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DENTAL TRAUMATOLOGY

Dental injury among Brazilian schoolchildren in the state of São Paulo

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Abstract – To describe the distribution of dental trauma in Brazilian schoolchildren and its association with demographic, environmental and clinical factors. A random sample of 73 243 schoolchildren's oral examination records from private and public units, selected from 131 cities within the state of São Paulo, Brazil, was analysed. Trauma was assessed based on international methodological standards prescribed by the World Health Organization for Oral Health Surveys (1997). Proportions obtained were compared between urban and rural schools, as well as between private and public units. Oral health status indices were estimated based on the decayed, missing and filled teeth (DMFT) index – the average number of decayed, missing and filled teeth; the proportion of caries-free 5-year-old schoolchildren and anterior maxillary *overjet* among 12-year-old schoolchildren. The prevalence of dental trauma in anterior dentition was of 2.4, enrolling average 1.2 teeth per child. A rate of 2.4 impaired anterior teeth per thousand was obtained, upper central incisors being those that were most affected – 7.7 in every 10. Among 8- to 11-year-old children, the rates grew regularly. The proportion of dental trauma was significantly higher in boys than in girls ($P < 0.01$), and gender prevalence ratio was of 1.58 for boys. The results showed positive associations between dental trauma and caries-free 5-year-old schoolchildren ($P = 0.003$), anterior maxillary *overjet* ≥ 3 mm ($P < 0.001$), and private school as a socio-economic proxy indicator ($P = 0.048$).

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Dental trauma is an injury associated to external factors, such as violence, accident and fall among others, the extension, intensity and gravity of which may reach both the dental element and its supporting structure (1).

In the past few years, a number of authors have attempted to investigate the problem of dental trauma at population levels. Epidemiological information has been limited to the knowledge of the problem's magnitude, obtained through studies of prevalence and incidence, and also to the search for evidences concerning its aetiology (2–5).

In Brazil, some studies based on populations of delimited regions have been published containing information and epidemiological data on dental trauma rates. Prevalence rates of 8% at age 9, 13.6% at age 12, and 16.1% at age 14 were found in the city of Belo Horizonte (6). In Brasília, another city located in the central part of the country, the rates were 10% for children under 2 years, 12% between ages 3 and 4, and 20% at age 5 (7). A household survey in Bauru, São Paulo State, found a prevalence of dental trauma of 30.2% in primary dentition (3).

Advances in research, along with the greater success of prevention, have contributed to the decline of cavity incidences in several countries world wide (8, 9). Studies show this tendency in Brazil as well (10, 11). As a result of this decrease in cavity incidence, and of the increase in violence and child/teenager participation in contact sports, dental trauma in the state of São

Paulo will, in future, tend to grow in importance, which may be accompanied by significant economic consequences (1, 10).

The purpose of this study is to describe the frequency of dental trauma among schoolchildren between 5 and 12 years old from private and public schools of the state of São Paulo, Brazil, according to characteristics, such as gender, age, occlusal disorders, type of school and caries attack.

Methods

Between August and December 1998, official agencies of the Brazilian health authority completed an epidemiological survey (12) of oral health in the state of São Paulo, Brazil, following international standards established by the World Health Organization (13). The examination of 87 918 schoolchildren, youngsters, adults and senior citizens evaluated dental caries, treatment needs, prosthesis, periodontal diseases, fluorosis and occlusion disorders. The multistage sampling design was planned to be representative of the whole state and of each of the participating cities, and to allow the estimation of the decayed, missing and filled teeth (DMFT) index of 5- to 12-year-old schoolchildren.

As sponsoring institutions made the survey data available for public consultation, we evaluated 73 243 oral examination records of 5–12-year-old schoolchildren. The data were collected from 131 cities from the state of São Paulo, Brazil. In each city, at least 20 schools (private + public) were randomly selected, not including those with 20 or less units.

