

Profiles of Trauma in Primary and Permanent Teeth of Children and Adolescents

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This retrospective study aimed to evaluate the dental trauma profile in primary and permanent teeth from patients between 0 and 15 years old who attended the Faculty of Dentistry of the Federal University of Rio de Janeiro. Data regarding gender, age, trauma classification, tooth type, and affected tissues were obtained from dental records. The data were analyzed descriptively and by the χ^2 test ($p < 0.05$). Data associated with 333 traumatized teeth (70% primary and 30% permanent teeth) were included. The mean ages of children with affected primary and permanent teeth were 3.35 ± 2.02 and 9.09 ± 2.43 years, respectively. Males presented more permanent teeth with trauma (64.4%) than primary ones (55.6%; $p = 0.085$). The upper central incisors, both primary (68.9%) and permanent (69.4%), were the teeth most commonly affected. Primary teeth showed a higher frequency ($p < 0.001$) of supportive tissue trauma (73.3%) and lower frequency ($p = 0.001$) of hard tissue trauma (40.7%) than those in permanent ones (51.5% and 60.6%, respectively). The most frequent trauma in the supportive tissue was subluxation (27.2%) and permanent lateral luxation (42.0%). In the hard tissues, permanent teeth presented a higher prevalence of trauma than primary ones ($p = 0.001$), however this difference was not statistical significant when each type of fracture injury was evaluated individually ($p > 0.005$). With affected primary teeth, there was a greater frequency of trauma in the gingival mucosa (31.0%; $p = 0.022$); in the permanent ones, traumatic lesions in the chin region were the most prevalent (20.8%; $p = 0.009$). Trauma was recurrent in 26.3% of primary teeth and in 20.2% permanent teeth. Therefore, primary and permanent teeth showed distinct trauma profiles, suggesting that distinct preventive and therapeutic approaches are needed for these two groups.

Keywords: Children, Dental trauma, Primary teeth, Permanent teeth

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INTRODUCTION

Dental trauma is considered a highly prevalent dental emergency and a serious public health problem worldwide that has a great impact on quality of life and a high cost for treatment.¹⁻⁴ Primary teeth of children between 1 and 3 years old⁵ and permanent teeth of children and adolescents aged from 8 to 12 years are most frequently affected.⁶ In addition, gender and children and adolescents with a history of multiple episodes of dental trauma contribute disproportionately to this high prevalence.⁷

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Most lesions in both primary and permanent teeth involve the anterior teeth, and mainly the upper central incisors.⁸ Usually these lesions affect a single tooth, but certain types of trauma can affect multiple teeth and are associated with a worse prognosis.^{9,10}

In addition, studies suggest that trauma in supportive tissues is more prevalent with primary teeth, whereas dental tissues are more commonly associated with trauma in permanent teeth.¹¹ Nevertheless, the frequency of both types of trauma associated with soft tissue in children and adolescents is high. Therefore, anti-tetanus prophylaxis should not be neglected in this population.¹²

Despite the large number of studies on dental trauma, there are still questions regarding the profiles of trauma in primary and permanent teeth, especially in patients who attend reference dental center. Understanding these profiles would enable the implementation of more effective prevention and treatment programs, as well as the design of therapeutic and educational approaches that are more appropriate for individual cases. Therefore, in this study, we determined the profiles of dental trauma in primary and permanent teeth of children and adolescents treated at the Dental Trauma Surveillance Center at Universidade Federal do Rio de Janeiro (DTSC/UFRJ).

MATERIAL AND METHOD

In this retrospective study, we examined medical records of children and adolescents with one or more traumatized teeth. Study participants were between 0 and 15 years of age, both genders, and received dental care at DTSC/UFRJ after referral or direct solicitation. The sample was selected by convenience.

After the approval of the Ethics Committee on Human Beings of the University Hospital Clementino Fraga Filho (HUCFF) (no. 202/14), data on gender, age, tooth type, affected tissues, types of injuries, and trauma recurrence were collected from the dental records of patients attending DTSC/UFRJ between 2014 and 2016.

