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Original Article

Prevalence, Etiology and Treatment Needs of Traumatic Dental Injuries in Schoolchildren aged 12 years at Brasília, Brazil

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Abstract

Objective: To investigate the prevalence of dental trauma, its causes, sites and age at the occurrence of injuries and treatment needs related to dental trauma in schoolchildren aged 12 years at Brasília, DF, Brazil. **Material and Methods:** A cross-sectional, population-based study was conducted on a sample of 1,389 schoolchildren of public and private schools. Two questionnaires were used: one targeted to parents/legal caretakers and the other responded by the schoolchildren. The criteria for classification of trauma used in the Children's Dental Survey in the United Kingdom were adopted. The examinations were performed by two trained and calibrated examiners (inter and intra-examiner kappa: 0.85 to 1.00). The association between dental trauma and the study variables was evaluated by the chi-square test. **Results:** A total of 1,445 students were examined, with a response rate of 80.48%. Prevalence of 14.63% (public schools) and 23.40% (private schools) of dental trauma was found. The most common cause of dental trauma was fall (7.87%), followed by collision with objects or persons (5.03%), inadequate use of the teeth (2.33%), sports accidents (2.11%) and car accidents (0.66%). It was observed that 256 students presented injury to at least one tooth, with predominance of enamel fracture (88.67%) followed by discoloration (5.47%), enamel and dentin fracture (3.90%) and tooth loss (1.95 %). The teeth most affected by trauma were the maxillary central incisors. The accidents occurred predominantly at home (44.25%) and at the school (26.99%). Only 28.51% had received treatment for the injuries. **Conclusion:** Dental trauma in the study population was significant, presenting diverse etiology and expressive treatment needs, indicating the importance of preventive programs to inform the population on the possible complications after trauma, as well as the need to follow-up traumatized teeth to avoid subsequent problems.

Keywords: Tooth Injuries; Prevalence; Causality; Therapeutics.

Introduction

Traumatic dental injuries have been considered an important public health problem all over the world [1-3], not only because of their relatively high prevalence but also because the treatment is expensive and has been neglected [4], causing a significant impact in the life of children, adolescents and adults affected by these sudden lesions [5]. These injuries affect the anterior teeth, causing physical and psychological discomfort, pain, loss of chewing and speech function, with possible impact on the quality of life, thus requiring preventive measures [5].

During the last decades, the number of causes of traumatic dental injuries (TDI) has dramatically increased in the scientific literature. The etiology of these injuries includes oral factors, environmental factors and human behavior, which can be further separated into unintentional and intentional TDIs. This progress shows the complexity of etiological relationships between oral, environmental and human factors and TDIs, which warrants separate discussion on the etiology [6]. Knowing the occurrence or induction of TDIs may favor the prevention of these injuries, allowing more conscious and evidence-based educational programs directed to the general population [7].

Some investigators have highlighted the negligence of most countries as to the treatment of TDIs [1,5,8]. This is potentially severe because the trauma is harmful in short, medium and long term [5,9].

The publication of epidemiological data in Brazil is recent and there is lack of data to guide effective preventive programs that actually address the population needs. Few studies have been conducted in Brasília. Thus, this study investigated the prevalence of dental trauma, identified the causes, sites and age at the occurrence of injuries and analyzed the treatment needs related to dental trauma in schoolchildren aged 12 years at Brasília, DF, Brazil.

Material and Methods

This study was approved by the Institutional Review Board of the Health Sciences School at University of Brasília, DF, Brazil (Protocol n. CEP/FS:023/11). The study investigated the prevalence of dental trauma, identified the causes, sites of occurrence of injuries and the child's age at the occurrence of trauma, and analyzed the treatment needs in relation to dental trauma in schoolchildren aged 12 years at Brasília, DF – Brazil.

A cross-sectional, population-based study was conducted for a sample of 1,389 girls and boys aged 12 years, enrolled in public and private fundamental schools at the Administrative Region of Brasília, Brazil.

The sample size was calculated based on a sample error of 1.7%, at a significance level of 5%, prevalence of dental injuries of 20% and a population of 4,000 students aged 12 years, enrolled in public and private schools at Brasília, according to the school census of 2011.

A total of 83 fundamental schools at the administrative region of Brasília were initially invited to participate in the study, being 43 public and 40 private. Only one public school refused to participate, while only 23 private schools accepted to participate in the study.

A letter was sent to all parents or caretakers of selected children explaining the objectives, characteristics and importance of the study. The study was only conducted on children whose caretakers signed an informed consent form. The final sample was composed of 1,445 students (787 from public schools and 658 from private schools).

The non-clinical data included the type of school (public or private), gender and educational level of the caretaker in completed years of study. The socioeconomic data of caretakers were collected by a form previously applied in another epidemiological study (10). One section containing questions on the TDI(s) was added to this questionnaire. This form was sent to the caretakers who accepted to participate in the study, before clinical examination of the children. The clinical and interview forms had been previously tested and did not require adjustments.

