Case Report

The impact of treatment of dental trauma on the quality of life of adolescents – a case-control study in southern Brazil

Ramos-Jorge ML, Bosco VL, Peres MA, Nunes ACGP. The impact of treatment of dental trauma on the quality of life of adolescents – a case-control study in southern Brazil. © Blackwell Munksgaard, 2006.

Abstract – The aim of this study was to investigate the impact of treatment for Enamel-Dentin Fracture (EDF) on the daily activities of adolescents. This was a case-control study (1:4). The case group was composed of 40 adolescents from 11 to 17 years of age, presenting definitive restoration treatment for EDF for over 6 months. The control group was made up of 160 adolescents with no history of dental trauma and belonging to the circle of friends of the participants of the case group, matched by gender, age, and socioeconomic level. The outcome variable 'impact' was assessed through the Oral Impact on Daily Performances (OIDP). The independent variables were collected for being of interest to the study (dental trauma) or for acting as potential confounding factors (malocclusion, decay, and mother's education). Descriptive, univariate, simple and multiple logistic regression analyses were performed. Among the cases, the impact prevalence was 40.0%, whereas among the controls it was 16.9%. The more affected daily activities were showing the teeth (18.0%), eating (6.5%), speaking (2.0%), and cleaning the mouth (0.5%). The odds ratio of adolescents treated for EDF of presenting an impact on daily activities was 3.3 times (confidence interval 95%: 1.4–7.7) greater than among adolescents without dental trauma, controlling for mother's education, decay and the presence of malocclusion. Adolescents whose teeth have been esthetically treated for EDFs run a greater risk of presenting OIDP when compared to adolescents that have never suffered dental injuries.

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Historically, the oral cavity has been dissociated from the rest of the body when considering the general health condition of individuals (1). However, recent studies have revealed that oral disorders have biological, emotional and psychosocial consequences for the individual. For instance, dental losses affect the quality of life, lowering self-esteem, inhibiting the exercising of daily activities and awakening feelings of shame due to an undesired appearance (2).

Tooth trauma can cause several aesthetic and functional alterations, such as fractures, color alteration, dental mobility, loss, tooth and pain (3, 4). Such alteration may have a considerable impact on the quality of life of the affected individuals. It has been proven that fractured anterior teeth can lead

to social and psychological embarrassment, such as feeling embarrassed to smile; having difficulty in social relationships; feeling incapable of maintaining a balanced emotional state, which in turn, provokes state of irritation; not being able to eat certain foods; and having difficulty in cleaning the teeth (5).

Coronal fracture involving the dentin is the type of dental trauma most often treated by dental surgeons, as well as the most prevalent dental trauma among studies carried out in dental clinics (6–9).

Research in MEDLINE in the period between 1966 and 2004, without restriction of publication language and with the use of the keywords Dental Trauma and Permanent Teeth identified no studies developed with the objective of evaluating the result of the treatment for coronal fracture on the quality of life. Among the 234 articles identified, only two were carried out with the objective of evaluating the impact of dental trauma on the quality of life of individuals (5, 10).

Hypothetically, the treatment of the traumatic dental lesions constitutes an important strategy for promoting health that can at least significantly minimize, if not avoid, negative biological and social consequences for the individual. Treatment can restore the capacity to smile, eat and carry out daily activities with no aesthetic and functional harm (11).

The aim of this study was to investigate and estimate the magnitude of the impact of treatment for coronal fracture on the quality of life of adolescents.

Methods

The study was developed in the city of Florianópolis, capital of the State of Santa Catarina, in southern Brazil, as well as in other two municipal districts: São José and Biguaçu.

A hospital-based case-control study was carried out. The case group was selected among patients treated in the Traumatized Patient Care Program in the Pediatric Dentistry Department of the Stomatology at the Federal University of Santa Catarina (UFSC) from August to October 2003. Each adolescent identified as a case was requested to indicate four friends enrolled at the same school, from the same class, of the same age and of the same gender. The decision was made to evaluate four controls for each case in order to improve the statistical power of the study.