Dental trauma characteristics were described according to the following classification criteria, outlined by Andreasen et al.¹³:

- Dental tissue: Enamel crack, enamel fracture, enamel fracture, uncomplicated and complicated dentin fracture, uncomplicated and complicated corono-radicular fracture, and root fracture.
- Supportive tissue: concussion, subluxation, lateral luxation, extrusive luxation, intrusive luxation, avulsion, and alveolar fracture.
- Soft tissues: Contusion, abrasion, and laceration, with the possibility of more than one type of injury at the same time.

Children and adolescents with dental records showing syndrome and/or neuromotor changes or teeth lost due to caries, whose data was incomplete, those for whom radiographic examination was not possible, and those who refused to participate were excluded from the study.

All of the patients were examined by graduate students of the Faculty of Dentistry of UFRJ who had previously trained under the supervision of an expert professor to diagnose dental trauma.

After collection, the data was tabulated in a spreadsheet created in Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 20.0 and analyzed descriptively in terms of frequencies and statistically by non-parametric χ^2 test, with a significance level of 5% ($p < 0.05$) and 95% confidence interval.

RESULTS

Among the 251 records examined, 19 were excluded because of incomplete data. In total, 232 medical records were analyzed, with 129 associated with males and 103 with females. These records represented 333 traumatized teeth: 232 primary (70%) and 101 permanent (30%) (Table 1). The mean ages of children with primary and permanent teeth affected were 3.35 ± 2.02 and 9.09 ± 2.44 years, respectively. Males had a greater number of traumatized permanent teeth (64.4%) than primary ones (55.6%) traumatized, whereas females had fewer traumatized permanent teeth (35.6%) than primary ones (44.4%). However, this difference was not statistically significant ($p < 0.085$). Upper central incisors, both primary (68.9%) and permanent (69.4%), were the teeth most affected by trauma. The distribution of affected teeth is shown in Table 2.

When permanent teeth were traumatized, a higher frequency of affected hard tissues was observed (60.6%) than with traumatized primary teeth (40.7%; $p = 0.001$). On the other hand, when primary teeth affected, a greater frequency (73.3%) of supportive tissue trauma ($p < 0.001$) was observed than with permanent teeth (51.5%).

Among cases of dental tissue trauma, there was a higher prevalence of lesions associated with permanent teeth than with primary teeth ($p = 0.001$). However, when evaluating the types of dental tissue injury independently, no difference was found between the dental types analyzed ($p > 0.05$). The types of damage observed are summarized in Table 1.

Regarding supportive tissue trauma, there was a higher prevalence of subluxation ($p = 0.001$) and alveolar fracture ($p = 0.022$) in primary teeth, whereas lateral luxation ($p < 0.001$) and avulsion ($p = 0.005$) were more common in permanent teeth. There was no difference in the prevalence of concussion ($p = 0.056$), extrusion ($p = 0.399$), or intrusion ($p = 0.128$) between primary and permanent teeth (Table 1).

Regarding soft tissues, there was no significant difference in the prevalence of extra-oral ($p = 0.113$) and intra-oral injuries ($p = 0.305$) with either primary and permanent traumatized teeth.

When specific regions of these injuries were evaluated, there was a higher prevalence of injury in the chin (20.8%; $p = 0.009$) and nose (8.0%; $p = 0.035$) regions when permanent teeth were traumatized compared to when primary teeth were affected. In addition, gums (31.1%; $p = 0.022$) were more often injured at the time of trauma to primary teeth than at other times.

Among the types of injuries most affected in the chin region, abrasion (47.6%) was the most common, whereas, in the nasal region, contusions were more frequently observed (75.0%) with permanent teeth. With primary teeth, the most prevalent injuries were contusions (81.4%) in the gingival mucosa. The types of damage observed are summarized in Table 3.

Recurrence was reported in 26.3% of children with traumatized primary teeth and in 20.2% of those with traumatized permanent teeth ($p = 0.169$).

