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Aetiology and rates of treatment of traumatic dental injuries among 12-year-old school children in a town in southern Brazil

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. © Blackwell Munksgaard, 2006.

Abstract – The objective of this study was to assess the prevalence, aetiology, place of occurrence and rates of treatment of traumatic dental injuries (TDI) among 12-year-old schoolchildren in Herval D'Oeste, Brazil. A cross-sectional survey was carried out through clinical examination of upper and lower permanent incisors and interviews with 297, 12-year-old schoolchildren enrolled in public and private schools. Intra-examiner diagnosis variability, measured by kappa values on tooth-by-tooth basis was above 0.7. The prevalence of TDI was 17.3% (95% CI 12.7–21.9). Children who had an incisal overjet size >5 mm were 3.5 (95% CI 1.5–8.1) times more likely to have TDI than children who had an incisal overjet of <5 mm ($P = 0.005$). The most common type of injury found was enamel fracture alone. Of the total of 87 traumatized teeth, only 27.6% were treated. Acid etch restorations were the most common treatment provided. Acid etch restorations were the most common type of treatment needed. The majority of the cases of TDI occurred at home (17.8%) and at school (17.8%). Collisions (24.5%), mainly with doors, and physical leisure activities (20.0%) such as cycling and playing soccer were the main activities related to TDI aetiology. It can be concluded that there is a great treatment need reflecting neglect of TDI treatment. The main causes of TDI were collisions and physical leisure activities.

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In certain parts of the globe traumatic dental injuries (TDI) in children can be considered an important public health problem (1) not only because their prevalence is relatively high (2–4) but also because their treatment has been neglected (5) resulting in a substantial impact on children's daily life (6).

There are few data on TDI in South America. A PubMed Medline and LILACS (Latin American and Caribbean Literature on Health Sciences) search covering the period 1993–2004 using 'dental trauma', 'dental injury' and 'epidemiology' as descriptors revealed relatively few published population-based studies describing the aetiology and treatment rates of TDI in the permanent dentition. The data that were found came from studies carried out in the Brazilian south regions. The reported prevalence of TDI ranges from 10.7 to 58.6% (4–11). No population-based data was found on TDI either from other regions of Brazil or from other South American countries, demonstrating the importance of obtaining new data on the subject in order to clarify the TDI panorama and trends in this part of the globe. Furthermore, most of the

studies in the literature 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.

Studies that have included the treatment needs of and treatment provided for TDI have revealed neglect in its treatment, both in developed countries and in Brazil. UK data showed that <20% of schoolchildren experiencing TDI received treatment (2) similar results were reported in the USA (3). In Brazil, high levels of treatment needs were observed in the few studies that included this variable (7, 9, 11).

Falls and collisions have been reported as the main causes of TDI worldwide (12). However, the majority of data on this subject come from clinic-based studies and their results cannot be inferred to the general population (11). Also, large incisal overjet (13) and inadequate lip coverage (13) have been reported as important biological predisposing risk factors to TDI.

The objective of this study was to assess the prevalence, aetiology, place of occurrence and rates of treatment of TDI among 12 years old schoolchildren in a small town in southern Brazil.

Methods

The study was conducted in Herval D'Oeste, a small town with 20 044 inhabitants (14) located in the mid-west region of Santa Catarina State, southern Brazil. Santa Catarina has higher socio-economic and health indicators when compared with Brazil as a whole.

A cross sectional study was carried out involving all 12 years old schoolchildren enrolled in the public and private schools of Herval D'Oeste in 2000. Local authorities including the Health Council and the Education Council provided the names and addresses of all the schools in the city and the total number of 12 years old students in each school. Subsequently, 297 schoolchildren from 11 schools were invited to participate in the study. A letter was sent to the parents of the children explaining the aim, characteristics and importance of the study, and asking for their participation. Parents who agreed that their children could participate signed a consent form. Parents were assured that children who opted not to participate would not suffer any consequences.

Dental examinations were carried out and questionnaires were administered by a single dentist (DDB) supported by a dental nurse. Before the field work both examiner and dental nurse participated in a calibration exercise that involved 12 schoolchildren aged 10–12 years from a neighbouring city, as described in an earlier publication (15).

