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Prevalence and association of dental injuries with socioeconomic conditions and alcohol/ drug use in adolescents between 15 and 19 years of age

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Correspondence to: Kelly O. Jorge, Rua Três, 131/303, 32280-640 Contagem, Minas Gerais, Brazil Tel.: +55 31 8537 4742 Fax: +55 31 3409 2472 e-mail: kellyoliva@yahoo.com.br Accepted 7 August, 2011 Abstract – Background: The aim of the present study was to investigate the prevalence of dental trauma, etiological factors, predisposing factors, and associations with socioeconomic status and the risk of alcohol and illicit drug use among adolescents in the city of Belo Horizonte, Brazil. Methods: A crosssectional study was carried out that included clinical examinations and selfadministered questionnaires. The sample population was composed of 891 adolescents from public and private schools. The Social Vulnerability Index (SVI) was used for socioeconomic classification. Information on alcohol and illicit drug use was obtained using two questionnaires: the Alcohol Use Disorders Identification Test (AUDIT) and the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST). Results: The prevalence of traumatic dental injury (TDI) was 24.7%. Falls (17.7%) was the most frequently cited etiological factor in dental injury. Among the participants with TDI, 32.8% were students in the private school system (P = 0.006). A total of 56.8% of individuals with accentuated overjet had some type of TDI (P = 0.000). There was a high prevalence of adolescents who consumed alcoholic beverages (50.3%) and used illicit substances (15.2%). However, no statistically significant associations were found between these variables and the presence of TDI. The results of the analysis demonstrate that individuals in a private school system [prevalence ratio (PR) = 1.11; 95% confidence interval (CI): 1.03-1.20] and those with accentuated over jet (>3 mm) (PR = 1.17; 95% CI: 1.10-1.25) had a 1.11- and 1.17-fold greater chance of belonging to the group of individuals diagnosed with some type of TDI. Conclusions: The prevalence of dental trauma in the study population was high. The same was true regarding alcohol and illicit drug use among the adolescents examined, although no statistically significant associations were found between these variables and a history of TDI. Private school system and accentuated overjet were significantly associated with dental trauma.

Dental trauma has become a public health problem among adolescents. There is a high prevalence of dental trauma in the adolescent population, and the trauma causes functional harm to the oral structures. Chewing difficulties and speech problems stem from dental trauma and impact quality of life (1, 2). Falls, collisions, physical violence, sports, and traffic accidents are the main etiological factors of dental trauma (3). However, the influence of socioeconomic factors is insufficiently defined in the scientific literature (1, 4, 5); the few studies that have investigated this association present conflicting results (6).

Alcohol abuse occurs equally in the adult and adolescent populations. According to the Fifth National Survey of Students carried out in 2004 by the Brazilian Information Center on Psychotropic Drugs, 65.0% of the students surveyed reported the use of alcohol, and 7.0% reported heavy use of 20 times or more in the previous month (7). Such behavior increases the chances of social and clinical problems occurring and the abuse of illicit drugs (8). The main consequences of this behavior are traffic accidents, violence, unintentional injuries, and the encouragement of risky behavior, which could result in damage to dental tissues (9).

Adolescence is a stage of development characterized by considerable exposure and vulnerability to drug use. The period of greatest risk for the initiation of habits involving cigarettes, alcohol, and/or marijuana is prior to the age of 20 years, and the period of risk for other illicit drugs is prior to the age of 21 years (10). A number of studies have associated drug use with a high prevalence of caries, poor gingival health, and poor oral hygiene (8, 11). However, data on the association of the use of psychotropic substances with dental trauma are scarce.

The aim of the present study was to determine the prevalence of dental trauma and describe the etiological and predisposing factors associated with such trauma. A further aim included determining whether dental trauma was associated with socioeconomic factors and the risk of alcohol/illicit drug use among adolescents.

Materials and methods

Sample characteristics

A cross-sectional study was carried out that involved male and female adolescents between 15 and 19 years of age who attended 717 public and 174 private schools in the city of Belo Horizonte between August 2009 and February 2010. Belo Horizonte is the state capital of Minas Gerais, Brazil, and has approximately 2 million inhabitants. It is an industrialized city that is geographically divided into nine administrative districts with considerable social, economic, and cultural disparities (12–14).

