







Prevalence and Associated Factors of Dental Trauma in Six-Year-Old School-Children

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Academic Editor: Alessandro Leite Cavalcanti

Received: 21 July 2020 / **Review:** 31 August 2020 / **Accepted:** 27 September 2020

How to cite: Malinverni B, Lunardelli AN, Lunardelli SE, Martins LGT, Nunes RD, Traebert E, et al. Prevalence and associated factors of dental trauma in six-year-old school-children. *Pesqui Bras Odontopediatria Clín Integr.* 2021; 21:e0171. <https://doi.org/10.1590/pboci.2021.033>

ABSTRACT

Objective: To estimate the prevalence and associated factors of dental trauma in 6-year-old school children in the city of Palhoça, Brazil. **Material and Methods:** Cross-sectional study nested in a cohort study. It involved a representative sample of school children born in 2009, residing in the municipality and regularly enrolled in public and private schools (n = 1,102). Clinical data were obtained through oral exams. To evaluate the incisal overjet, the distance in millimeters was measured horizontally from the labial surface of the lower central incisor to the labial surface of the upper incisor. Bivariate analyses were performed using the Chi-square test, with a p-value <0.05 considered statistically significant. Multivariate analyses using Poisson Regression were performed to identify independent associations between the prevalence and the independent variables studied. **Results:** Prevalence of dental trauma was 4.2% (95% CI 3.0-5.4). Dental trauma was statistically associated with studying in a private school (PR = 1.03; 95% CI 1.01-1.06) (p=0.016) and with inadequate lip coverage (PR = 1.08; 95% CI 1.01-1.14) (p=0.016). **Conclusion:** The prevalence of 4.2% of dental trauma in six-year-old children, associated with inadequate and greater lip coverage in children from private schools should be taken into account, since most teeth at this stage are newly erupted.

Keywords: Epidemiology; Tooth Injuries; Tooth Fractures; Dentition, Mixed.

Introduction

Dental trauma (DT) is considered by the World Health Organization (WHO) to be a worldwide public health issue [1]. Epidemiological studies show a drop in the prevalence of dental caries in children which rates are not as high as they have been for several decades [2-4]. On the other hand, there is a considerable prevalence of DT among Brazilian preschool children [5-7]. A study reported in the international literature, aiming at identifying DT epidemiology in both primary and permanent dentition, found that 25% of all school-age children had already suffered some type of DT, and that practically 33% of adults had also experienced DT before they were 19 years old [8]. This prevalence reveals the need to investigate DT causes and associated factors, and consequently optimize prevention of their occurrence [9].

The high rates of violence, traffic accidents and sports activities are cited as important factors for DT, as they have contributed to the increase in their occurrence [10]. When we review the location of the occurrences we find that the traumatic experience usually occurs at home, on the street, school, parks or squares [11]. Regarding etiology, falls, traffic accidents, contact sports and violence are the mostly reported factors. However, there are also less common types of causes, such as iatrogenesis of hospital procedures, physical abuse in childhood, unspecific shocks, dizziness, psychic changes and epilepsy [11].

It is important that appropriate measures be taken promptly after the occurrence of DT, aiming at a good prognosis in relation to the affected tissues. Problems during the rescue, depending on the type and intensity degree of the impact can lead to the loss of the dental element. It is, therefore, necessary to offer guidelines and prepare the population on the necessary care at the time of the accident [10].

Predisposing factors contribute to increased susceptibility to DT, such as marked incisal overjet and inadequate lip coverage. In addition, the risk increases in males [5,7,12].

It is important to highlight that DT not only affects the physical part with injury to the face and teeth, but also, psychologically causing anxiety and distress not only for the child, but also for the parents [6]. In relation to the physical-functional aspect, a lesion located in the anterior region of the oral cavity can lead to physical disability, such as difficulty in chewing, phonation or both. In the psychosocial aspect, it can provide social and psychological embarrassment, such as smiling avoidance, affecting social relationships. In addition, the high prevalence of DT has been responsible for a high demand for emergency dental services, generating high public costs [6].

