Incidence of dental trauma among adolescents: a prospective cohort study

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Correspondence to: Maria Letícia Ramos-Jorge, R. Nunes Vieira, 255/502 Santo Antônio, Belo Horizonte MG, Cep:30350-120, Brazil Tel.: +55 31 3499 2434 Fax: +55 31 3499 2470 e-mail:mlrjorge@hotmail.com Accepted 16 May, 2006 2-year follow-up of adolescents with and without previous dental trauma and verified the hypothesis that individuals with previous trauma are more prone to recurrent TDI events. The present study was developed in three phases. First, a dental trauma cross-sectional study was carried out with 2260 schoolchildren aged 11–13 years in Biguaçu, southern Brazil. In the second phase, a casecontrol study was developed to identify risk factors associated with dental trauma. The third step was a 2-year longitudinal observational study with the participants of the second phase of the study. The exposed group of individuals with previous dental traumatism (208) and a non-exposed group (208) of participants who had no previous signs of dental trauma were followed up for 2 years. Descriptive, univariate, simple and conditional multiple logistic regression analyses were performed. The greatest incidence of dental trauma was identified among adolescents with previous dental trauma (11.9%-11.44/1000 incisors) when compared with those without previous dental trauma (2.7%-2.45/1000 incisors) (P < 0.001). In the study period, adolescents with previous dental trauma showed a 4.85 times greater odds ratio for presenting further dental trauma when compared with adolescents without previous dental trauma (P = 0.005) after adjusting for incisal overjet, lip coverage and mother's schooling. A notable difference was observed regarding the incidence of TDI between the case and control groups. Individuals with previous dental trauma had greater chances of developing develop further dental trauma in a 2-year follow-up.

Abstract - We estimated the incidence of traumatic dental injuries (TDI) in a

The increase in the levels of violence, the number of traffic accidents, the growing participation of children and adolescents in sporting activities, and the increase in the availability and access to leisure equipment with risk potentials have contributed towards transforming dental trauma into a public health problem (1). Traumatic dental injury (TDI) affects a large part of the younger population and may have physical, psychological and social impact (2-4). A study in Brazil points out that children with untreated fractured teeth are more likely to report more difficulties in 'eating and enjoying food'. 'cleaning teeth', 'smiling, laughing and showing teeth without embarrassment', 'maintaining a normal emotional state without becoming irritable' and 'enjoying contact with people' than children with no traumatic injury (4).

Many studies have been carried out with the aim of determining possible risk factors associated with dental traumatism. Male gender (5-8), incisal overjet greater than 5 mm (1, 7, 9, 10), the absence of lip coverage (7, 11, 12) and adverse socioeconomic characteristics (1, 12-17) have been pointed out as important risk factors for the occurrence of dental injuries.

In this context, it seems obvious that unless the environmental circumstances of the child are drastically changed, the risk of TDI will not change and recurrent

The aims of the present study were to estimate the incidence of dental traumatism among groups with and without previous dental traumatism for a period of two years and verify the hypothesis that individuals with previous trauma are more prone to recurrent TDI events.

hypothesis has been confirmed.

Methods

The study was carried out in the municipality of Biguaçu, in the state of Santa Catarina in southern Brazil and developed in three distinct phases (Fig. 1).

events are likely. However, the literature offers no

evidence regarding this aspect or the clinical implications

and preventative methods to be adopted once this

First, a cross-sectional dental trauma study was developed in 2001 to estimate the prevalence and aetiology of traumatism to the permanent dentition of all 11, 12 and 13-year-old schoolchildren born in Biguaçu, SC (18). A dental trauma prevalence of 10.7% (18) was found among the 2260 school children examined. In the second step, a case-control study was developed to identify associated risk factors (18).

In the third step, a cohort study was performed to verify the occurrence of further TDI events during the 2-year period from 2001 to 2003. Participants from the



Fig. 1. Flowchart displaying study phases and number of participants involved in each phase.

first and the second steps (18) formed the study group, which was made up of an exposed group of individuals with previous dental traumatism (208) and a nonexposed group of participants who had no previous signs of traumatism (208). Both groups were paired in relation to gender and age. All students were tracked through the Secretary of Education databank of the State of Santa Catarina, thereby allowing individuals to be located in current schools, as well as the registration of moves from the municipality.

A single dentist (M.L.R.-J.) carried out the dental examinations and interviews with the support of a scribe and a monitor, visiting 28 schools between August and October 2003.