The sample size was calculated to detect an Odds Ratio (OR) of 3.0 between cases and controls in order to have an 80% power of demonstrating a significant difference between groups at a 5% level. An impact prevalence of 15% was estimated among individuals not exposed to dental trauma (controls), and 40% among individuals having undergone treatment for traumatized teeth (cases). These parameters were based on the impact prevalence of dental trauma in case-control studies carried out with adolescents in Brazil (5). Considering four controls for each case, the sample totaled 40 cases and 160 controls. The Epi-info was used for the calculation of the sample size (12).

Adolescents between the ages of 10 and 19 years, having undergone restorative treatment (composed resin or fragment collage) through the Traumatized Patient Care Program for 'dentin fracture traumatism' more than 6 months earlier, were included in the case group. Adolescents from the case group that were undergoing orthodontic treatment or had fixed or removable prosthesis were excluded from the research study, as were those that presented other buccal traumas generating serious sequelae, such as dental mobility and dental loss; those that presented no definitively recuperated fractured tooth and those not registered at any school at the time of the data collection.

The control group included adolescents that presented the same age and gender as the participants of the case group, made up part of the circle of friends and studied in the same school and class as the adolescent in the case group. Adolescents from the control group that presented dental trauma and/or were in orthodontic treatment and/or had fixed or removable prosthesis were excluded of the research study.

The research team was made up of a dentist (MLRJ) and two academics in Dentistry. Twenty-eight schools were visited in the period from August to October 2003 for the data collection of the case and control groups.

The dental exams were carried out at the schools by a previously calibrated single examiner (MLRJ). The calibration exercise was carried out with 20 students at a public school in the city of Florianópolis. Ten individuals were selected for presenting coronary fracture treatment and presenting diverse situations of diagnosis of dental traumatism (13). In addition, another 10 students were randomly selected to participate in the calibration exercise. The examiner was assisted by an annotator and the exercise followed the standardization procedure previously described (14). The single calibrated examiner (MLRJ) conducted all the clinical examinations. A second dentist (VLB), who did not participate in the data collection, served as the gold standard. Scores for the measures of agreement calculated on a tooth-by-tooth basis (14) were high (maximum and minimum kappa values were 1.00 and 0.71,

respectively). To evaluate the occurrence of dental trauma in the individuals included in the control group, the classification criteria proposed by O'Brien (13) was adopted. When dental injuries were diagnosed, the participant was excluded from the study and directed to the dental service. The selected individuals were examined at the school during class hours. Flat clinical mirrors, CPI-probes and gauze were packed properly and sterilized.

As possible confounding variables, occlusal conditions and decay lesions were identified and analyzed. For the analysis of the specific types of malocclusions associated to the anterior teeth, the established Dental Aesthetic Index criteria were adopted (15). The World Health Organization criteria were used for dental caries (16). A pilot study involving 43 school children was carried out prior to the data collection.

The impact of treatment for dental trauma on the daily activities of adolescents was the outcome measured by Oral Impact on Daily Performances (OIDP) (17). The OIDP was dichotomized among individuals with impact (OIDP $\geq$ 1) and without impact (OIDP = 0). The OIDP is an instrument for measuring oral impact on an individual's capacity to execute daily activities in the previous 6 months. The OIDP presents the advantage of being objective and addressing the main psychosocial consequences of dental problems. Other studies carried out with Brazilian adolescents have used and validated the OIDP. The choice of this instrument in the present study had the aim of making comparisons possible.

The main independent variable was the presence or absence of teeth treated for dental trauma. Other variables were selected as potential confounding variables, such as malocclusion (absent IED $\leq$ 25; present IED > 25) and dental caries (caries free DMFT = 0; with one tooth affected DMFT = 1 and with two or more cavity lesions DMFT $\geq$ 2) and the mother's education (higher level of education: 8 or more years of study; lower level of schooling: under 8 years of study). The control variables, malocclusion and caries (cavity lesion) were assessed clinically and the mother's education variable was collected by way of a questionnaire sent to the participants' mothers.