The examinations were performed under natural light. Strict cross-infection control measures were adopted. The examiner used disposable gloves. Packages with plane mirrors, community periodontal index (CPI) periodontal probes and gauze pads were sterilized in sufficient number for a single day's work. Dental examinations included only upper and lower incisors and adjacent soft tissues. The examiner recorded the type of damage sustained, any treatment or treatment needed because of TDI, the size of incisal overjet and whether lip coverage was adequate. The criteria adopted for TDI were those used in the Children's Dental Health Survey in the UK (2). Intra-examiner variability was checked through duplicate examination of every tenth child. Kappa statistics were used on a tooth-by-tooth basis to measure intra-examiner reliability.

The questionnaires included gender and children who had experienced TDI were asked to provide details of the injury event. These details included place and activity performed when the incident happened.

In order to test the administration of questionnaires and dental examination procedures a pilot study was carried out in a sample of 25 children from a neighbouring city. The results of this confirmed that the protocol was feasible.

Data analysis included descriptive statistics such as frequency distribution and cross tabulation. Statistical significance for differences between proportions was assessed using the chi-square test. Multivariate logistic regression analysis was used to assess the odds ratios of studied variables and to identify associations. The level of significance was set at 5%.

Results

A total of 260 (87.5%) schoolchildren were examined and interviewed, 51.9% were girls and 48.1% were boys. Kappa values were calculated for clinical measures on a tooth-by-tooth basis in order to check intra-examiner diagnosis variability, and the minimum kappa value was 0.7.

The overall prevalence of traumatic injuries to the permanent incisors was 17.3% (95% CI 12.7–21.9). Boys had more TDI (22.4%) than girls (12.6%) ($P = 0.039$; Table 1). Children who had an incisal overjet >5 mm presented a higher prevalence of TDI (41.9%) than those whose incisal overjet was up to 5 mm (14.0%) ($P < 0.001$; Table 1) and children who had inadequate lip coverage also presented a higher prevalence of TDI (28.1%) than those who had adequate lip coverage (14.3%) ($P = 0.017$; Table 1).

Table 1. Frequency distribution of traumatic injuries to permanent incisors in 260 schoolchildren by gender, size of incisal overjet and type of lip coverage in Herval D'Oeste, Brazil, 2000

	Dental injury [*n* (%)]	No dental injury [*n* (%)]	All [*n* (%)]	Unadjusted OR (95% CI)	*P*-values	Adjusted* OR (95% CI)	*P*-values**
Gender							
Boys	28 (22.4)	97 (77.6)	125 (48.1)	1.0	0.039	1.0	0.201
Girls	17 (12.6)	118 (87.4)	135 (51.9)	2.0 (1.0–3.9)		1.6 (0.9–3.2)	
Incisal overjet size							
≤5 mm	32 (14.0)	197 (86.0)	229 (88.1)	1.0	<0.001	1.0	0.005
>5 mm	13 (41.9)	18 (58.1)	31 (11.9)	4.4 (2.0–9.9)		3.5 (1.5–8.1)	
Lip coverage							
Adequate	29 (14.3)	174 (85.7)	203 (78.1)	1.0	0.017	1.0	0.284
Inadequate	16 (28.1)	41 (71.9)	57 (21.9)	2.3 (1.2–4.7)		1.5 (0.7–3.3)	
All	45 (17.3)	215 (82.7)	260 (100.0)				

*Adjusted for all variables in the model.
**Adjusted *P* values.

The results of multiple logistic regression (Table 1) confirmed that the association between TDI and size of the incisal overjet was of statistical significance ($P = 0.005$) after adjusting for the other variables studied. Children who had an incisal overjet size >5 mm were 3.5 (95% CI 1.5–8.1) times more likely to have TDI than children who had an incisal overjet size <5 mm ($P = 0.005$). Neither gender nor lip coverage were significantly associated with TDI after adjusting for incisal overjet.