The outcome was 'further cases of dental traumatism' (no = 0; yes = 1) in individuals. Criteria were adopted from those on TDI used in the Children's Dental Health Survey of the UK (19). Dental examinations included only upper and lower incisors and adjacent soft tissues. Two strategies were adopted for registering the occurrence of further cases of traumatism in the same tooth: (i) the participant was asked about the occurrence of further episodes of dental traumatism in the preceding 2 years; and (ii) the clinical chart of the examinations performed in steps I and II was attached to the chart of the examination performed in step III. Thus, the clinical observation, together with the report of the participant, supplied reliable information for the study. Furthermore, the examiner recorded the type of damage sustained from the traumatic injury, the extent of incisal overjet and whether lip coverage was adequate (20). Mother's schooling was used as a socioeconomic indicator and was collected through an interview.

All schools were visited twice. Children were examined and interviewed at school during class hours.

A pilot study was carried out prior to data collection. Prior to the field work, the examiner, the scribe and the monitor participated in a calibration exercise involving 40 children aged 13–15 years attending a public school in a neighbouring city, as described elsewhere (21). A strict cross-infection control was adopted. The examiner used disposable gloves and packages with plane mirrors, Community Periodontal Index (CPI) probes and gauze pads were sterilized in sufficient numbers for each day of work. Intra-examiner reliability was checked through a duplicate examination of every tenth child. Scores for agreement measures calculated on a tooth-by-tooth basis were high (maximum and minimum kappa values were 1.00 and 0.91 respectively).

Statistical analysis

The results were organized and entered into a databank using the Statistical Package for Social Sciences (SPSS) software, version 10.0. For the statistical analysis, we initially carried out a description of the absolute and relative frequencies of the variables studied. Thereafter, associations were tested using univariate analysis between independent variables and the outcome (McNemar test). The inexistence of an association between variables (significance value greater than 0.05) was considered as the null hypothesis. To verify whether individuals from the case group had a greater chance of suffering further episodes of dental traumatism than individuals in the control group, the variables under study were included one at a time into a conditional multiple logistic regression model (22). The final model was adjusted for the effect of all the variables (overjet, lip coverage and mother's schooling), that is, the effect of each exposure was determined for the likelihood of individuals from the case group presenting a greater chance of suffering further dental traumas. Adjusted R^2 , the odds ratio (OR) value and 95% confidence intervals were estimated for each variable in the logistic model.

Ethical considerations

Before commencing the study, the research protocol was submitted to and approved by the Ethics Committee of the Federal University of Santa Catarina. A letter was sent to the parents or guardians 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. The main researcher (M.L.R.-J.) assured parents that participation was voluntary.

Results

A total of 306 schoolchildren from 28 schools in the municipality of Biguaçu, SC, participated in the study. The response rate was 73.5% (76.4% in the case group and 70.7% in the control group). The main reasons for dropout were: moving away from the city in the previous 2 years (18), non-authorization from the parents (39) and absence from school during both dental examination visits (49). It was verified, however, that the group of 'absent' participants presented the same characteristics as the sample, that is, dropouts occurred at random. There were no statistically significant differences with regard to the following risk factors for dental traumatism

As displayed in Table 2, the occurrence of further cases of traumatism was greater in the case group than in the control group (P < 0.001). Twenty-three individuals suffered further episodes of dental traumatism, affecting a total of 34 teeth (11.44/1000 incisors in the case group and 2.45/1000 incisors in the control group). Among the adolescents with previous traumatism, 11.9% presented further traumas, whereas only 2.7% of the adolescents in the control group presented further episodes of dental injuries. The remaining variables (overjet, lip coverage, and mother's schooling) were also statistically associated with the occurrence of further cases of traumatism (P < 0.001).

The results displayed in Table 3 show that the effect of the potentially confounding variables on the variable of interest was slight, with OR and *P*-values remaining

Table 1. Frequency distribution of participants composing the case and control groups

	Exposed, <i>n</i> (%)	Non-exposed, n (%)
Age		
Born in 1990	51 (52.6)	46 (47.4)
Born in1989	60 (53.6)	52 (46.4)
Born in1988	48 (49.5)	49 (50.5)
Gender		
Female	96 (49.0)	100 (51.0)
Male	63 (57.3)	47 (42.7)
Mother's schooling		
>4 years	86 (52.1)	79 (47.9)
≤4 years	69 (51.9)	64 (48.1)
Overjet		
<5 mm	124 (49.2)	128 (50.8)
≥5 mm	35 (64.8)	19 (35.2)
Lip coverage		
Adequate	112 (51.4)	106 (48.6)
Inadequate	47 (53.4)	41 (46.6)

Table 2. Association between independent variables (of interest and confounding) and further episodes of dental traumatism

	New episodes of dental injuries		
	Yes, <i>n</i> (%)	No, <i>n</i> (%)	P*
Dental trauma			
Non-exposed	4 (2.7)	143 (97.3)	<0.001
Exposed	19 (11.9)	140 (88.1)	
Overjet			
<5 mm	18 (7.1)	178 (90.8)	<0.001
≥5 mm	5 (4.5)	105 (95.5)	
Lip coverage			
Adequate	15 (6.9)	203 (93.1)	<0.001
Inadequate	8 (9.1)	80 (90.9)	
Mother's schooling			
>4 years	15 (9.1)	150 (90.9)	<0.001
≤4 years	8 (6.0)	125 (94.0)	
*McNemar test.			

