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ORIGINAL ARTICLE

Assessment of the Need for Dental Treatment Resulting From Dental Trauma in 12-Year-Old Brazilian Schoolchildren: A Cross-Sectional Study

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Abstract

Objective: To identify the need for restorative treatment in 12-year-old Brazilian schoolchildren with dental trauma and its association with clinical and socioeconomic factors. **Material and Methods:** A cross-sectional population-based study was carried out with sample composed of 588 12-year-old students from the city of Diamantina, Minas Gerais, Brazil. Data were collected from August to November 2016 through clinical examination, adopting the Andreasen classification and semi-structured questionnaire to verify the etiology and location of the accident that resulted in dental trauma. Statistical analysis included the frequency distribution and bi and multivariate analysis, with 5% significance level. **Results:** The presence of 219 traumatized teeth in 176 students was observed (29.9%). The main lesion was enamel fracture (41.4%), followed by enamel and dentin fracture (39.4%). The presence of restorative treatment was observed only in 11.5% of students. Fall (43.5%) was the most frequent etiology, followed by accidents on the streets (35.8%). Need for treatment was present in 53.4% of adolescents. Statistically significant association between males (p=0.010), severe overjet (p<0.0001) and inadequate lip protection (p<0.0001) and presence of dental trauma was observed. Maternal schooling over 8 years of study was statistically associated with need for restorative treatment (OR = 2.047; CI: 1.099-3.813; p=0.023). **Conclusion:** Prevalence of dental trauma, need for restorative treatment and number of adolescents with no access to restorative treatment in this study were high, point out that the health system is unable to satisfactorily prevent dental trauma and absorb all dental treatment demand resulting from dental trauma.

Keywords: Epidemiology; Oral Health; Tooth Injuries; Tooth Fractures.

Introduction

Among oral alterations, dental trauma stands out as one of the most serious public health problems in children and adolescents, with high prevalence and high psychosocial impact [1-3]. Dental trauma can be defined as any injury of thermal, chemical or physical nature that affects teeth, of varying intensity, severity and extension and can be recognized from a small enamel fracture to the complete loss of the dental element, which origin can be accidental or intentional [1].

Individuals affected by dental trauma can present numerous changes such as loss of structure, sensitivity and tooth mobility, root resorption, changes in dental crown color and pulp necrosis. The consequences and sequelae of a traumatized tooth can take long time to manifest, and the healing and repair process does not occur immediately after the accident [1,4].

The main etiologies of dental trauma are falls, collisions with objects or people, automobile accidents, sports practices and violence [5], with the majority of studies pointing out that falls and collisions are more prevalent [6-9]. The location of the occurrence of dental trauma varied according to local or cultural habits. Environmental, behavioral factors, socioeconomic status and architecture of parks and schools play an important role in the etiology of dental injuries [6], with home, street or school being the main locations reported in literature [6,9-11].

Clinical factors such as lip coverage and horizontal overjet of teeth have also been identified as predisposing to dental trauma. Lip covering is responsible for protecting the teeth by absorbing and cushioning possible impacts during a collision. Thus, individuals with inadequate lip coverage and greater horizontal overjet would be more likely of suffering traumatic injuries to anterior teeth [1,12].

The immediate need for treatment aims to ensure pain control, restoration of function, aesthetics and prevention of social and psychological consequences for children and adolescents affected by dental trauma [13]. Studies have suggested that dental trauma is often not properly treated, being often neglected as an emergency care [14]. The high cost of initial care and the need for patient proservation, in some cases for a longer period of time, stands out [15,16].

In recent years, several studies have investigated the prevalence of dental trauma and associated factors, highlighting the importance of its knowledge for planning health policies, but few have evaluated the presence of dental treatment for traumatized teeth or its need. Therefore, the aim of the present study was to investigate the need for restorative dental treatment due to dental trauma and associated factors in 12-year-old adolescents in the city of Diamantina, Minas Gerais, Brazil

Material and Methods

Study Design and Sample Characterization

The present study was carried out in the municipality of Diamantina, located in northeastern state of Minas Gerais, with approximately 46,372 inhabitants. The municipality has literacy rate of 83.4% and Human Development Index (HDI) of 0.716, being considered by the United Nations Development Program (UNDP) as having the best index among cities belonging to the Vale do Jequitinhonha region of Minas Gerais [17].