The objective of this study was to estimate the prevalence and factors associated with DT in six-year-old school children in the city of Palhoça, Brazil. This age was chosen to enable the analysis of DT at the beginning of mixed dentition, an age that has been little studied and with little data available in the scientific literature.

Material and Methods

Study Design

The study population consisted of six-year-old children regularly enrolled in schools and residing in the municipality of Palhoça, SC, Brazil in 2015. The municipality is located 14 km from Florianópolis, the capital of the Santa Catarina State. The resident population of Palhoça in 2015 was estimated at 157,833 inhabitants [13].

A cross-sectional study was carried out nested in the study named Coorte Brasil Sul [14], conducted by the Post-Graduate Program in Health Sciences at the Universidade do Sul de Santa Catarina. A total of

1,102 children who had oral health data composed the sample, out of a total of 1,270 students being followed up [14].

Data Collection

Clinical data were obtained through oral exams using the O'Brien criteria [15]. To evaluate the incisal overjet, the distance in millimeters was measured horizontally from the labial surface of the lower central incisor to the labial surface of the upper incisor. WHO-type periodontal probes were used to verify the measurements. Regarding lip coverage, with the student mentally reading a document, without knowing that he was being observed, adequate lip coverage was considered when the lips touched each other, completely covering the anterior teeth. No lip coverage was considered when the examiner was able to observe the teeth through the lips at rest.

The examinations were carried out in a school environment, with natural light, observing all the biosafety criteria [16]. The data collection team was composed of nine Dental Surgeons (DS) and nine Oral Health Assistants (OHA), all of whom work for the Municipality of Palhoça, SC. The team was properly trained and calibrated in order to obtain uniformity and diagnostic reproducibility. Four hours training and calibration sessions were conducted and a closing meeting was held to present the results. The calibration process was carried out using the "in lux" methodology [17,18] and the Kappa index was used to measure intra- and inter-examiner diagnostic reproducibility. The team was considered calibrated when the Kappa values were greater than 0.7 for all tests. A total of 5% of the sample was examined in duplicate with the purpose of diagnostic monitoring during collection. Other information collected was gender and the type of school in which the student was enrolled (public or private).

Data Analysis

The data were inserted into Excel spreadsheets and after correcting the inconsistencies, they were exported to the IBM SPSS® 18.0 program where they were analyzed. A descriptive analysis of the studied variables was carried out. Bivariate analyses were performed using the Chi-square test, with a p-value <0.05 considered statistically significant. Multivariate analyses using Poisson Regression with robust estimators were performed to identify independent associations between the prevalence of DT and the independent variables (gender, type of school, incisal overjet and lip coverage). Prevalence ratios (PR) and their relevant confidence intervals (95%) were estimated.

Ethical Clearance

A free and informed consent form describing the investigation objectives, data confidentiality and voluntary participation was forwarded to the participants' parents. The results of clinical examinations were made readily available to all participants. Reports signed by the research team were delivered to parents and they reported any identified health problems. The investigation project was submitted to and approved by the Research Ethics Committee with Human Beings of the Universidade do Sul de Santa Catarina under opinion number 38240114.0.0000.5369.

Results

The total number of children examined was 1,102, yielding a response rate of 86.7% compared to the total number of children being followed up. The main reasons for losses were the parents' non-permission and

the child's absence from school on the exam days. The degree of diagnostic reproducibility showed Kappa values greater than 0.70, calculated from tooth to tooth, both intra and inter-examiner.

Of the total participants, 50.2% were male and 83.6% studied in public schools. These and other proportions related to clinical issues such as incisal overjet and lip coverage are shown in Table 1. The prevalence of DT found was 4.2% (95% CI 3.0; 5.4). Out of the total of 55 teeth that presented DT, 32 (60.4%) presented fracture only in the enamel and 13 (18.9%) enamel-dentin fracture (Table 2).

Table 1. Sample distribution according to socio-demographic and clinical variables.