A representative sample of 936 adolescents was randomly selected using a stratified cluster sampling method. The sample size was calculated to give a standard error of 2.0%. A 95.0% confidence interval (CI) and 16.1% prevalence of traumatic dental injury (TDI) (4) were used for the calculation. The minimum sample size needed to satisfy the requirements was estimated to be 503 individuals. To compensate for possible losses, the sample size was increased by 20.0% (n = 603), and a correction factor of 1.5 was applied to increase the precision (n = 905). The inclusion criterion was the presence of all four upper and lower incisors in the oral cavity, unless they were missing owing to avulsion. The exclusion criteria were the loss of dental structures owing to carious lesions and the use of a fixed orthodontic appliance.

Non-clinical data collection

The Social Vulnerability Index (SVI) was used for socioeconomic classification. This index measured social exclusion in the city of Belo Horizonte. The city hall database of SVI scores for each district was used based on the address of each family (15). This index has 20 variables for quantifying access to housing, schooling, income, jobs, legal assistance, health, and nutrition. The index values range from 0 to 1, with higher values denoting worse community conditions and a greater vulnerability to social exclusion in the community in question.

Information regarding the consumption of alcohol and illicit drugs was collected using two self-administered questionnaires: the Alcohol Use Disorders Identification Test (AUDIT) and the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST), both of which have been validated for use in Brazil (16, 17). AUDIT is a simple method of screening for excessive drinking and consists of ten questions regarding recent alcohol use, symptoms of alcohol dependence, and alcohol-related problems. This screening tool helps to identify whether an individual exhibits hazardous (or risky) drinking, harmful drinking, or alcohol dependence (16). The scores are as follows: a score of up to 7 points denotes abstinence or low-risk use, a score of 8-15 points denotes risky use, a score of 16-19 points denotes harmful use, and a score of 20-40 points denotes possible dependence. The ASSIST questionnaire is composed of eight questions regarding the use of nine classes of psychoactive substances (tobacco, alcohol, marijuana, cocaine, stimulants, sedatives, inhalants, hallucinogens, and opiates). The questions address the frequency of use and related problems, concern on the part of people close to the user, negative effects on the performance of expected tasks, unsuccessful attempts to cease or reduce use, compulsive feelings, and drug use through injection (17). A risk score ranging from 0 to 4 is provided for each substance with the sum total ranging from 0 to 20. Scores are grouped as follows: 0-3 indicates occasional use, 4-15 indicates abuse, and ≥ 16 indicates dependence. The questionnaires were handed out in the classroom by the researchers and collected immediately after being filled out.

Clinical data collection

Dental examinations were performed by two dentists (K.O.J. and P.M.) and three assistants who had participated in a calibration exercise. The calibration was carried out with color slides of each type of injury in the permanent dentition, with two images of each injury. The results of the examinations were compared with the judgment of a dentist with experience in traumatology (gold standard). Intra- and inter-examiner agreement was determined using the kappa index (0.89 and 0.92, respectively).

The adolescents were examined at school. The examination for TDI only involved the upper and lower central and lateral incisors. Artificial light (Petzl Zoom head lamp®; Petzl America, Clearfield, UT, USA) provided the standardized light source for the examination. The teeth were dried with dental gauze, and a mouth mirror was used for the examination. The examiners were seated in front of the seated participant. The examiners used appropriate individual cross-infection protection equipment, and all instruments and necessary materials were packaged and sterilized.

The criteria for the classification of dental trauma were those proposed by Andreasen and colleagues (18). To measure overjet, the examiners placed a disposable tongue retractor perpendicular to and in contact with the vestibular face of the lower incisors, marking the contact edge of the upper incisors with the point of a no. 2 pencil. Using a millimeter ruler, the measurement from the tip of the tongue retractor to the pencil mark constituted the overjet. The overjet was categorized as: (i) \leq 3 mm and (ii) > 3 mm (19).

Ethical considerations

The study received approval from the Ethics Committee of the Universidade Federal de Minas Gerais (Brazil). Authorization was obtained from the schools. The participants and their parents/guardians signed informed consent forms. The participants were assured anonymity and confidentially regarding their answers.