This cross-sectional population-based study was carried out between August and November 2016 and aimed at adolescents aged 12 years enrolled in elementary schools of the urban area. Adolescents were randomly selected from public and private schools. For sample calculation, maximum population variability (0.25) was used with 95% confidence level, $Z\ \alpha / 2 = 1.96$; 4% estimation error, $d = 0.03$. The minimum sample size calculated was 546, adding 10% to compensate for possible losses, totaling 601 adolescents.

The age of 12 years was chosen because it is the age recommended by the World Health Organization [18] to represent the population of adolescents in oral health epidemiological studies, which coincide with the end of the period of mixed dentition and being the age of greatest incidence of dental trauma 1, enabling comparison among studies.

Data Collection

Authorizations for the conduction of the study were obtained from Municipal and State Health and Education Secretariats. Subsequently, pre-scheduled visits were made to all participating schools requesting the collaboration of the board, teachers and supervisors. Awareness-raising lectures were held in classrooms, highlighting the importance of participation and consent of students and their guardians through the signing of the informed consent form and assent form, explaining the importance of participation and the conduction of epidemiological studies and knowledge of possible results in order to achieve changes and improvements on the behalf of the community.

Information about socioeconomic status was collected through maternal schooling in years of study and family income through the sum of all wages received by economically active members living with the adolescent, divided by the current minimum wage. For statistical purposes, maternal schooling was dichotomized in up to eight years of study and above eight years, coinciding with the end of elementary school and the average years of study of the Brazilian population [17]. Family income was dichotomized by the median. The questionnaire with questions related to socioeconomic status was sent to parents / guardians of adolescents together with the informed consent form (ICF). For results to be correlated and guarantee secrecy and confidentiality of data, clinical file and questionnaires were coded.

Prior to data collection, the methodology was tested in a pilot study with a convenience sample of 101 12-year-old students who did not participate in the main study. In the pilot study, the examiner was trained by an expert in dental trauma, and at this moment, all doubts regarding trauma classification and variables involved were resolved. No changes to the proposed methodology were necessary.

On a day previously scheduled with the school management, a room was reserved for data collection. The team consisted of an examiner, dentist with solid clinical experience, previously trained and calibrated for the diagnosis of dental trauma, need for restorative treatment and clinical variables (Kappa 0.79 and 0.88), a note taker, who filled out data and an assistant who took students to the examination site. Sex and date of birth were recorded during clinical examination and confirmed by school records. The environment had good natural lighting, as well as artificial lighting with continuous-flow Petzl lamp.

For the clinical examination, the student was seated in front of the examiner. Teeth were dried and cleaned with sterile gauze and through clinical mirror, all permanent incisors were examined. Periodontal probe was used to assist in the removal of possible residues and to evaluate the presence and quality of restorations [1] and to measure the horizontal overjet, which was considered to be accentuated above 5 mm. Lip protection was observed without adolescents realizing it, while answering the questions asked by the examiner. All instruments were sterilized in accordance with biosafety guidelines and in sufficient amount for one day of examination (± 25 examinations per day).

Andreasen's classification [1] was adopted to assess the presence of dental trauma. When the presence of trauma was detected, the adolescent was asked about its etiology, location of the accident, time since trauma, if there was any assistance and, if so, what type of assistance. The need for restorative treatment was also assessed. All adolescents with dental trauma were referred for restorative treatment and proservation at the Dental Traumatism Clinic of the Dentistry Course, Federal University of Vales do Jequitinhonha and Mucuri.

Statistical Analysis

Data analysis was performed using the SPSS Statistical Package for the Social Sciences (SPSS for Windows, version 19.0, SPSS Inc, Chicago, IL, USA) and included frequency distribution and association tests. Statistical significance for the association between need for restorative treatment due to dental trauma and independent variables in the bivariate analysis was determined using the chi-square test ($p<0.05$).

Ethical Principles

The research project was submitted to and approved by the Ethics Committee for Research with human being of the Federal University of Vales do Jequitinhonha and Mucuri (Protocol No. 1.597.571). Adolescents received the Free and Informed Consent Form addressed to parents / guardians and also the Assent Form directed addressed to adolescents themselves, according to principles established by Brazilian Resolution 466/12. Only adolescents authorized by parents / guardians and who agreed to participate participated in the study.