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Table 3. Multiple logistic regression analysis – verification of the effect of each confounding variable on the risk of further episodes of dental injuries among participants with dental trauma (exposed)

OR (95% CI)	Ρ	R ²	Model
4.85 (1.6–14.6) 4.81 (1.6–14.6) 4.83 (1.6–14.6) 4.85 (1.6–14.7)	0.005 0.005 0.005 0.005	0.199 0.210 0.215 0.221	Brute (exposed) Adjusted for overjet Adjusted for overjet + lip coverage Adjusted for overjet + lip coverage + mother's schooling

unaltered. Participants who had previously suffered dental traumatism had a 4.85 times greater chance of suffering further episodes of dental traumatism than participants in the control group, after adjusting for incisal overjet, lip coverage and mother's schooling (Table 3).

Discussion

The adopted study design confers upon it a unique and totally original character. The participants were selected from a cross-sectional survey carried out with all 2260 schoolchildren of the city of Biguaçu, Brazil, and allowed the formation of two distinct groups (one with TDI and another without TDI). Furthermore, the same individuals were followed up for a 2-year period in order to record the incidence of further cases of TDI. Thus, for enabling the observation of diverse aetiological exposures related to traumatism in the permanent dentition and for having a population base, the present study design proposal confers weight to the findings when compared with most of the epidemiological studied described in the literature, which have used crosssectional designs and data from patients treated in clinics and hospitals.

The criteria for TDI adopted in the present study were similar to those used in studies evaluating the prevalence of TDI (5, 18, 19). TDI has well-defined diagnostic criteria, which was an important characteristic of the present study. Thus, measurement biases were avoided with the high degree of reliability in determining individuals for the case and control groups. The high degree of diagnostic reliability, as measured by the kappa statistic, contributed towards the internal validity of the study.

Although the data collection had been thoroughly planned, we verified a 26.5% dropout rate. Many authors have reported that sample losses can trigger distortions in the results if distributed in an unequal fashion. In the present study, we observed that dropouts occurred at random and produced no significant effect on the results of the investigation. Dropouts presented characteristics similar to those of the sample, with no statistically significant differences regarding risk factors for dental traumatism (overjet, lip coverage, mother's schooling and family structure). Thus, the final sample can be interpreted as a representative sub-sample of the original sample and the results obtained can be generalized for the entire population.

We confirmed the hypotheses that individuals having suffered dental traumatism present greater chances of suffering further episodes of trauma than those with no prior traumatism. In the multiple logistic model, the chances of individuals from the case group (those having suffered prior dental traumatism) suffering further episodes of dental traumatism was 4.85 times greater than in the control group. A survey of the literature provided no evidence confirming this hypothesis or the clinical implications and preventative measures to be adopted. The causes of dental trauma are complex and are influenced by different factors such as human biology, behaviour, environment and healthcare organizations (5, 9). A risk profile would therefore be of value for planning the prevention of further trauma episodes (23-26). However, one might expect that if an individual has suffered an episode of dental traumatism and continues practising the same sports, living in the same environment, presenting the same oral (overjet, lip coverage) and psychosocial characteristics (socioeconomic level, behaviour), the individual would present greater chances of suffering a further episode of trauma than an individual whose bio-psychosocial factors did not lead to dental traumatism.

The results of the present study indicate that the proportion rate of TDI in the case and control groups (11.9% vs 2.7%) was not significant to the point of being a public health problem. Nonetheless, the risk difference is notable and reducing the risk, if possible, would be useful from a preventive dentistry point of view. In this context, it is important to point out that the results of this study would not be helpful to a public health agency or even private dentistry in identifying adolescents who are at high risk of TDI if such individuals have not suffered a previous occurrence of TDI.

The risk profile could be a combination of systematic information from both the patient and parents, as well as standard trauma information in dental records. A database consisting of systematically and continuously compiled information on such risk profiles would provide better knowledge on how to avoid further cases of dental trauma. Once the profile of an individual having suffered TDI is characterized, the professional should consider a preventative, individualized treatment plan in order to avoid further traumatic dental injuries.

Conclusions

Individuals from the case group presented greater chances of suffering further episodes of dental traumatism than individuals from the control group. Professionals should be attentive and adopt strategies for individuals with previous TDI in an effort to prevent further cases of TDI.

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