The results were entered and organized in a database, using the Statistical Package for Social Science (SPSS) software, Version 10.0. The description of the absolute and relative frequencies of the variables studied was carried out. Associations were then tested using univariate analysis between the independent variables and the outcome (chi-square test and Fisher's exact test). Chi-squared test and Fischer's exact test are used for independent (i.e. not matched) observations. The inexistence of an association between variables was considered the null hypothesis (significance value higher than 0.05). To verify the independent association of the impact of treatment for dentin fracture on the quality of life of adolescents, the variables studied were included step-by-step in a conditional logistic regression model (18). All confounding variables were included in the model, regardless of the significance obtained in the chi-square or Fisher's exact test. The final model was adjusted for the effect of all variables; the effect of each exposition in the probability of dental trauma [enamel-dentin fracture (EDF)] was determined, even after the treatment, in harming the quality of the adolescent's life. The variable of interest (dental trauma) was considered as a risk factor if the significance was 0.05 or less (18). Conditional logistic regression is a variant of logistic regression in which cases are only compared to controls in the same matched set. Additional confounders may be included, and there is no restriction on the numbers of cases and controls in each matched set. Exposure effects are estimated by considering possible combinations of exposures, conditional on the observed exposures within each matched set (19).

Before commencing the study, the research protocol was submitted to and approved by the Federal University of Santa Catarina Ethics Committee. 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.

Results

The response rate was 97.6% in both the case and control groups. Table 1 shows the distribution of the possible confounding variables. There were no statistically significant differences between groups

Table 1. Frequency distribution of the participants that made up the case and control groups in accordance to malocclusion, DMFT and mother's education

	Case group (n) (%)	Control group (n) (%)	P
Malocclusion			
Absent	27 (67.5)	121 (75.6)	
Present	13 (32.5)	39 (24.4)	0.295
DMFT			
None	33 (82.5)	127 (79.4)	
One tooth affected	3 (7.5)	26 (16.3)	
Two or more teeth affected	4 (10.0)	7 (4.4)	0.168
Mother's education (years of study completed with success)			
≤8 years	21 (52.5)	102 (63.8)	
>8 years	19 (47.5)	58 (36.3)	0.191

with relation to mother's education, malocclusion (DAI) and dental caries (DMFT).

Table 2 shows that the impact prevalence was greater in the case group for nearly all the appraised activities. Among the adolescents with of history treatment for EDF, 40% presented at least one a negatively affected daily activity in the previous 6 months. In the group of adolescents with no history of trauma, 16.9% were observed to present some oral impact on daily life. In decreasing order, the most affected activities for the oral condition were: showing the teeth when smiling, eating, speaking, maintaining a stable emotional state and cleaning the mouth. No adolescent investigated cited an impact on the activities of sleeping, accomplishing school tasks, practicing sports or going out with friends.

For the univariate analysis, the dependent variable (OIDP) was associated to the independent variables using the chi-square test and analysis of simple logistic regression. The variable of interest, 'dental condition', was statistically associated to the oral impact on the daily activities (Table 3).

To proceed with the analysis of multiple logistic conditional regressions, all variables were included regardless of the significance value verified during the univariate analysis. After adjusting for the socioeconomic level, malocclusion (DAI) and decay (DMFT) variables, it was verified that the 'dental condition' variable remained significant. Adolescents with aesthetically treated EDF had a greater chance of presenting oral impact on the daily activities than those never having suffered dental trauma [OR 3.26 – Confidence interval 95% (CI) = 1.4–7.7] (Table 4).