Statistical analysis

Data analysis was performed using the Statistical Package for Social Sciences (SPSS for Windows, version 17.0; SPSS Inc., Chicago, IL, USA). Descriptive and bivariate analyses were carried out using the chi-squared test (P < 0.05). Poisson logistic regression was used in the multivariate analysis. The criterion for inclusion in the model was a significance value of < 25% in the outcome of the bivariate analysis.

Results

The final sample group was composed of 891 adolescents [352 boys (39.5%) and 539 girls (60.5%)] with a mean age of 16.3 ± 1 years. Among these participants, 80.5% attended public schools and 19.5% attended private schools. The dropout rate was 1.5% (14 individuals). The losses were mainly due to refusals on the part of the adolescents or non-authorization from parents/guardians.

A total of 220 individuals exhibited some type of dental trauma (prevalence of 24.7%). The most common type of injury was enamel fracture (152 participants; 17.1%), followed by enamel and dentin fracture without pulp exposure (57 participants; 6.4%). The upper central incisors were the most affected teeth (119 participants; 20.2%). Falls (17.7%), playing around with others (12.7%), and collisions (10.0%) were the most frequently cited etiological factors of dental injury (Table 1). Among the 352 male participants, 97 (27.6%) had some type of dental trauma. However, there was no statistically significant association between dental trauma and gender (Table 2).

Among the 803 participants without accentuated overjet (≤ 3 mm), 634 (78.9%) had no TDI; the difference in overjet between those with and without TDI was statistically significant (P = 0.000). A total of 163 adolescents (22.7%) in the public school system and 57 (32.8%) in the private school system had a history of TDI; the higher prevalence among adolescents in the private school system was statistically significant (P = 0.006). The SVI was dichotomized as more vulnerable (social classes 1 and 2) and less vulnerable (social classes 3, 4, and 5). A total of 118 adolescents (24.7%)

Table 1. Distribution of adolescents with traumatic dental injury (TDI) and related cause of injury

Cause of TDI	N	%
Falls	39	17.7
Playing	28	12.7
Collision	22	10.0
Violent incident	16	7.3
Sports	14	6.4
Use of teeth for functions other than eating	13	5.9
Chewing	11	5.0
Traffic accidents	4	1.8
Unknown	73	33.2
Total	220	100

among those classified as having greater social vulnerability and 102 (24.6%) of those classified as having lesser social vulnerability had some type of dental trauma. Thus, no statistically significant association was found between the SVI and history of dental trauma (Table 2).

In the overall sample group, 448 individuals (50.3%) ingested alcoholic beverages at a frequency ranging from less than once a month to at least four times a week. Among the 63 adolescents who reported drinking alcoholic beverages two to three times a week, 37 (57.8%) were between 15 and 16 years old, and seven (10.9%) were between 18 and 19 years old. AUDIT scores were dichotomized as 7 points or less (low risk) and 8–40 points (risky use to possible dependence). In total, 730 individuals (82.2%) were classified as having low risk, and 158 (17.7%) were classified as having risky use to possible dependence. Among the individuals classified as having low risk for alcohol intake, 545 (74.5%) had no type of dental trauma (Table 2).

Tobacco use was reported by 168 adolescents (18.9%), and the consumption of illicit substances was reported by 15.2%. Regarding illicit drugs, the prevalence of inhalants achieved the highest value (reported by 70 participants; 7.9%), followed by marijuana (66 individuals; 7.4%) and hypnotics or sedatives (22 individuals; 2.5%). Cocaine or crack (18 individuals; 2.0%), hallucinogens (14 individuals; 1.6%), amphetamines (13 individuals; 1.5%), and opiates (1 individual; 0.1%) were less prevalent. There was no statistically significant association between the use of licit or illicit drugs and TDI.

Table 3 displays the results of the Poisson analysis. After adjusting for age, individuals in the private school system [prevalence ratio (PR) = 1.11; 95% CI: 1.03–1.20] and those with accentuated overjet (>3 mm) (PR = 1.17; 95% CI: 1.10–1.25) had a 1.11-fold and 1.17-fold greater chance of belonging to the group of individuals diagnosed with some type of TDI.