Table 1: Distribution of the traumatic dental injury, according primary and permanente affected teeth.

Traumatic dental Injury, according to the affected tissue	Tooth type				p-Value
	PrimaryDeciduous		Permanent		
	Absolut Value	Relative Value %	Absolut Value	Relative Value %	
HARD TISSUE	90	40.7	60	60.6	(p =0.001)*
Enamel Crack	4	4.5	4	6.8	0.407
Enamel Fracture	42	47.7	23	39.0	0.190
Non complicated Fracture	29	33.0	28	47.5	0.055
Complicated Fracture	7	8.0	6	10.2	0.428
Crown Root Fracture	4	4.5	0	0	0.125
Root Fracture	5	5.7	1	1.7	0.226
SUPPORT TISSUE	162	73.3	51	51.5	(p<0.001)*
Concussion	34	21.0	5	10.0	0.056
Subluxation	44	27.2	3	6.0	0.001*
Lateral Luxation	26	16.0	21	42.0	<0.001
Extrusion	7	4.3	1	2.0	0.399
Intrusion	33	20.4	6	12.0	0.128
Avulsion	18	11.1	14	28.0	0.005*
Alveolar Fracture	12	8.5	0	0	0.022*

Note: The same tooth could have more than one condition.
Chi-squared test (*Statistical significance P < 0.05)

Table 2: Distribution of the traumatic dental injury, according to the type of tooth: primaryDeciduous and permanent.

PrimaryDeciduous Teeth	Absolut Value	Relative Value %	Permanent Teeth	Absolut Value	Relative Value %
51	85	36.6	11	35	34.5
52	18	7.8	12	8	7.9
53	4	1,7	21	35	34.7
61	75	32.3	22	7	6.9
62	22	9.5	23	2	2.0
63	3	1.3	24	2	2.0
71	6	2.6	31	2	2.0
72	3	1.3	32	1	1.0
81	8	3.4	41	5	5.0
82	6	2.6	42	4	4.0
83	1	4.0			
84	1	4.0			
Total	232	100.0		101	100.0

DISCUSSION

In the present study, among 333 traumatized teeth, 70% were primary teeth and 30% were permanent ones. This can be explained by the greater demand for care by younger children at DTSC/ UFRJ, which acts as a reference center in the city of Rio de Janeiro. Preschool-aged children are often not served by the municipal public health system because of their youth and behavioral complexity. In addition, the patient sample was selected for convenience, based on previously described eligibility criteria. These factors may have contributed to the higher frequency of traumatized primary than traumatized permanent teeth included in the study.

Previous epidemiological studies have identified factors that predispose a child for dental trauma, such as gender, age, and tooth type.¹⁴ The majority of these studies has found males, associated with more aggressive behavior and a preference for violent games, to have with a higher prevalence of trauma in both types of teeth.⁴ However, the present study does not support these findings because, although there was a higher frequency of trauma in permanent teeth than in primary teeth in males, this difference was not statistically significant when compared to the results of females from previous studies.¹⁵

Table 3: Distribution of the location of soft tissue and types of injury in the extra- and intra oral regions, according to the type of tooth: primaryDeciduous and permanent.

SOFT TISSUE	Soft Tissue				p-Value
	PrimaryDeciduous		Permanent		
	Absolut Value	Relative Value %	Absolut Value	Relative % Value	
EXTRA-ORAL	72	32.0	40	39.6	0.113
Upper lip	46	20.6	17	17.0	0.274
Lower lip	49	21.8	15	34.1	0.062
Nose	6	2.7	8	8.0	0.035*
Chin	21	9.9	20	20.8	0.009*
Cheek	9	4.0	2	2.0	0.284
Front	0	0.0	1	1.0	0.312
INTRA-ORAL	84	37,3	34	33,7	0.305
Lips	59	26.2	18	17.8	0.064
Vestibule	38	17.0	16	16.0	0.477
Gum	70	31.1	20	19.8	0.022*
Jugal mucosa	2	0.9	0	0.0	0.476
Palate	3	1.3	1	1.0	0.635

Note: The same tooth could have more than one condition.