Results

The final sample consisted of 588 students, representing 97.8% participation, of these, 176 had dental trauma, which represented prevalence of 29.9% with 219 traumatized teeth. Most adolescents had only one traumatized tooth (Table 1), with upper central incisors being the most affected (n = 182; 83.9%), with no statistical difference between right and left sides (p=0.965).

Table 1. Frequency distribution of students with traumatized teeth.

Number of Traumatized Teeth	N	%
One	138	78.4
Two	33	18.7
Three	04	2.3
Four	01	0.6

One hundred and twenty of adolescents with dental trauma (68.2%) had horizontal overjet greater than 5 mm and 136 (77.3%) had inadequate lip protection.

The most prevalent alteration in the first fractured tooth was enamel fracture and / or crack (n = 77; 35.5%), followed by enamel / dentin fracture without pulp exposure (n = 71; 32.7%). The most common alteration in the second tooth was enamel / dentin fracture without pulp exposure, followed by enamel fracture and / or crack. In the third fractured tooth, the most common alteration was enamel / dentin fracture without pulp exposure. Although 219 traumatized teeth were observed, only 25 (11.4%) had restorative treatment (Table 2).

Table 2. Distribution of dental trauma according to the number of traumatized teeth.

Type of Dental Trauma	Number of Traumatized Teeth		
	One	Two	Three
	N (%)	N (%)	N (%)
Enamel Fracture and / or Crack	77 (35.1)	12 (5.5)	1 (0.4)
Enamel / Dentin Fracture without Pulp Exposure	71 (32.7)	17 (7.8)	2 (0.8)
Enamel / Dentin Fracture with Pulp Exposure	3 (1.4)	0 (0.0)	1 (0.4)
Lateral Dislocation	1 (0.4)	0 (0.0)	0 (0.0)
Intrusive Dislocation	6 (2.8)	1 (0.4)	1 (0.4)

Color Change	1 (0.4)	0 (0.0)	0 (0.0)
Restoration Due to Trauma	17 (7.8)	8 (3.7)	0 (0.0)
Total	176	38	5

Most adolescents (52.4%) did not inform or did not remember the period of the day when trauma occurred. Of the 82 adolescents (46.6%) who could answer, 51 (62.2%) reported the afternoon, 16 (19.5%) the morning and 15 (18.3%) the evening. The main etiological factor was fall (n = 40; 43.5%) followed by playing with others (n = 16; 17.4%), on the streets (n = 33; 35.8%). Fifty-nine adolescents (33.5%) were able to inform the time elapsed from the accident, with the majority reporting that it occurred more than a year ago. Only 39 adolescents (22.2%) received dental care after dental trauma and 105 adolescents (59.7%) did not receive any type of care / follow-up.

The need for restorative treatment was present in 94 adolescents (53.4%). Of these, 56 (59.6%) were male, 91 (96.8%) attended public schools. Seventy-six adolescents (43.1%) declared family income below 3 minimum wages.

Severe horizontal overjet (≥ 5 mm) was present in 59 adolescents (62.7%) and most had inadequate lip protection (n = 62; 45.6%). Of the 176 adolescents who suffered dental trauma, 94 (56.4%) needed restorative treatment. Of these, 42.6% needed restorations in composite resin and 9.65% needed endodontic treatment prior to resin restoration.

Table 3 shows the results of the association test between need for restorative treatment due to dental trauma and independent variables. In the study sample, only maternal schooling over 8 years of study (Complete Elementary School) (OR = 2.047; CI: 1.099-3.813; p=0.023) was associated with need for treatment.

Table 3. Dental trauma distribution and need for treatment according to clinical and socioeconomic factors.