The most common type of injury found in this study was enamel fracture alone, with a rate per thousand incisors of 27.9. Other types of dental injuries were less common (Table 2). Of the total of 87 traumatized teeth, only 27.6% were treated. Acid etch restorations were the most common treatment provided for TDI, with a rate per thousand incisors of 10.1 (Table 2). The treatment need was 66.7% of traumatized teeth and acid etch restorations were the most common type of treatment needed, with a rate per thousand incisors of 25.5 (Table 2). Of the traumatized teeth 5.7% suffered small enamel fractures and did not need restorative treatment.

Table 2. Rate per thousand incisors of different types of dental injuries, treatment provided and treatment needs in Herval D'Oeste, Brazil, 2000 ($n = 2080$ incisors)

	Frequency (*n*)	Relative frequency per thousand incisors
Untreated injury		
Enamel fracture alone	58	27.9
Enamel/dentine fracture	4	1.9
Pulp involvement without fracture	1	0.5
Treatment		
Acid etch restoration	21	10.1
Permanent crown	3	1.4
Treatment need		
Acid etch restoration	53	25.5
Acid etch restoration and endodontic treatment and bleaching	3	1.4
Acid etch restoration and endodontic treatment	2	1.0

Regarding locations where the TDI event occurred, Table 3 shows that most injury events occurred at home (17.8%) or at school (17.8%) followed by in public leisure areas (15.5%). Unknown location was reported by 37.8% of schoolchildren with TDI.

Collisions (24.5%), mainly against doors, walls (8.9%) and toys (8.9%) and physical leisure activities (20.0%) such as cycling (6.7%) and playing soccer (6.7%) were the main activities related to the TDI event (Table 4).

Table 3. Frequency distribution of locations where TDI event occurred in a sample of 45 schoolchildren aged 12 years who had experienced injuries to the permanent incisors, Herval D'Oeste, Brazil, 2000

Location	Frequency [*n* (%)]
Home	8 (17.8)
School	8 (17.8)
Public leisure areas	7 (15.5)
Street/road/pavement	5 (11.1)
Unknown place	17 (37.8)
Total	45 (100.0)

Table 4. Frequency distribution of activities related to the TDI event in a sample of 45 schoolchildren aged 12 years who had experienced injuries to the permanent incisors, Herval D'Oeste, Brazil, 2000

Activity	*n* (%)
Collisions	11 (24.5)
Doors/walls	4 (8.9)
Toys	4 (8.9)
Inanimate objects	3 (6.7)
Physical leisure activities	9 (20.0)
Cycling	3 (6.7)
Playing soccer	3 (6.7)
Skateboarding	1 (2.2)
Rollerskating	1 (2.2)
Playing volleyball	1 (2.2)
Falls	7 (15.5)
Running	6 (13.3)
From ground level	1 (2.2)
Do not remember	18 (40.0)
Total	45 (100.0)

Discussion

Both the internal and external validity of this study were assured by the high response rates and the high intra-examiner reliability, added to the census-based study design.

All Brazilian population-based studies of TDI were performed in medium-sized and large cities in the South. This is of concern because there is little information available regarding TDI either from other regions of this country, which is characterized by great cultural, social and economic differences (14). Hypothetically, the determinants of TDI can vary 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 towards health and safety at school could be lower. Moyses et al. (16) have shown that the commitment towards health and safety at school was strongly associated with dental trauma.

As a result of the concentration of available information on TDI, it is very difficult to establish a panorama in Brazil. Also, at least at this moment, it is impossible to observe TDI tendencies in Brazil, since the first studies were published only in the year 2000 (7, 8).

In other South American countries, available data come from non-population studies undergone in Chile (17) and in Argentina (18), witch do not provide general population epidemiological evidence (19), being impossible to establish any kind of panorama or tendency.

The prevalence of TDI found in this study (17.3%) was similar to those found in the majority of studies in the UK (2, 20), in the USA (3) and in Brazil (4, 5, 8–11). It is important to note that similar methodologies have been used in these studies, particularly concerning the adoption of the same criteria for clinical examinations of TDI. As methodologies were similar to each other and also similar to that used in this study, the prevalence are comparable. However, to compare our results with other studies that have used other methodologies is inappropriate. For instance, a study carried out in 131 cities in the state of São Paulo, Brazil using a not specific methodology to investigate TDI but rather to investigate dental caries and treatment needs (21) has found a much lower prevalence (2.4%) (22). The same argument can be applied to other population-based Latin American studies such as those performed in Mexico (23) and in the Dominican Republic (24–26).