Discussion

The prevalence of dental injury to permanent incisors in the present study is higher (24.7%) than that described by Cortes et al. (4), who investigated children aged 9-14 years in the same city. This may be explained by the age of the present sample group because dental trauma has a cumulative tendency based on age. To exemplify this, in the study by Cortes et al. (4), the prevalence of TDI was 8.0% among 9-year-olds, 13.6% among 12-year-olds, and 16.1% among 14-year-olds. There is considerable variability with regard to the prevalence of TDI, as seen in national studies (3, 20, 21), with the prevalence ranging from 10.7% to 58.6%, as well as in studies carried out in other countries (6, 22-24) with prevalence values ranging from 11.4% to 34.0%. Such discrepancies may be explained by methodological differences, different diagnostic criteria, the age group studied, and geographic location.

No statistically significant association between a history of dental trauma and gender was found in this study. Most epidemiological studies that have assessed these variables concluded that male adolescents have a higher prevalence of TDI owing to the fact that they

Table 2. Sample distribution according to the prevalence of traumatic dental injury (TDI) and independent variables (Belo Horizonte, Brazil)

	TDI			
Independent variables	Yes n (%)	No n (%)	<i>P</i> -value*	
Social vulnerability index				
Greater vulnerability	118 (24.7)	359 (75.3)	0.972	
Lesser vulnerability	102 (24.6)	312 (75.4)		
Type of school				
Public	163 (22.7)	554 (77.3)	0.006	
Private	57 (32.8)	117 (67.2)		
Gender				
Male	97 (27.6)	255 (72.4)	0.109	
Female	123 (22.8)	416 (77.2)		
Accentuated overjet				
Yes (>3 mm)	50 (56.8)	38 (43.2)	0.000	
No (≤3 mm)	169 (21.1)	634 (78.9)		
Risk of alcohol use				
Low risk (up to 7 points)	187 (25.5)	545 (74.5)	0.218	
Risky use to possible	33 (20.9)	125 (79.1)		
dependence (8-40 points)	· · ·	, , , , , , , , , , , , , , , , , , ,		
Use of illicit drugs				
Yes	34 (25.2)	101 (74.8)	0.885	
No	186 (24.6)	570 (75.4)		
*Chi-squared test.				

Table 3. Risk factors for traumatic dental injury (TDI) among adolescents (results of Poisson logistic regression analysis*; Belo Horizonte, Brazil)

Dependent variable	Independent variables	PR (95% CI) Crude	PR (95% CI) Adjusted*	
TDI	Type of school (private)	0.60 (0.42-0.86)	1.11 (1.03–1.20)	
	Overjet (>3 mm)	2.17 (1.58–2.99)	1.17 (1.10–1.25)	
PR, prevalence ratio; CI, confidence interval. *Adjusted for control variable (age).				

engage in more aggressive physical activities, such as sports and contact games, and often use toys and equipment that offer a greater risk of dental trauma (1, 3, 4, 25, 26). However, the present study does not corroborate this finding, as more than 60.0% of the sample group was composed of female adolescents.

As with most epidemiological studies on TDI, the most common types of injury in the present study were enamel fracture and enamel and dentin fracture without pulp exposure; the upper central incisors were the most affected teeth (6, 19, 21–23, 26–28). A possible reason for this is the protective role of the maxilla in relation to the mandible during occlusion (29). Falls was the predominant cause of TDI, which has also been described in previous studies (6, 27). A number of different factors are associated with falls that can cause TDI, especially physical violence (30) and the practice of sports (26).

In the present study, a statistically significant association was found between accentuated overjet and the prevalence of TDI, which corroborates other studies found in the scientific literature (4, 19, 27). According to Bauss et al. (31), accentuated overjet and inadequate mouth protection are the two greatest risk factors for the occurrence of TDI in permanent incisors. A systematic review involving meta-analysis reported that an overjet > 3 mm increases the chances of an individual's suffering from some type of dental trauma regardless of variables such as age and gender (32).

