

DENTAL HOT-COLD SENSITIVITY AND TRAUMATIC DENTAL INJURIES

ABSTRACT

AIM: Although several studies have indicated negative impacts of traumatic dental injuries on children's quality of life, virtually none of them have explored the possible association between them and the occurrence and dental hot-cold sensitivity. The aim of this study was to study the possible association of hot-cold dental sensitivity and history of traumatic dental injuries. **MATERIAL AND METHODS:** A cross-sectional study involving a representative sample of 11- to 14-year-old schoolchildren from 13 Brazilian municipalities was carried out. Data on traumatic dental injuries were collected through oral examinations. Non-clinical data were obtained through structured interviews on socio-demographic profile and prevalence of dental hot-cold sensitivity. Non-conditional logistic regression analysis was performed for the presence of dental hot-cold sensitivity controlled for gender, maternal schooling and history of dental caries. **RESULTS:** The prevalence of dental hot-cold sensitivity was 30.3% and the prevalence of traumatic dental injuries was 16.6%. Schoolchildren presenting traumatic dental injuries had 22% higher prevalence of dental hot-cold sensitivity compared to those without it regardless other studied variables. **CONCLUSIONS:** A significant and independent association between dental hot-cold sensitivity and history of traumatic dental injuries was observed.

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KEYWORDS

Dental Pain. Dental Trauma. Oral Health-Related Quality of Life.
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INTRODUCTION

Traumatic dental injuries (TDI) have the potential to decrease the quality of life on children and adults¹⁻³. The prevalence of TDI has been reported to be high, and the negative impact may include disturbances in mastication and phonation as well as mental, emotional, financial, and social burdens of dealing with the traumatic event¹⁻³. Although several studies have pointed out a negative impact of TDI on children's quality of life^{4,4}, virtually none of them have explored the possible association between the occurrence of dental hot-cold sensitivity and the history of TDI.

Dental hot-cold sensitivity is a type of dental pain and can impact daily life, interfering especially with the ability to work, study or sleep⁵. The prevalence of dental pain among children in European countries varies between 47.5% and 61.0%⁶⁻⁷ causing intense suffering⁸. A survey on the impact of dental pain measured among eight-year-old English schoolchildren who had experienced pain in the previous month, revealed important limitations in performing daily activities, mainly to eat, to sleep, to play and to attend school normally⁶. Although scarce, prevalence studies have found high proportions of children suffering from dental pain generating considerable impact on children and their families' lives⁹⁻¹⁰. About 33% of 14- to 15-year-old schoolchildren reported dental pain in the

six months preceding the survey in a Brazilian city. Among those affected, approximately 20% reported severe or very severe intensity⁵. Other study showed a prevalence of 22.8% associated with poor oral health status¹¹ and another one showed the most common type of dental pain was dental hot-cold sensitivity set off by hot or cold foods and drinks¹².

This study is based upon the hypothesis that TDI can be associated with a greater occurrence of dental pain. Its aim was to estimate the prevalence and intensity dental hot-cold sensitivity set off by hot or cold foods and drinks and to test its possible association with the history of TDI.

MATERIAL AND METHODS

A cross-sectional study was carried out involving 11- to 14-year-old schoolchildren of public and private schools from 13 municipalities in the Midwestern region of the Southern Brazilian state of Santa Catarina in 2009.

The sample size was calculated to give 80% power to demonstrate a significant difference ratio of 1:1.5 between exposed vs. non-exposed subjects, at a significance level of 5%. Due to the design of the study, a correction factor of 1.5 was applied. An additional 20% was added to the total sample, to compensate for possible losses. The final number of the sample was 409 subjects. A two-stage sample selection was used. Initially,

schools were divided into three groups according to the number of students: small schools (up to 50 students enrolled), medium size schools (51 to 100 students enrolled) and large schools (over 100 students enrolled). Each school was given a number and grouped according to size. Then, they were randomly selected within their group. The total number of selected schools was 20. A simple random sampling technique was used to obtain the required number of subjects.

Clinical data concerning history of TDI were collected through oral examinations carried out by a team of seven dentists previously trained and calibrated according to the methodology published elsewhere¹³. In order to control for possible confounding variable, information on dental caries was also obtained using the World Health Organization criteria¹⁴. Clinical examinations were performed in large venues with enough natural light with children lying on desks. All biosafety procedures were strictly observed. The diagnostic reproducibility was tested through duplicated examinations on 10% of the sample, by each of the examiners.