Clinical data on dental trauma were collected by oral examinations. The etiology and site of occurrence of dental trauma were obtained by direct interview with the child. The trauma was classified following the criteria of the Children's Dental Health Survey of the United Kingdom [11]. These criteria include fractures, discolorations and tooth loss due to trauma to the permanent dentition. Data were collected by two dentists (Frujeri, MLV and Frujeri, JAJ) aided by two recorders, previously trained and calibrated at the Trauma Center of the Federal University of Minas Gerais (UFMG). The calibration/training exercises lasted 40 hours and consisted of utilization of photographs and images of the several types of trauma and in patients presenting dentoalveolar trauma.

Clinical examinations were conducted at the schools, during school time, in wide areas with enough natural light and the children seated on chairs. All biosecurity procedures were strictly followed. Dental mirrors, CPI periodontal probes and gauze were packed and sterilized in sufficient quantity for each day of work. All permanent teeth were dried before clinical examination to increase the accuracy of diagnosis. The examiner assessed the type of damage, treatment that had been carried out, whether the incisal overjet was smaller or equal to 5 mm or greater than 5 mm, and whether lip coverage was inadequate. The examination was conducted uniformly beginning from the maxillary right quadrant to the mandibular in clockwise direction. When the child was absent from the school at the day of examination, a second visit was performed.

A pilot study was conducted on thirty schoolchildren of the sample to test the methodology. The results demonstrated that it was viable in the local situation. The inter- and intra-examiner diagnostic variability was tested by examinations in duplicate in 10% of the sample and analyzed by the Kappa statistics.

Data were inserted and analyzed on the software SAS 9.2 for Windows. The prevalence of trauma, its causes, sites of occurrence, child's age the occurrence of trauma, treatment performed and treatment needs and their associations were analyzed by the chi-square test, at a significance level of $p < 0.05$.

Results

The response rate was 80.48%. The main reasons for sample loss were the non-authorization by the caretakers and the child being absent from the school at the day of both examinations. The degree of diagnostic reproducibility was high and the kappa coefficients for inter-examiner agreement ranged from 0.85 to 1.00, indicating almost perfect to perfect agreement, with kappa equal to one in most cases.

The kappa coefficients for intra-examiner agreement were all equal to 1.00, indicating perfect agreement for both examiners.

The prevalence of dental trauma according to the variables analyzed was 14.63% for public schools and 23.40% for private schools.

The cause most reported by students who had suffered dental trauma was the fall (42.86%), followed by collision with objects or people (27.38%), inadequate use of teeth (12.70%), sports accident (11.51%), car accident (3.57%) and violence (1.19%).

Concerning the sites of occurrence of trauma, 44.74% occurred at home, 26.75% at the school, 10.09% at the street, and 18.42% in other places (club, hotel, park, sports court and school, fitness studio, daycare center, etc.).

Concerning the child's age at the occurrence of trauma, 26.78% of schoolchildren stated it had occurred at the age of 10 years, 24.59% at 11 years, 16.94% at 8 years, 8.74% at 12 years, 7.10% at 7 years. From a total of 1,445 students, 14 (0.97%) had trauma at two moments and one student at three moments.

The association between the etiology of trauma and the site of the accident was analyzed by the chi-square test (Table 1).

Table 1. Distribution of frequency – cause of trauma according to the site of occurrence – Brasília, DF, 2012.

| Cause | Site | | | | | | | | Total |
|-------------------------|------|-----|--------|-------|--------|-------|--------|-------|-------|
| | Home | | School | | Street | | Others | | |
| | N | % | N | % | N | % | N | % | |
| Fall | 60 | 60 | 22 | 36.07 | 7 | 30.43 | 19 | 45.24 | 108 |
| Car accident | 0 | 0 | 0 | 0 | 8 | 34.78 | 1 | 2.38 | 9 |
| Sports accident | 1 | 1 | 16 | 26.23 | 5 | 21.74 | 6 | 14.29 | 28 |
| Health problem accident | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Inadequate use of teeth | 7 | 7 | 3 | 4.92 | 1 | 4.35 | 0 | 0 | 11 |
| Collision | 29 | 29 | 18 | 29.51 | 2 | 8.70 | 16 | 38.10 | 65 |
| Violence | 1 | 1 | 2 | 3.28 | 0 | 0 | 0 | 0 | 3 |
| Other | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Total | 100 | 100 | 61 | 100 | 23 | 100 | 42 | 100 | 226 |

Chi-square = 102.21 p < 0.0001

The result of the chi-square test revealed significant association between the etiology of trauma and the site of the accident ($p < 0.0001$). Namely, students suffering accidents at home were more associated with the etiology fall, while those suffering accidents at the school were more

associated with sports accident, those suffering accidents at the street were more associated with car accidents and those suffering accidents elsewhere were more associated with collision.