There was a greater prevalence of TDI among the adolescents in the private school system. In Brazil, studying in a public or private school determines the type of environment in which the student lives. Therefore, this variable is used as a socioeconomic indicator (33). There is no consensus in the literature regarding the association between socioeconomic status and dental trauma (3-5, 20). One of the reasons for this is the fact that few studies have addressed these variables, and there is no standardization of socioeconomic classification indices (3, 4, 20). Some Brazilian studies have found that school children with a better economic status have a greater chance of suffering some type of TDI owing to greater access to water skiing, bicycles, and skateboards in comparison with those with a lower socioeconomic status (4, 20). These studies used household income, parents' schooling, job status, and the possession of household appliances as the criteria for socioeconomic classification. Other studies, however, considered indices that are not limited to economic issues such as the SVI, which is a broaderscoped index, and assess access to housing, education, income, work, legal assistance, health care, and nutrition. As in the present study, Bendo et al. (13) found no statistically significant association between a history of TDI and the SVI. These findings confirm the considerable variability in classifications and criteria and underscore the conflicting results in the literature regarding dental trauma and socioeconomic status.

While there was no statistically significant association between the prevalence of TDI and the consumption of alcohol, tobacco, and illicit drugs, a high percentage of adolescents made use of such substances (50.3%, 18.9%, and 27.0%, respectively). These percentages are higher than those reported in other studies (34–38). It should be stressed that these results were found in the 15- to 19year-old age group. Although alcohol and tobacco are considered licit drugs, the legal age for the consumption of these two substances in Brazil is 18 years. In spite of not being allowed to consume alcoholic beverages, adolescents between 15 and 16 years of age reported a higher frequency of use of these substances with regard to weekly intake (two to three times) in comparison with those aged 18 and 19 years.

Although there was no statistically significant association between the use of alcoholic beverages and TDI, the data revealed that the majority of participants (74.5%) with a low intake risk had fewer dental injuries. These results could represent a tendency concerning lower alcohol intake and its association with fewer dental injuries.

Alcohol is implicated in a wide variety of diseases, disorders, and injuries. Automobile accidents, pedestrian injuries, falls, and work-related harm frequently result from excessive alcohol consumption. The risks related to alcohol are linked to the drinking pattern and amount of consumption (39). Alcohol and illicit drug consumption is associated with risky behavior, which increases the chances of: adolescents becoming involved in interpersonal violence and unintentional injury; having an unplanned pregnancy; committing suicide or homicide; experimenting with tobacco, marijuana, cocaine, and inhalants; and exhibiting behavioral problems and poor scholastic performance (35, 36, 40). Behavior and social environment are risk factors of TDI (41). Odoi et al. (41) suggest that not every type of behavioral problem is directly related to TDI, but it may be associated with violence. Violence is currently considered one of the main causes for seeking dental care. In a study carried out by Stewart et al. (42), approximately 30% of the school children who had suffered from domestic violence visited a dentist because of an accident in the previous 12 months. Hutchison et al. (43) found that alcohol consumption was associated with the occurrence of 90.0% of facial injuries in bars and 45.0% on the street.

The present study has limitations that should be considered. The data regarding the consumption of psychotropic substances may have been underestimated, as the respondents may have been embarrassed or fearful of answering affirmatively to questions regarding the use of illegal substances even though they were assured that all information was confidential. Another reason for a possible underestimation is that school children who are more exposed to episodes of violence converse less openly about drugs, as demonstrated by Stewart et al. (42). Moreover, the methodological limitations of the cross-sectional study design do not allow for the establishment of a cause-and-effect relationship.

The present study revealed a high prevalence of dental trauma among adolescents in comparison with other studies carried out in Belo Horizonte using similar methodologies (4, 13) and epidemiological studies involving adolescents in other countries (24, 44). Enamel fracture is a type of dental trauma that should not be overlooked because it may be associated with pulp and periodontal impairment, which could go unperceived during the clinical exam immediately following the dental trauma. A simultaneous luxation injury has been suggested to increase the prevalence of pulp necrosis in teeth with crown fractures. A late diagnosis of posttraumatic pulp necrosis can result in manifestations of additional complications, such as apical periodontitis, fistulas, or inflammatory root resorption (45-47).

In a study by Traebert et al. (1), in which the majority of traumas were attributable to enamel and enamel/ dentin fractures, the need for treatment was relatively high. In the present study (Table 1), one of the causes of dental injury was the use of teeth for functions other than eating, such as biting on hard objects. However, this prevalence was low (5.9%).

TDI was significantly associated with the private school system and accentuated overjet. Although no statistically significant association was found between TDI and alcohol/illicit drug use, experimentation with such substances was frequent among the adolescents surveyed.

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