Variables	N	%
Gender [n=1,102]		
Male	553	50.2
Female	549	49.8
Type of School [n=1,102]		
Public	921	83.6
Private	181	16.4
Incisal Overjet [n=1,099]		
≤ 3mm	660	60.1
>3mm	439	39.9
Lip Coverage [n=1,081]		
Adequate	918	84.9
Inadequate	163	15.1

Table 2. Absolute and relative distribution of types of dental trauma.

Variables	School Children		Teeth	
	N	%	N	%
Enamel Fracture	29	63.0	32	60.3
Enamel and Dentin Fracture	10	21.8	13	24.5
Fracture with Pulp Involvement	5	10.8	6	11.4
Tooth Absence due to Trauma	2	4.4	2	3.8
Total	46	100.0	53	100.0

The groups of teeth most affected were the upper central incisors (70.9%), followed by the upper lateral incisors (21.9%) in both the primary and permanent dentition. The values for the other teeth are shown in Table 3.

Table 3. Prevalence of dental trauma according to tooth and dentition.

Variables	N	%
Primary Dentition		
52	5	9.1
51	8	14.5
61	5	9.1
62	3	5.5
72	-	-
71	1	1.8
81	-	-
82	-	-
Permanent Dentition		
12	3	5.5
11	12	21.8
21	14	25.5
22	1	1.8

32	-	-
31	1	1.8
41	2	3.6
42	-	-
Total	55	100.0

The results of the association studies showed that the gender variable was not statistically associated ($p=0.238$). With regard to the type of school, which is a proxy for socioeconomic conditions, children who studied in private schools had a statistically higher prevalence when compared to those in public schools ($p=0.001$). The incisal overjet measurement greater than 3 mm ($p=0.042$) and inadequate lip coverage ($p=0.001$) were also associated with dental trauma (Table 4).

Table 4. Result of bivariate analysis.

Variables	Dental Trauma				Total N (%)	p-value
	Yes		No			
	N	%	N	%		
Gender						0.238
Male	27	4.9	526	95.1	553 (50.2)	
Female	19	3.5	530	96.5	549 (49.8)	
Type of School						0.001
Public	29	3.1	892	16.9	921 (83.6)	
Private	17	9.4	164	90.6	181 (16.4)	
Incisal Overjet						0.042
$\leq 3\text{mm}$	21	3.2	639	96.8	660 (60.1)	
$>3\text{mm}$	25	5.8	414	94.3	439 (39.9)	
Lip Coverage						0.001
Adequate	38	3.6	1.014	16.4	918 (84.9)	
Inadequate	8	17.4	38	82.6	163 (15.1)	

The results of the multivariate analysis showed that children from private schools had a statistically higher and independent prevalence of DT compared to children from public schools ($PR_a = 1.03$; 95% CI 1.01-1.06) ($p=0.016$). The same happened with those children with inadequate lip coverage ($PR_a = 1.08$; 95% CI 1.01-1.14) regardless of the other variables studied. The variables incisal overjet and lip coverage were shown to be collinear ($p<0.001$), thus opting to maintain lip coverage in the adjusted model (Table 5).

Table 5. Results of the crude and adjusted analysis for the prevalence of dental trauma in 6 year-olds.

Variables	PR_c (CI 95%)	p-value	PR_a (CI 95%)	p-value
Gender		0.238		0.207
Male	1.00		1.00	
Female	0.99 (0.98-1.01)		0.99 (0.98-1.01)	
Type of School		<0.001		0.016
Public	1.00		1.00	
Private	1.04 (1.01-1.00)		1.03 (1.01-1.06)	
Incisal Overjet		0.042	#	
$\leq 3\text{mm}$	1.00			
$>3\text{mm}$	1.02 (1.01-1.03)			
Lip Coverage		<0.001		0.016
Adequate	1.00		1.00	
Inadequate	1.07 (1.01-1.14)		1.08 (1.01-1.14)	

PR_c = Crude Prevalence Ratio; PR_a = Adjusted Prevalence Ratio; CI 95% = 95% Confidence Interval; #The variables incisal overjet and lip coverage were shown to be collinear ($p<0.001$). We opted to maintain lip coverage in the adjusted model.