Table 2. Frequency distribution of the participants that made up the case and control groups in accordance to the impact of the buccal condition on the performance of daily activities

	Case group (*n*) (%)	Control group (*n*) (%)	*P*
Eating			
OIDP = 0	34 (85.0)	153 (95.6)	0.015 C
OIDP ≥ 1	6 (15.0)	7 (4.4)	
Speaking			
OIDP = 0	38 (95.0)	158 (98.8)	0.179 F
OIDP ≥ 1	2 (5.0)	2 (1.2)	
Showing the teeth (smiling)			
OIDP = 0	26 (65.0)	138 (86.3)	0.002 C
OIDP ≥ 1	14 (35.0)	22 (13.8)	
Maintaining stable emotional state			
OIDP = 0	39 (97.5)	160 (100.0)	0.215 F
OIDP ≥ 1	1 (2.5)	0 (0.0)	
Cleaning the mouth			
OIDP = 0	40 (100.0)	159 (99.5)	0.215 F
OIDP ≥ 1	0 (0.0)	1 (0.5)	
Total OIDP			
OIDP = 0	24 (60.0)	133 (83.1)	0.001 C
OIDP ≥ 1	16 (40.0)	27 (16.9)	

C, chi-square test, F, Fisher's exact test.

Table 3. Association between independent variables (of interest and confounding variables) and the impact of the buccal condition on daily performance. Univariate logistic regression analysis

	Impact			
	OIDP ≥ 1 (*n*) (%)	OIDP = 0 (*n*) (%)	OR (CI 95%)	*P*
Dental condition				
Without trauma	27 (16.9)	133 (83.1)	1.00	
Treated EDF	16 (40.0)	24 (60.0)	3.3 (1.5–6.9)	0.002
DMFT				
None	31 (19.4)	129 (80.6)	1.00	
One tooth	5 (17.2)	24 (82.8)	0.9 (0.3–2.4)	0.788
Two or more teeth	7 (63.3)	4 (36.4)	7.3 (2.0–26.4)	0.003
Malocclusion				
Without malocclusion	20 (13.5)	128 (86.5)	1.00	
With malocclusion	23 (44.2)	29 (55.8)	5.1 (2.4–10.4)	<0.001
Mother's education				
>8 years	28 (22.8)	95 (77.2)	1.00	
≤8 years	15 (19.5)	62 (80.5)	1.3 (0.6–2.7)	0.582

OIDP, oral impact on daily performances; OR, odds ratio; CI, confidence interval.

Table 4. Multiple logistic regression analysis – verification of the effect of each confounding variable on the risk of impact among participants treated for EDF

Dental condition	OR (CI 95%)	*P*
Without trauma	1.00	
Treated EDF	3.8 (1.5–6.9)*	0.002
Without trauma	1.00	
Treated EDF	3.4 (1.6–7.3)[†]	0.002
Without trauma	1.00	
Treated EDF	3.2 (1.4–7.1)[‡]	0.004
Without trauma	1.00	
Treated EDF	3.3 (1.4–7.7)[§]	0.007

EDF, enamel-dentin fracture; OR, odds ratio; CI, confidence interval.
*OR unadjusted.
[†]OR adjusted for mother's education.
[‡]OR adjusted for mother's education and DMFT.
[§]OR adjusted for mother's education, DMFT and malocclusion (DAI).

Discussion

Some comments on methodology are relevant. During the study design phase, the aim was to address the four fundamental aspects for the development of case-control studies, namely: (i) to form a homogeneous and representative group of cases; (ii) to choose the controls appropriately, (iii) to collect standardized data from the case and control groups; and (iv) to annul the effects of the confounding variables. For the execution of this last requirement, the matching was defined for each case as four controls of same age, gender and from the school. School in Brazil is a proxy for socioeconomic condition and is often used in epidemiological studies. To control the possible socioeconomic variability existing internally at the schools, the mother's education was used as a control variable.

The other confounding variables (the presence of malocclusion and dental decay) were also controlled in the analysis despite not differing statistically between cases and controls. This procedure has showed as relevant when it is observed an OR reduction after introduction of each confounding variable. The OR reduced from 3.8 in the crude model to 3.4 after introduction of mother's education variable reveling their confounding effect. In the next step, when DMFT was inserted in the model, the OR value reduced to 3.2 showing the possible impact of dental caries experience. The final model, included DAI, only slightly increased the OR value (3.2–3.3). The final model revels that impact of treatment of fractured teeth (OR = 3.3) in those individuals affected when compared with those never traumatized.