In this method, a crown is considered as fractured when a part of its surface is missing as a result of trauma and there is no evidence of caries. Permanent teeth missing for any other reason than caries–including orthodontic and trauma causes – were also registered. Filled teeth with history of traumatic injuries were not recorded. Proportions obtained were compared between urban and rural schools, as well as between private and public units. We estimated the following indices of oral health status: (i) the DMFT, corresponding to the average number of decayed, missing and filled teeth; (ii) the proportion of schoolchildren who were caries-free at age 5; and (iii) anterior maxillary *overjet* among 12-year-old schoolchildren.

Data analysis – carried out using SPSS software (14) – included frequency distribution and cross-tabulation. Chi-squared tests were used to investigate the association between dental trauma, and demographic, environmental and clinical variables at a significance level of $P < 0.05$.

Results

Prevalence was 2.66% in the entire dentition. A total of 1947 cases of dental trauma were observed in a universe of 73 243 records pertaining to Brazilian schoolchildren from 5 to 12 years of age. Trauma to anterior teeth prevailed in relation to trauma to posterior teeth (1794/224), whereas coronal fractures overcame missing teeth because of injury (1671/276). The number of cases increased along with age.

Table 1. Dental trauma to anterior dentition by number of affected teeth per child (state of São Paulo, 1998)

Affected teeth per child	*n*	%
1	1414	80.3
2	313	17.8
3	25	1.4
4	8	0.4
5	1	0.1
Total	1761	100.0

Sources SES-SP/FSP-USP.

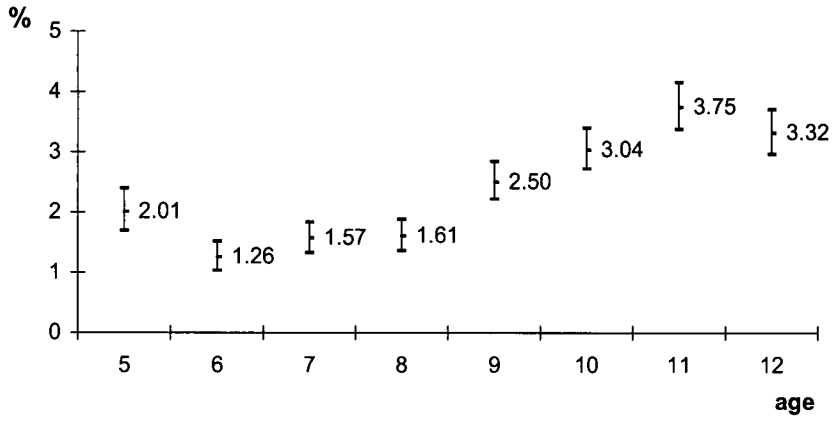
In view of these results, our analysis concentrated upon anterior dentition. Prevalence of dental trauma was of the order of 2.4%, with an average of 1.2 tooth per child. Among subjects affected by trauma, 19.7% had more than one tooth involved (Table 1). A total of 878 916 gaps in anterior dentition were observed in the sample, of which 2152 (0.24%) were affected by trauma – a rate of 2.4 per thousand anterior teeth. The upper central incisor was the tooth most affected – 7.7 per 10.

A higher rate of trauma cases was observed among children between 8 and 11 years. Prevalence increased along with age (Fig. 1). A number of factors were associated to dental trauma. The proportion of dental trauma was significantly higher in boys than in girls ($P < 0.01$), gender prevalence ratio being 1.58 for boys (Table 2). The results showed positive associations between dental trauma and caries-free 5-year-old schoolchildren ($P = 0.003$), anterior maxillary *overjet* ≥ 3 mm ($P < 0.001$) and private school as a socio-economic proxy indicator ($P = 0.048$).

Discussion

Epidemiological measures are affected by both random and systematic sources of error. Research based on large samples present, in general, relatively high levels of precision, which can protect the study from random error. Concerns in these cases may include sample selection process and measuring instrument usage. As this study was based upon a large and randomly drawn sample, the central issue rested upon the proper usage of measuring instruments.