Variables	Dental Trauma		p-value	Need for Treatment		p-value
	Yes N (%)	No N (%)		Yes N (%)	No N (%)	
Sex						
Female	76 (25.2)	226 (74.8)	0.010*	38 (50.0)	38 (50.0)	0.429
Male	100 (35.0)	186 (65.0)		56 (56.0)	44 (44.0)	
Maternal Schooling						
≥ 8 Years of Study	106 (28.2)	270 (71.8)	0.237	49 (46.2)	57 (53.8)	0.023*
< 8 Years of Study	69 (32.9)	141 (67.1)		44 (63.8)	25 (36.2)	
Family Income**						
< 3 Minimum Wages	135 (30.5)	307 (69.5)	0.605	76 (56.3)	59 (43.7)	0.164
≥ 3 Minimum Wages	41 (28.3)	104 (71.7)		18 (43.9)	23 (56.1)	
Horizontal Overjet						
< 5 mm	120 (23.9)	383 (76.1)	<0.0001*	59 (49.2)	61 (50.8)	0.099
≥ 5 mm	56 (65.1)	30 (34.9)		35 (62.5)	21 (37.5)	
Lip Protection						
Adequate	40 (12.6)	277 (87.4)	<0.0001*	20 (50.0)	20 (50.0)	0.623
Inadequate	136 (50.2)	135 (49.8)		74 (54.4)	62 (45.6)	

*Statistically Significant; **Brazilian Minimum Wages.

Discussion

The present study showed prevalence of dental trauma of 29.9% among adolescents aged 12 years. This result is higher than studies carried out in Biguaçu, Herval D'Oeste and Palhoça, cities located in southern Brazil, which showed prevalence of 10.7%, 17.3% and 22.5%, respectively, in adolescents with the

same average age [1,19,20]. However, this prevalence was similar to study carried out in Montes Claros, in the northeastern region of the state of Minas Gerais, Brazil, using the same methodology, finding prevalence of 34.9% [10]. This variation in prevalence can be attributed to cultural aspects peculiar to each population and also to the lack of methodological standardization.

The most frequent lesion was enamel fracture followed by enamel and dentin fracture without pulp exposure. These results are in accordance with national epidemiological studies that also reported enamel fractures as the most prevalent [1,3,9,13]. According to literature, teeth most commonly affected in dental trauma are upper central incisors, lower central incisors, lower lateral incisors and upper lateral incisors, which corroborates results of the present study. As trauma affects anterior teeth, studies highlighted the negative impact on quality of life in terms of physical and psychological discomfort, in addition to the high potential for negative interference in social relationships such as aesthetics impairment and psychological problems, making the affected individual to avoid talking and smiling, in addition to functional difficulties such as biting or chewing [21,22].

The etiology and location of accidents that resulted in dental trauma were investigated through participants' self-report. Falls on the streets were the main causes of dental trauma. Fall was the main etiological factor reported in studies that investigated etiological factors [4,5,8,16,20]. In a recent retrospective study in children under 5 years of age, falls were also observed as the most prevalent etiological factor (64.4%) [8]. Although in the present study no case of trauma was associated with situations of violence, many of these falls may be the result of acts of aggression, thus, intentional trauma could be underestimated [23-25]. Regarding the accident site, controversial results have been reported. In the city of Herval D'Oeste, the main accident site was the school [7], differing from this study where the highest occurrence was observed in the streets. Probably, the place of occurrence can be explained by cultural and geographical aspects. Diamantina is a country town with emphasis on cultural and tourist aspects. It offers satisfactory security with municipal guards protecting its historical heritage and, consequently, its population. Thus, children and adolescents still have fun playing in the streets and frequently walk to schools. However, some factors such as its rugged relief and central streets with typical paving of irregular stones must be considered, which could lead to greater occurrence of accidents, unlike other locations [26].

Most interviewees did not remember the place where the trauma occurred or its etiology. This can be explained by the fact that most lesions affected the enamel, often imperceptible and, when added to the presence of bodily injuries, would result in not seeking immediate dental treatment [23]. Thus, it is necessary to create and monitor safe environments for children and adolescents, to provide information to parents and teachers both for preventive actions and for handling dental trauma in order to minimize its prevalence, as well as its sequelae [24].

Only 39 adolescents (22.2%) received dental care. This result is superior to other studies carried out in Brazil, such as Palhoça [20], with 6.60% and Biguaçu [19] with 15.60% of adolescents who received dental care.

It is important to consider that most dental injuries in the present study occurred in the form of enamel cracks and fractures, requiring, in most cases, no type of restorative treatment, therefore reflecting in lower percentage of dental care received, which needs proservation, as sequelae may appear later [1]. However, the study points out that the Public Health System is still unable to meet all of the demand, either due to the need for more educative actions to inform the population about dental trauma and its consequences,

or due to the low number of dentists in the network. Immediate care for the traumatized patient is crucial to establish a positive prognosis; moreover, injuries can be more critical than they clinically appear to be [4].