Discussion

The good response rate, the calibration process and the intra and inter-examiner reproducibility data ensure good internal data validity. There are few epidemiological studies of DT focused on mixed dentition. A study carried out with school children aged 5 and 6 years ($n = 684$) in the city of Barueri, Brazil [5], showed a 52.3% DT prevalence, which indicates a significant difference in the prevalence found in this study (4.2%). However, another study conducted in the municipality of Tubarão, Brazil, with 7 and 8-year-old students ($n = 1,435$) [19] who were in the initial eruption period of the permanent incisors, showed a prevalence of 9.6%, close to that of the present study.

In this phase, certain factors can be brought into the picture to explain the different prevalences found in the literature. Exfoliation of primary teeth that suffered trauma prior to the data collection and the eruption period of the permanent anterior teeth are factors that may explain the difference in the prevalences reviewed [19]. In addition, the diversity of classifications used in the studies makes it difficult to compare the results, so that the development of standard protocols would allow a better data comparison [6].

It is important to note that children with a history of DT have a higher chance of new episodes. Adolescents with a history of DT were almost five times more likely to experience new occurrences compared to adolescents who never suffered DT [20]. A recent meta-analysis indicated that the risk of a new DT occurrence in individuals who had already suffered DT in the past was twice as high [21]. It is important to identify DT early, from the beginning of permanent dentition, as proposed in this work. Early identification of children with DT enables the consequent intervention with preventive measures against new episodes of DT. In addition, DT diagnosis in primary teeth is of fundamental importance as a risk indicator for DT in future permanent teeth [22].

Although most studies indicate a greater association of the prevalence of DT and the male gender, both in permanent and primary dentition [5,7], in this study no statistically significant association was observed. This could, hypothetically, be explained by the fact that currently contact sports and other behaviors previously typically restricted to boys are also being practiced by girls. Thus, the risk of gender-related DT would be equalized [20,23-26].

The identification of a statistically significant association between the prevalence of DT and the private school may be ascribed to socioeconomic conditions. The type of school attended by the child may reflect different family economic conditions [27]. This finding may be related to a greater facility of children with better socioeconomic conditions having greater access to equipment such as bicycles, skateboards, skates, scooters, when compared to those of families with lower socioeconomic conditions [26,28]. However, it is difficult to see the use of protective and safety equipment such as helmets and mouth guards in contact sports or risky games, which could prevent traumatic episodes [6,17,29].

Among the most studied clinical factors, variables related to occlusal conditions, such as the incisal overjet and the adequacy of lip coverage are the most prominent [30-33]. In this study, these variables were shown to be statistically associated. The findings about overjet and inadequate lip coverage corroborates with other studies [10,30,34,35]. A meta-analysis focused on observational studies has shown that marked overjet can double or even triple the risk of trauma to the anterior teeth. Measures can be taken to minimize the risk of DT, ranging from orthodontic treatment to protection through mouth guards, in addition to tutors and parents' guidance [36].








Among the limitations of this study, we can mention the large number of examiners used, which could generate a measurement bias. However, precautions were taken, such as examiners' training and calibration exercises, in addition to monitoring the diagnostic variability in the data collection process.

Even so, the prevalence results should be observed with caution, since the low DT rate may be a possible reflection of the under-studied age group. Therefore, further studies in the same age group are necessary in order to compare the prevalence of the occurrence of DT in the six-year-old population.

Conclusion

The prevalence of 4.2% of DT in six-year-old children, associated with increased incisal overjet or inadequate and large lip coverage deficiency in children from private schools should be taken into account, since most teeth at this age are newly erupted.

Authors' Contributions

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All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

Financial Support

FAPESC - Grant Number 2016 TR22 and PROSUC/CAPES - Financing Code 001.

Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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