The comparison of results of different studies concerning dental trauma is not an easy task. Depending on the observation tool employed, data obtained may not be exact and some aspects of the injury may not be recorded. Research restricted to specific population groups, or based on dental trauma



Source: SES-SP/ FSP-USP

Fig. 1. Percentage distribution of dental trauma in Brazilian schoolchildren by age (state of São Paulo, 1998).

Table 2. Frequency distribution of dental trauma to the anterior teeth of schoolchildren by gender, type of school and anterior maxillary overjet (state of São Paulo, 1998)

Variables	Dental trauma		*P*-value for Chi-squared test
	Yes (*n*; %)	No (*n*; %)	
Gender			
Boys	1055 (3.01)	35 099 (96.99)	<0.001
Girls	706 (1.90)	36 383 (98.10)	
School type			
Rural	176 (2.70)	6339 (97.30)	0.104
Urban	1585 (2.38)	65143 (97.62)	
Private	117 (2.88)	3952 (97.12)	0.048
Public	1636 (2.38)	67030 (97.62)	
Inhabitants			
≤10000	459 (2.52)	17666 (97.48)	0.082*
10001–50000	640 (2.49)	25055 (97.51)	
>50 000	666 (2.26)	28761 (97.74)	
dmft at 5 years old			
Caries-free	68 (2.63)	2515 (97.37)	0.003
Not free	64 (1.60)	3930 (98.41)	
Max. overjet at age 12			
≥3 mm	206 (4.25)	4641 (95.75)	<0.001
<3 mm	97 (2.44)	3879 (97.56)	

*≤10 000 compared to >50 000 inhabitants.

patients, rarely supplies data representative of the population as a whole. Considering the little demand for the treatment of dental trauma because of the reason that crown fracture is generally a mild injury, the number of children treated for this kind of problem is small. Therefore, from the population point of view, data collected from such services are generally of limited epidemiological value (1, 10, 15).

The analysis of epidemiological studies shows that prevalence varies significantly, which may be a result of the variability of criteria according to which dental trauma is measured. The variation perceived has been associated to a series of factors: trauma classifications employed, type of dentition, geographical and lifestyle differences in the studied populations and the access to health services for evaluation and treatment purposes, all of which, by themselves or combined, make data comparison a difficult task (1, 2, 10).

The prevalence of dental trauma in anterior dentition among 5–12-year-old São Paulo State schoolchildren was 2.40%. Criteria applied were code '5' and 'T', both of which are part of the WHO orientation for Oral Health Surveys (13). According to such orientations, when a fractured tooth contained a carious lesion as well, it was classified as decayed. A tooth with trauma, which, at the moment of the exam, had already been treated, was reported as filled. These two sources of error lead us to consider that values obtained are probably an underestimate, and that, for this reason, it is likely for prevalence rates to be higher. Another methodological precaution employed in this study was to base data only on anterior dentition, once posterior dentition could lead to false-positive cases. Code '5' is used when the dental element is absent not only for trauma reasons, but also for congenity, periodontic reasons and mainly orthodontic ones, which could directly influence our data.

Andreasen & Andreasen (15) also pointed out that the prevalence of dental trauma is higher than that normally reported in epidemiological surveys because cross-sectional studies tend to underestimate its occurrence. When simplified classifications are used, such as those by WHO or Ellis (16), only trauma in the internal structure of the mouth is described, disregarding alveolar socket injuries or maxillary and mandibular fractures.