Hospital care intervenes in cases of polytrauma, and when it comes to dental fractures, the patient should seek a dentist in a specialized dental office [27]. Other factors that could also be associated with low treatment rate are the fear that many people have about dental treatment and the low socioeconomic conditions, which make the search for treatment unfeasible. The literature also highlights that the neglect of treatment may be a consequence of the low level of knowledge of dentists regarding the management of dental trauma and its proservation [27-28]. In a study assessing the level of knowledge of dentists in Rio Grande do Sul on the management of traumatic dental injuries, it was concluded that the general level of knowledge of professionals about the guidelines of the International Association of Dental Traumatology (IADT) is moderate, highlighting the need for continuing education on dento-alveolar trauma [29]. A literature review with the aim of evaluating the extent of physicians' knowledge on dental trauma management for lesions of the dental structure, supporting bones, periodontium and soft tissues, showed deficiency in knowledge and confidence in the treatment of dental trauma, justifying the intervention of educators [13].

The fact that the majority of the Brazilian population is considered socially and economically vulnerable and the difficulty of scheduling dental treatment in public services, may contribute to the low number of restorative treatments observed in this study [21].

Of the 176 adolescents who suffered dental trauma, 94 (56.4%) needed restorative treatment and the majority had indication of composite resin restoration. These treatments are of low complexity and are available in public dental services. However, when radiographies are indicated for treatment and control and endodontic treatment prior to restorative treatment, the difficulty of accessing public health services is even greater due to its complexity not yet met by Dental Specialties Centers (CEO). In 2016, less than half of municipalities in the southern region of Brazil had dental radiographic equipment, and among those who had such equipment, half did not perform any procedure [30]. In other regions of the country, CEOs show service disorganization at different levels of care, impairing the integrality of care and overloading the health care network [14], in addition to waiting time for inadequate endodontic treatment and flows that do not follow defined standards [31].

The results of this study showed that maternal schooling over 8 years was associated with greater need for restorative treatment. This result corroborates study carried out in Biguaçu, Brazil [19]. Lower maternal schooling was associated with worse quality of life related to oral health in adolescents, living in urban areas [32] and in rural areas [33]. Some authors suggest the need for female presence in the labor market, which would culminate in the delegation of childcare to third parties [34]. Thus, literature highlights the conflict of results, requiring further studies to establish the behavior of this variable in relation to oral health.

Health professionals must be prepared to identify and advise parents / guardians on the best measures to be adopted after dental trauma. The lack of treatment at the right time and the need for follow-up for a longer period of time can also lead to complications such as changes in color, mobility, dental arch, painful symptoms, sensitivity, internal and external root resorption, necrosis and loss of the dental element, which can lead to difficulties in social interaction, low self-esteem and problems with future relationships, especially in the absence of the dental element [4].

Comparing the results of studies involving the population is extremely difficult, since there is no uniformity of methodologies [16,19]. Thus, further studies should be developed with standardized protocol, so that comparisons can be made through analysis of their data.

The limitations of the present study must be considered and mainly result from memory bias, probably present when interviewees reported information regarding the conditions in which dental trauma occurred. Thus, a more accurate report should be obtained through more judicious approach evaluating, for example, access to restorative treatment.

Conclusion

The need for restorative treatment in a considerable number of adolescents affected by dental trauma who did not have access to restorative treatment points to the poor preventive profile of health systems, as well as their inefficiency in absorbing all the dental treatment demand presented in this portion of the population.

Authors' Contributions

HNP	0000-0002-4476-8842	Investigation and Writing - Original Draft Preparation.
CMPA	0000-0001-6012-9058	Investigation and Writing - Original Draft Preparation.
KBS	0000-0002-9462-2315	Investigation and Writing - Original Draft Preparation.
TTVS	0000-0001-7198-4981	Investigation and Writing - Original Draft Preparation.
PMOF	0000-0002-1725-5531	Writing - Review and Editing.
PCPP	0000-0002-5960-4760	Conceptualization, Methodology, Formal Analysis and Writing - Review and Editing.

All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

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