The TDI classification criteria used were those of the Children's Dental Health Survey used in the UK¹⁵. These criteria included fractures, discoloration and tooth loss because of TDI in the permanent dentition. The need for treatment was reported in cases of signs of untreated TDI or loss of restoration carried out

earlier because of the TDI. In the absence of other signs, small enamel fractures that did not negatively affect the aesthetics were not included in the need for treatment. The required type of treatment included adhesive restorations, endodontic treatment, whitening, single crowns and movable dentures.

Non-clinical data were collected through structured interviews conducted shortly after the clinical examination, which included questions related to age and maternal schooling. Hot-cold sensitivity was assessed through a dental pain specific questionnaire proposed by Locker and Grushka¹⁶ in which one question was "did you feel dental pain set off by hot or cold foods and drinks in the last month?".

A pilot study was carried out in a neighboring municipality involving 10% of total sample (n=40) aiming to test the proposed methodology. No adjustments were found to be necessary.

Statistical analysis was performed using the Statistical Package for the Social Sciences 16.0 (SPSS for Windows, version 16.0, SPSS Inc., Chicago, IL, USA). The outcome "dental hot- cold sensitivity set off by hot or cold foods and drinks in the last month" was categorized as present or absent. Child's gender, maternal schooling, presence of TDI, history of caries (number of Decayed, Missing and Filled Teeth index – DMFT) and the presence of decayed teeth ("D" component of DMFT) were the

independent variables. The variable “maternal schooling” was categorized as less than eight years of schooling and eight years or more; TDI was categorized as present or absent; history of caries was categorized as DMFT equal to zero and different of zero; and the presence of decayed teeth was categorized as equal to zero and different of zero. Data analysis involved descriptive statistics (frequency distribution and cross-tabulation). The chi-square test was used to determine statistically significant association between the outcome and independent variables. Unconditional multiple logistic regression was carried out using the stepwise method¹⁷ to test the independence of associations. All the variables with a p-value < 0.20 in the bivariate analysis were entered into the model ordered by significance, and only those with a p-value < 0.05 were maintained in the final model. The variables history of caries (DMFT) and the presence of decayed teeth (“D” component of DMFT) were maintained regardless of their statistical significance due to their role in adjusting the model.

The research project was submitted to and approved by the Ethics Committee of the *Universidade do Oeste de Santa Catarina*. After that, permission was granted by the administration of the selected schools. An invitation letter was then sent to the parents of the selected children, explaining the aim, characteristics, importance and methods of the

study and asking for permission for their children to participate.

RESULTS

In total 403 schoolchildren were examined and interviewed giving a response rate of 98.5%. The degree of diagnostic reproducibility was high, with Kappa values greater than 0.8, calculated on a tooth-by-tooth basis, both intra- and inter-examiner.

The prevalence of dental hot-cold sensitivity set off by hot or cold foods and drinks in the last month was 30.3% (95% CI 25.8; 34.8) being either very mild or mild [10.9% (95% CI 7.9; 13.9)] moderate [10.2% (95% CI 8.0; 13.8)] and severe or very severe [9.4% (95% CI 6.6; 12.2)] (Table 1). The prevalence of TDI was 16.6% (95% CI 13.0; 25.6) (Table 1). Table 2 shows the relative frequency of the type of damage, treatment provided and treatment needs due to TDI.

The prevalence of dental caries was 64.3% (95% CI 59.6; 69.0). The mean DMFT was 1.83 (SD=2.12) and the “D” component of the DMFT was 1.09 (SD=1.73) which corresponded to 59.7% of DMFT.

The association studies showed statistical significance between the prevalence of dental hot-cold sensitivity set off by hot or cold foods and drinks in the last month and the occurrence of TDI (p=0.025) but not with children’s gender, maternal education, DMFT or “D” component of DMFT.

The results of the logistic regression modeling showed that schoolchildren with TDI had 22% higher prevalence of dental hot-cold sensitivity set off by hot or cold foods and drinks in the last month compared to those

without TDI, regardless child's gender, maternal schooling and history of dental caries.

Table 1. Dental pain set off by hot or cold foods and drinks in the last month, history of dental caries and occurrence of TDI.