Thus, with the aim of forming a homogeneous and representative group of cases, adolescents presenting EDFs aesthetically treated over 6 months earlier were chosen to compose this group. Fractures of enamel-dentin are the most often treated type of dental traumatism for dental surgeons. This increases the relevance of researching the effect of this treatment on the daily life of adolescents. The instrument used (OIDP) evaluates the impact of the oral condition on the daily life of individuals in the previous 6 months. An adolescent that experienced the two conditions (fractured tooth and restoration treatment) in the previous 6 months could have become confused during the interview and report the impact of the dental traumatism instead of the impact after *treatment* for the dental trauma. The basic principle during the selection phase was the maximum similarity between cases and controls, except in relation to the presence of dental trauma, which only affected the cases. The choice of the controls can be considered ideal, as the closest friend of each adolescent from the case group were selected. In adolescence, the circle of friends is also denominated by 'group of same' due to the intense coexistence, identification and behavioral similarity (20).

The data collection between cases and controls was standardized. The interview (OIDP) and the clinical exam were carried out by different examiners, thus avoided gauging inclinations. During the data collection, the interviewer had no knowledge as to whether the interviewee was a case or a control.

Most of the possible confounding variables were collected and controlled during the statistical analysis. The choice of the set of possible confounding variables was based, in principle, on previous studies (21, 22). Thus, dental decay, malocclusion and socioeconomic level were identified as potentially confounding variables. In the present study, these variables were collected with the sole aim of being statistically controlled and thereby, not interfering with the results. However, other potentially confounding variables such as 'tooth color' or 'obesity' were not assessed due to operational reasons and consist in the main limitation of this study.

The recall bias (systematic mistake due to differences among the case and control groups in remembering past episodes) is the principal inclination in case-control studies. This comes about due to the individuals of the group case having a greater tendency (affected) to be more informed on the causes of the problem and overestimating some memories. For their part, the controls cannot remember events and exhibitions as easily, not having suffered the consequences of such events (23). In the present study, it is possible that adolescents with the recuperated EDF more easily remembered daily activities that were negatively affected by the oral condition. It is important to point out that the inclination of memory emerges in any case-control study and it should be considered.

The high degree of reproducibility of the diagnoses, as measured by the kappa statistics, and the form of selection of the controls contributed to the internal validity of the study.

In hospital-based case-control studies, it is customary to choose the cases and the controls from within the same hospital, as a question of practicality. However, such a control group is not representative of the population, as individuals often seek medical or dental attendance when they feel sick. Thus, the group for ideal comparison is that originating from the general population and representative of a healthy population. In the present study, such criteria were considered. The controls were selected from the general population to which the cases also belonged. It was considered that individuals seek treatment in the clinics of the Department of Stomatology for noticing some harm from their oral condition on the performance of daily activities. Thus, it can be supposed that such individuals exhibit more problems due to the oral condition than those of the general population.

The hypotheses was confirmed that adolescents having suffered EDFs present a greater prevalence of dental impact on daily living, even after having accomplished orthodontic treatment when compared with adolescents with no history of dental trauma. This reveals that in spite of restoration efforts, the occurrence of the trauma leaves sequelae that such effort cannot fully eliminate, but merely minimize.

In the population-based case-control study carried out by Cortes et al. (5) in Brazil, it was verified that most (66.2%) adolescents with enamel-dentina fractures (case group) presented dental impact (OIDP), whereas among those with no history of

trauma (control group), 14.7% presented dental impact. Comparing the dental impact reported by adolescents from the case group in the present study with that of the study carried out by Cortes et al. (5), a smaller prevalence of dental impact was verified among the adolescents in the present study, which demonstrates the relevance of the treatment.

The prevalence of dental impact among the control groups of the two studies was similar. Comparing the case groups, the impact of untreated EDFs was greater in the study by Cortes et al. (5) than in the present study.

It can be concluded that the treatment of coronary fractures does not eliminate the impact of trauma on the daily life of the adolescents surveyed, although it possibly reduces such an impact. Cultural differences regarding the perception of dental problems and evaluation of aesthetics vary between social groups within a single country as well as between countries, thus making the generalization of these discoveries difficult.

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