Concerning the association between the cause of trauma and the child's age at the occurrence of trauma, the chi-square test revealed no significant association between the etiology of trauma and the child's age at the occurrence of trauma ($p=0.7910$) (Table 2).

Table 2. Distribution of frequency – cause of trauma according to the child's age at the moment of occurrence – Brasília, DF, 2012.

| Cause | Age at the moment of occurrence | | | | | | | | | | | | | | Total N |
|-------------------------|---------------------------------|-----|----|------|----|------|----|------|----|------|----|------|----|------|------------|
| | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | | |
| | N | % | N | % | N | % | N | % | N | % | N | % | N | % | |
| Fall | 2 | 100 | 6 | 50 | 17 | 54.8 | 22 | 50 | 25 | 51 | 10 | 37 | 4 | 25 | 86 |
| Car accident | 0 | 0 | 0 | 0 | 1 | 3.2 | 1 | 2.3 | 3 | 6.1 | 1 | 3.7 | 0 | 0 | 6 |
| Sports accident | 0 | 0 | 2 | 16.7 | 5 | 16.1 | 3 | 6.8 | 5 | 10.2 | 1 | 3.7 | 5 | 31.2 | 21 |
| Health problem | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 1 |
| Inadequate use of teeth | 0 | 0 | 1 | 8.3 | 1 | 3.2 | 1 | 2.3 | 2 | 4.1 | 2 | 7.4 | 2 | 12.5 | 9 |
| Collision | 0 | 0 | 3 | 25 | 5 | 19.3 | 16 | 36.4 | 13 | 25.5 | 12 | 44.4 | 5 | 31.2 | 55 |
| Violence | 0 | 0 | 0 | 0 | 1 | 3.2 | 1 | 2.3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3.7 | 0 | 0 | 1 |
| Total | 2 | 100 | 12 | 100 | 31 | 100 | 44 | 100 | 49 | 100 | 27 | 100 | 16 | 100 | 181 |

Chi-square =34.41 $p = 0.7910$

The most common injury was enamel fracture (88.67%), followed by tooth discoloration (5.47%), enamel and dentin fracture (3.90%) and tooth loss due to dental trauma (1.95%).

Concerning the treatment needs and treatment performed, it was observed that among 324 (22.42%) students suffering dental trauma only 28.51% had been treated. Concerning the treatment, composite restoration was the procedure most used for restoration of traumatized teeth. There were two cases of fragment bonding and one case of permanent replacement with temporary removable appliance.

Discussion

Despite the great difficulties faced concerning protocols and institutional authorizations required for examination of the study subjects, this study presented a significant response rate and collaborated to the knowledge on the local reality in relation to TDIs, since few population-based studies on dental trauma have been conducted at the city of Brasília, DF, Brazil.

The prevalence of dental trauma varies widely between countries. The reported prevalence ranges from 2.4% to 58.6% [2,3,12-14]. It should be highlighted that it is difficult to establish a comparison with previous studies due to the wide diversity of methodologies employed for the

studies. The prevalence found in this study, namely 14.63% for public schools and 23.40% for private schools, were expressive compared to other studies at the age of 12 years [13,15], similar to others [2,3,8,14,16,17] and lower than other [12].

According to several authors [2,18] the most common causes of TDIs are falls or collisions with objects or people. In the present study, the cause most reported by students suffering dental trauma was fall (42.86%), followed by collision with objects or people (27.38%), corroborating the aforementioned studies [2,18].

The world literature reveals that accidents involving children are a public health problem [19-21]. A study conducted in England demonstrated that more than 700 children die per year, 125,000 are assisted in hospitals and almost 2,000,000 are assisted in emergency services due to accidents [19]. Domestic accidents are included among the main causes of death in children. Falls, intoxications, choking, poisoning, burns, shotgun wounds and electric shocks are the most common accidents occurring at home [21,22]. Other studies conducted in South Africa [23,24] and Brazil [20] also evidenced high rates of children suffering accidents at home, identifying the predisposing factors and materials involved in such accidents. Falls were the most frequent cause of domestic accidents in all these studies.

It has been observed that accidents affect children in contact with risk factors, such as exposure to hazardous areas (kitchen, bathroom, laundry room, stairs, gardens) without appropriate surveillance by the family or an adult. These domestic accidents are related with sociocultural aspects of the family, parents' lifestyle, child's age, his or her psychomotor development and risk situations. An important standpoint in this discussion is the lack of planning in relation to safety standards and prevention of these events, when the caregivers are planning the structure of buildings and homes [20].