In the study carried out in Brasília, 1853 children aged 1–5 years were analysed. Data were collected in public schools, and examiners employed their own classification (7). In Belo Horizonte, the authors evaluated 3702 boys and girls aged 9–14 years from public and private schools. Criteria employed were those from the Children's Dental Health Survey in the UK (6). In the study conducted in Bauru, data were collected by means of a household survey. Cases were identified through questionnaires and sent to

the Bauru Dental School's Paedodontic Clinic for clinical and radiographic examination (3). An analysis of these three Brazilian studies suggests that the extreme complexity of such comparisons is because of the differences in research tools, which emphasizes the fore-mentioned difficulties.

Concerning the most affected dental groups, the central maxillary incisors were the teeth most frequently injured, the results of which were consistent with those of a number of previous studies (2, 17, 18).

An average of 1.22 injured teeth per subject was observed. In most studies, trauma occurred more frequently in a single tooth than in several teeth (17, 19, 20). According to Bastone et al. (2), in a revision of the literature, the number of injured teeth per student varied between 1.1 and 2.0.

Analysing dental trauma cases as to subject age, we verified that, between ages 5 and 12, the distribution of cases increased along with age. This was also demonstrated in a number of national and international studies (6, 21, 22). This does not mean, however, that older children are more susceptible to dental trauma, as the quantification of the latter is performed cumulatively.

Boys were 1.58 times more likely to present dental trauma. A significant difference was observed, showing a positive association between male gender and dental trauma. From an epidemiological point of view, most authors suggest an association between male gender and dental trauma, attributing this difference to their more intense participation in contact sports, car accidents and fights (17, 18, 23). An exception to this epidemiological consensus was suggested in studies by Zadik (24) and Garcia-Godoy (4) who did not find significant gender-based differences.

In this study, a higher prevalence was found among children from private schools ($P = 0.048$), where better socio-economic conditions are expected when compared to public schools. Most epidemiological dental trauma studies in the literature were based on public school students. For this reason, little suitable information, concerning the relationship between dental trauma and school type, is available. There have been a few studies that address the relationship between dental trauma and socio-economic conditions, and results are conflicting. Hamilton et al. (5) observed that children of lower socio-economic level were more prone to present traumatic injuries if compared to the children of higher socio-economic level. In Belo Horizonte, Cortes et al. (6) observed a higher prevalence of dental trauma among the children included in the highest socio-economic level. Marcenes & Murray (25), in a study held in UK, showed that the prevalence of dental trauma was higher in Newham (23.7%), the poorest socio-economic area of London than in other areas of the UK. Further studies comparing dental trauma and socio-economic status are necessary in order to establish a more conclusive association.

The results showed that in the primary dentition of 5-year-old students, there was a higher proportion of injuries among caries-free children (2.60%) than among children with one or more decayed teeth (1.60%). These results corroborate the ideas of some authors, who suggest that, with the decline of dental caries, dental trauma may receive greater emphasis as an important oral health problem (1, 10, 21).

The results of this study showed a significant positive association in 12-year-old children with maxillary *overjet* ≥ 3 mm. Data regarding occlusal disorders were collected in 8823 12-year-old students, of which 52% presented maxillary *overjet* ≥ 3 mm. A number of studies suggest that maxillary *overjet* is a factor associated to dental trauma (21, 22, 26). In a country as large and as diverse as Brazil, the number of epidemiological studies concerning dental trauma is insufficient for it to be regarded as a country-wide public health problem.

In the state of São Paulo, the occurrence was of the order of 2.40%. Based on the characteristics of the records analysed, it was not possible to estimate injury severity distribution. The prevalence of dental trauma in the state of Sao Paulo is probably higher than the observed occurrence of 2.40% and the records do not allow the classification of severity levels. Dental trauma tends to constitute a public health problem in areas with a reliable decline of dental caries (11) where the proportion of severe cases may be socially significant.

Dental trauma cases have increased over the last decade (1,10) because of rising violence and greater children and teenager participation in sports activities. In some countries where the incidence of dental caries is declining, dental trauma has become a major oral health issue among children and teenagers, and prevention methods are being investigated in an attempt to control the incidence of this type of injury (27, 28).

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