Differently from what was observed in several studies (1, 7, 9, 27), in this investigation boys did not have more TDI than girls. These results could reflect the fact that girls can be exposed to the same TDI risk factors as boys, a characteristic of a modern Western society. Even in small towns girls can be exposed to the TDI risk behaviours because they are probably involved in physical leisure activities, such as cycling, skateboarding, roller-skating, and playing volleyball. Also, girls could be exposed to traffic accidents and violence in the same way as boys.

The most commonly identified forms of damage were fractures of the enamel only and enamel-dentine fractures, similar to the findings of other Brazilian studies (4, 5, 7–11). Nevertheless one should not expect that small fractures or fractures involving enamel and the dentine do not need treatment or a follow-up protocol with the objective of observing possible sequelae of the impact over the teeth, bones and soft tissues. In the case of TDI, differently from other parts of the body, the processes of healing can last several years and the sequelae can appear more than 5 years after the injury incident (28).

This study showed that 66.7% of traumatized teeth needed treatment. This result corroborates the results of other studies in developed countries (3, 20) and in Brazil (7, 9, 11) demonstrating a great neglect in the treatment of TDI. The reasons for such neglect are unclear. One could suggest that in developing countries, the majority of the population cannot afford private dental treatment and the public services are unable to offer more complex treatments. Nevertheless, high levels of untreated traumatized teeth were found in developed countries as well, such as the UK (20) where quality public dental services are accessible to the majority of the population. One factor that could be determining low rates of treatment is related to the fact that TDI is not a disease and parents might not pay the necessary attention to it. This could be related to the severity of the injury. As the majority of TDI affect only the enamel (4, 5, 7, 9) this could have a lower potential to produce a negative impact on children and their parents. However, one study carried out in Brazil showed that children with untreated dental fracture of permanent teeth had more negative impacts on their daily living than children without any traumatic injury (6).

Another aspect that could be enhancing the treatment neglect is the dentists' lack of knowledge regarding the treatment of dental trauma, both in developed countries (29) and in Brazil (30). The great variability of methodologies used for its classification and a lack of standard treatment protocols and follow-up to assess TDI sequelae

could be resulting in a lack of interest among professionals in continuing education about the up-to-date approach to the treatment of TDI (31). A combination of an evidence-based approach together with clinical judgement, both enhanced by continuing education, would reduce variation in the methodologies and protocols, facilitating treatment decisions and probably resulting in a greater interest in the problem on the part of the professionals.

In this study, the main reported types of incidents that resulted in TDI were collisions (24.5%) mainly against doors, walls and toys and physical leisure activities (20.0%), mainly cycling and playing soccer. The majority of incidents occurred at home and school during leisure and sports activities. This is an important consideration for health policy makers seeking prevention of accidents strategies that could reduce the probability of occurrence of facial and dental injury. These could include national and local campaigns and programmes to increase social awareness about dental injury. Because the impact of TDI on children's daily life is great, in terms of physical and psychological discomfort and pain (6), public policies should include providing specific and appropriate public places for leisure and sports activities, with impact-absorbing surfaces around the items from and on which children are most likely to fall. In addition, specific local laws requiring and regulating the use of safety equipment are necessary. Families and educational authorities must provide safe environments and equipment for children's activities such as cycling and skating with helmets and mouth guards. Moreover, contact sports should be played under competent supervision on appropriate surfaces and with complete safety equipment in order to prevent TDI.

Finally, it is very important to highlight the need for more complete studies including other clinical and socio-economic variables in order to clarify the importance of TDI as a public health problem in Brazil as a whole and in South America.

It can be concluded that incisal overjet was associated with TDI and there is a great treatment need that reflects neglect of its treatment. The main places and activities related to the occurrence of TDI were at home and at school in collisions and physical leisure activities.

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