Chi-squared test (*Statistical significance P < 0.05)

Regarding age, Ritwik *et al*¹⁶ found a higher prevalence of dental trauma in primary teeth in children between 2 and 4 years of age and in permanent teeth in children between 8 and 10 years of age, which agrees with the findings of this study, which showed that the highest prevalence of trauma in primary teeth was in children with a mean age of 3.35 ± 2.02 years and in permanent teeth was in children with a mean age of 9.09 ± 2.44 years. This difference is likely because young children have immature motor coordination.¹⁷

There is a consensus in the literature that the upper incisors are the teeth most affected by trauma, both in primary and in permanent teeth and without a distinction in sides of the mouth affected. This study corroborates these previous results. The risk associated with the upper incisors is likely because of their prominent location in the dental arch, along with predisposing factors in some children, such as inadequate lip coverage of the anterior teeth and marked prominence of the upper incisors.¹⁸⁻¹⁹ However, for Atabeck *et al*,²⁰ differences were noted when sides were compared, with a higher occurrence of trauma on the right side when primary teeth were involved and a higher prevalence on the left side with trauma to permanent teeth.

In the present study, among the injuries that affect dental tissues, a higher prevalence of traumatic lesions was found in permanent teeth than in primary teeth, but when evaluating the type of injury independently, no statistically significant difference between primary and permanent was found. This result may be because of the patients sampled, because they were treated at a reference center for dental trauma in pediatric dentistry at the Federal University.

However, when evaluating only the occurrence of injury in permanent teeth, we observed fractures of enamel and dentin without pulp involvement (47.5%) most commonly, which agrees with the results of Mahmood *et al.*³ and disagrees with those of Sari *et al*,

²¹ which indicated that enamel fractures were the most common fractures in permanent teeth. However, in primary teeth, we found that the most frequent dental injury was enamel fractures (47.7%), in agreement with a study by Folakemi *et al.*,²² but disagreeing with a study by Ekanayake *et al*,²³ which indicated that the most prevalent injuries in primary teeth were complicated enamel and dentin fractures. However, this previous study was conducted in a hospital unit in Sri Lanka that receives more severe cases of dental trauma than our center.

There was a higher prevalence of trauma associated with supporting tissues (73.3%) in primary teeth than in permanent teeth, and the most common type of supporting tissue injury was subluxation (27.2%), which was similar to results of study by Dang *et al.*,²⁴ but differed from those in a study by Ritwik *et al*,¹⁶ who observed that extrusive luxation was most prevalent in their study population. Lateral luxation (42.0%) in the supporting tissues was the most common injury in permanent teeth, corroborating the findings of Dang *et al*²⁴ but contrasting with those of Gulianelli *et al.*,²⁵ who found that avulsion as the most prevalent injury in permanent teeth. This difference can be explained by the fact that avulsion, considered a severe injury, is often performed in emergency hospitals, and these cases are only later referred to DTSC/UFRJ.

The lesions that occurred most frequently in permanent teeth were found in dental tissues (60.6%), and the ones in primary teeth were found in supporting tissues (73.3%). This was also observed by Zhang *et al*¹¹ and Sari *et al*,²¹ but not by Gulianelli *et al*,²⁵ who found a higher prevalence of injury in supportive tissues with both types of teeth. The most plausible reason for those results is that higher bone resilience is found in primary teeth, which associated with energy, angle and direction of traumatic impact favoring displacements to the detriment of fractures.²⁶

With soft tissue injuries, there was no difference in their prevalence between intra- and extra-oral regions and no difference between their prevalence in primary and permanent teeth. However, when evaluating the regions most affected by dental trauma types independently, and the types (81.4%) located in the gum tissues (31.1%) when trauma occurs in the primary and in the permanent teeth, there was a higher occurrence of lacerations (40.0%) in the region of chin (20.8%), prevalence considered to be high.