VARIABLES	n	%	95% CI
Intensity of dental pain set off by hot or cold foods and drinks in the last month			
Very mild and mild	44	10.9	7.9-13.9
Moderate	41	10.2	7.3-13.1
Severe and very severe	38	9.4	6.6-12.2
Total	122	30.3	25.8-34.8
History of caries			
DMFT > zero	259	64.3	59.6-69.0
D component of DMFT > zero	175	43.4	38.6-48.2
TDI			
Yes	67	16.6	13.0-20.2

Table 2. Relative frequency of TDI, treatment provided and treatment needs (n = 3,224 incisors examined).

	Overall frequency and per type of tooth (n)									Relative frequency per thousand incisors (‰)
	12	11	21	22	32	31	41	42	Total	
Type of damage										
Fracture of enamel	2	31	24	5	1		2		65	20.7
Fracture of enamel and dentin	3	10	8	1				1	23	7.1
Signs of pulp involvement		1							1	0.3
Type of treatment provided										
Adhesive restoration	2	8	4	2	1		1		18	5.6
Endodontic treatment and adhesive restoration		3	2						5	1.5
Need for treatment										
Adhesive restoration	3	27	20	4			1	1	56	17.4
Endodontic treatment and adhesive restoration		1	1						2	0.6

DISCUSSION

The prevalence of dental pain found in this study is higher than those reported in other studies conducted in Brazil^{10,12,18} and in other countries like Spain and Sweden⁷.

However, the results are similar to those found in the Brazilian National Oral Health Survey¹⁹.

In studying a representative sample of a district of London, England, Shepherd et al.⁶ found a 47.5% prevalence of dental pain

among eight-year-old children. The pain was strong enough to bring tears to their eyes in 17.7% of cases. However, comparisons between these prevalence rates should be made with caution due to the different ages studied and the variations in research protocols. It should be emphasized that this study aimed to assess a particular type of pain, the dental hot-cold sensitivity which was not the aim of the majority of studies.

There are few studies on types of dental pain in the literature. Richard and Scowefield²⁰ found a prevalence of 35.2%, while Newton et al.²¹ found a prevalence ranging between 8.0% and 26.9% of pain caused by eating certain foods. Variations are expected and can be attributed to cultural and behavioral factors, and to different pain measurement scales⁷.

The association between TDI and dental hot-cold sensitivity set off by hot or cold foods and drinks found here points to a poorly studied relationship with no evidence in the literature. It is interesting to note that the prevalence of TDI found in this study (16.6%) is similar to those found in several other studies involving the same type of population, age group and using a similar methodology²²⁻²⁵. Also, the types of damage are similar to those found in other studies²⁶⁻²⁷ in which enamel fracture (20.2%) and fracture of enamel and dentin (7.2%) were the most common. Similarly, treatment needs and the treatment provided due to TDI were mostly

adhesive restorations (18.6% and 6.2% respectively) which represent no differences compared to what has been shown²². However, the novel presented by this study is the relationship between history of TDI and hot-cold sensitivity set off by hot or cold foods and drinks.

The type of dental pain under study seems to be related to dentin exposure or to the use of dentin adhesives in the restoration process or long-term effects of pulp or ligament damages³. TDI of lesser severity such as fractures of enamel and dentin which are the majority in all population-based studies would be sufficient to generate sensitivity.

Even enamel fractures have potential to generate pain as an effect of concussion or subluxation resulting from the impact and consequent damage to pulp tissue or ligament, especially when chewing. The exposure of dentinal tubules or the reflexes of adhesives using in the restorative process could explain the sensitivity. In the latter case, pain would not be exclusively a result of TDI but eventually of any restorative process. However it should be noted the observed association maintained statistical significance regardless the history of dental caries.

Finally, it is necessary to emphasize that due to the study's cross-sectional design it is impossible to say that the dental hot-cold sensitivity was resulted from TDI. For that conclusion a cohort design is more appropriate

and recommended. Nevertheless, the findings of this study corroborate the idea of using dental pain, especially in children as a valid indicator for priority setting in primary oral health care. The increased prevalence of TDI observed in several studies can serve as a warning that, even with the declining trend of dental caries in children, the demand for oral health care based on dental pain may stay at the current level.

CONCLUSION

It can be concluded that a history of TDI was significantly and independently associated with the prevalence of hot-cold sensitivity of the dentition.

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