The results of these studies demonstrated that the knowledge of parents on the stage of development of the child and the dangers present at home are the most effective way to reduce these accidents. These studies also revealed that accidents with children are alarming and deserve specific attention as a preventive approach. The occurrence of accidents in children may be reduced by regional studies and development of specific prevention programs. The reduction of these accidents should be based on education, which requires the involvement of several population segments with the objective of ensuring to children and their families the access to information and treatments to reduce this problem, preventing the continuation of underestimation of accidents with children.

Concerning the TDIs, previous studies show significant occurrence of these injuries due to fall in the domestic environment (13.44 %). The oral region corresponds to 1% of the entire body area, yet it represents 5% of all injuries. In preschool children, oral lesions correspond to 17% of all injuries. The occurrence of traumatic dental injuries is 1% to 3%, and the prevalence is stable around 20% -30%. The yearly cost of treatment is \$ 2- \$5 million per 1 million inhabitants. The etiological factors vary between countries and age groups. These implications are important for public health and should be observed to improve the organization of emergency dental services and avoid dental

lesions, reduce costs and increase the knowledge of the lay population. Observation of these factors is important and necessary to change the epidemiological data and obtain more favorable values in the future [25]. This study revealed a high percentage of falls at home (Table 1). This high percentage, combined with collisions that can also lead to falls, is very significant. Analysis of these studies reveals the variability of accidents involving children and emphasizes the fact that the high prevalence of TDIs is inserted in a broader epidemiological context than currently analyzed.

A previous study [14] emphasized the complexity and subtlety of the actual classification of the etiology of dental trauma. People who fall because of a shove reports this accident as a fall. In this study, when the reason for the fall was assessed, several schoolchildren stated they had fallen as a consequence of intentional shove by another schoolchild during plays or sports activities. Therefore, we agree with that author that this fall should be notified as an act of violence, and not as an accidental fall.

The inadequate use of teeth was significant in this study (12.70%). Analysis of the subtypes in this aspect revealed reports of tooth fractures due to noxious habits to the teeth, such as chewing hard lollipops, pencils and pens, opening clasps, bottles, cans and even while fixing equipment and opening compartments with the teeth.

The sports activity has been indicated as a significant cause in the occurrence of TDIs. Some studies reveal high prevalence of these injuries in athletes and people practicing sports, especially contact sports [2,26,27]. In this study, a prevalence of 11.5% was found. Even though this prevalence was lower than found in the aforementioned literature, there is the need of greater awareness of individuals practicing sports concerning the use of preventive measures as the use of mouthguards.

This study revealed a low prevalence of TDIs compared to car accidents (3.57%) and violence (1.19%), different from some previous studies [28-30]. This may be related to the age of individuals surveyed, who still depend on their caretakers or school transportation for their displacement. It may also be related to the environmental characteristics and traffic in the city where the study was conducted, which is very organized with low rates of car accidents.

Concerning the sites of occurrence of trauma, 44.74% occurred at home, 26.75% at the school, 10.09% at the street, 18.42% elsewhere (club, hotel, park, sports court and school, fitness studio, daycare center, etc.). These results corroborate other studies [9,29,30] that also reported high prevalence of TDIs at home. The high occurrence of these injuries at home and at the school, where children naturally spend most of their time, reinforce the need of care by the family and school authorities to provide safer environments for the leisure activities and close supervision of children in these environments. Concerning the child's age at the moment of trauma, 26.78% of schoolchildren stated it had occurred at the age of 10 years, 24.59% at 11 years, 16.94% at 8 years, 8.74% at 12 years, and 7.10% at 7 years. From a total of 1,445 students, 14 (0.97%) had trauma at two moments and one student at three moments. Even though the quantity of students suffering trauma was

higher for the ages of 10 and 9 years, there was no significant association between the etiology of trauma and the child's age at the occurrence of trauma ($p=0.7910$) (Table 2).

Previous studies reported negligence concerning the treatment of TDIs [2,13,31], which was also evidenced in this study. It was observed that, among 324 (22.42%) schoolchildren suffering dental trauma, only 28.51% had been treated. In another study [2], the authors suggested that, even though the reasons for this negligence are not clear, this may be related to the poor access of the population to private treatment, stating that the public services do not offer complex treatments, yet in this study it was observed that most caretakers of children suffering trauma to their teeth reported they attended a private dentist. Thus, it may be assumed that this negligence is related to the lack of knowledge on the potential risks and possible complications in relation to dental trauma, as well as the need to follow-up these injuries. In this study, in the section on self-perception in relation to dental trauma, 31.84% of caretakers reported that, after the accidents, there was no immediate care after dental trauma. In addition, it was observed that only 14% of caretakers reported they had knowledge on first aid in case of dental trauma.

Conclusion

The dental trauma in the study population was significant, presenting diverse etiology and expressive treatment needs, indicating the importance of preventive programs to inform the population on the possible complications after trauma, as well as the need to follow-up traumatized teeth to avoid subsequent problems.

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