adolescent Arab population: prevalence, severity, and occlusal risk factors. Am J Orthod Dentofacial Orthop 2005;128:347–52.
18. Sandalli N, Cildir S, Guler N. Investigation of traumatic Injuries in Yeditepe University, Turkey during the last 3 years. Dent Traumatol 2005;21:188–94.
19. Gassner R, Bosch R, Tuli T, Emshoff R. Prevalence of dental trauma in 6000 patients with facial injuries: implications for prevention. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1999;87:27–33.
20. Nguyen QV, Bezemer PD, Habets L, Prahl-Andersen B. A systematic review of the relationship between overjet size and traumatic dental injuries. Eur J Orthod 1999;21:503–15.

21. O'Brien M. Children's dental health in the United Kingdom 1993: report of Dental Survey, Office of Population Censuses and Surveys. London: Her Majesty's Stationery Office; 1994.
22. Cortês MIS. Epidemiology of traumatic injuries to permanent teeth and the impact on the daily living of Brazilian schoolchildren. Thesis. London: Department of Epidemiology and Public Health, University of College; 2000.
23. Naidu RS, Boodoo D, Percival T, Newton T. Dental emergencies presenting to a university-based paediatric dentistry clinic in the West Indies. Int J Paediatr Dent 2005;15:177–84.
24. O' Mullane DM. Some factors predisposing to injuries of permanent incisors in school children. Br Dent J 1973;134:328–32.
25. 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.
26. Altay N, Gungor HC. A retrospective study of dento-alveolar injuries of children in Ankara, Turkey. Dent Traumatol 2001;17:197–201.
27. Traebert J, Bittencourt DD, Peres KG, Peres MA, de Lacerda JT, Marcenes W. Aetiology and rates of treatment of traumatic dental injuries among 12-year-old school children in a town in southern Brazil. Dent Traumatol 2006;22:173–8.
28. Cortes MIS, Marcenes W, Sheiham A. Prevalence and correlates of traumatic injuries to the permanent teeth of schoolchildren aged 9–14 years in Belo Horizonte, Brazil. Dent Traumatol 2001;17:22–5.
29. Saroglu I, Sõnmez H. The prevalence of traumatic injuries treated in the pedodontic clinic of Ankara University, Turkey, during 18 months. Dent Traumatol 2002;18:299–303.
30. Kargul B, Çaglar E, Tanboga I. Dental trauma in Turkish children, Istanbul. Dent Traumatol 2003;19:72–5.
31. Bastone EB, Freer TJ, McNamara JR. Epidemiology of dental trauma: A review of the literature. Aust Dent J 2000;45:601–6.
32. Burden DJ. An investigation of the association between overjet size, lip coverage, and traumatic injury to maxillary incisors. Eur J Orthod 1995;17:513–7.
33. Hamdan MA, Rajab LD. Traumatic injuries to permanent anterior teeth among 12-year-old schoolchildren in Jordan. Community Dent Health 2003;20:89–93.
34. Otuyemi OD. Traumatic anterior dental injuries related to incisor overjet and lip competence in 12 year old Nigerian children. Int Dent J 1994;4:81–5.