Although records of soft tissue lesions have been reviewed in only a few studies, Díaz *et al*²⁷ corroborates our findings, in part, in that gingival (gum) contusions were the most prevalent in primary teeth and lacerations were the most prevalent injuries in permanent ones. However, according to these same authors, the lips were the most common region for injury in permanent teeth, which contrasts with the results of the present study, in which the chin region was the most common location for injury in permanent teeth.

A recent and well-conducted study on soft tissue lesions by Soares *et al*.¹² showed that the prevalence of dental injury of 56.2%, the most affected group was boys between 0 and 3 years of age, and intra-oral injuries (lip contusion, 27.5%) were more common than extra-oral (upper lip contusion, 20.7%). A study by Ritwik *et al*¹⁶ agreed with this high prevalence (73.0%) of soft tissue injury. Zhang *et al*¹¹ found that the most frequent injury was laceration, although the anatomic regions where these injuries occurred was not indicated.

It is clear from this analysis that lips, because of their location covering part of the anterior upper incisors, can act as an impact absorber, reducing the possibility of dental fracture and increasing the risk of dislocation and alveolar fracture. This might support the current findings of a greater prevalence of gingival contusions in primary teeth than primary teeth.²⁶ However, estimates of soft tissue trauma may be underestimated because of their healing over time; therefore, they may not be recognized at the time of examination.²⁸

Some children and adolescents may experience a single episode of dental trauma, whereas others appear to be prone to multiple episodes of dental trauma and at high risk of developing certain lesions and complications. Thus, an important risk factor for dental trauma is a history of previous dental trauma. In our study, recurrence of dental trauma in primary teeth and permanent teeth were 26.3% and 20.2%, respectively, which is in line with results of studies by Glendor *et al*.⁷ These numbers may be greater in patients with motor limitations, overjets greater than 5 mm, lips with inadequate closure, and other predisposing factors.¹⁹

Although our results agree with those of most similar studies, it is still a challenge to examine all risk factors when few studies are comparable, either because of differences in methodologies or a lack of standardization methodologies in epidemiological research.¹⁸

A possible limitation of this study is the retrospective character of the study and thus the possibility of memory bias, because there is often a lapse of time between trauma and the search for care. Therefore, prospective longitudinal studies, although more expensive, are needed to more accurately determine the incidence and risk of traumatic dental injury.²⁸ It is worth remembering, however, that, even in longitudinal studies, this incidence rate may be underestimated because people with mild traumatic dental injury may fail to seek care. Therefore, prospective studies of short duration would be a better option than longer term studies, because this would minimize the disadvantages of both study types.²⁸

Finally, in this epidemiological study, we determined the profiles of traumatized tooth (permanent or primary) according to type in patients treated at the DTSC, which will facilitate the elaboration of more effective public policies to prevent, treat, and educate for the most appropriate care in each trauma case.

Such approaches should support the inclusion of pediatric dentistry specialists in emergency hospitals because these facilities are in most cases the first to receive serious dental trauma. These professionals are highly qualified to work with children whose therapeutic and behavioral complexities must be considered to ensure quality care.

In addition, the creation of mechanisms that increase the accessibility of referral services for dentoalveolar trauma to children and adolescents should be supported, because these professionals have in-service training and are accustomed to monitoring trauma patients until they can be safely discharged. Trauma in primary teeth can reverberate to the successive permanent teeth and lead to severe complications over time if not treated appropriately early.

Moreover, consultations with pediatric dentists should be mandatory during pre and postnatal care to better educate mothers on the management of dental injuries. The importance of early possible professional care should be stressed, as well as the need for compliance with laws on the use of mouth guards, helmets, and other personal protective equipment during sports activities, especially in older children.

Finally, it is of the utmost importance that, in addition to improving dental trauma care in public services, teachers, caregivers, and children themselves are also included in continuing health education programs with lectures, activities, and online resources such as videos and interactive games to reduce dental trauma, thus improving the quality of life of many people who have experienced dental trauma.

ACKNOWLEDGMENT

The authors acknowledge the Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ – E-26/202.810/2016) for their financial support.

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