



Dental Trauma Epidemiology in Primary Dentition: A Cross-Sectional Retrospective Study

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Abstract: Our aim was to investigate the epidemiology of dental trauma (DT) injuries in primary teeth, a health hazard issue that is often neglected by the public health care system. The records of 298 children who attended the Unit of Dental Care for Special Needs Patients and Pediatric Dentistry, University of Bologna, Bologna, Italy and had suffered a DT between January 2011 and December 2021 were examined to assess age, gender, cause and place of the DT, type of lesion and teeth involved. The chi-squared test was used to compare categorical variables. A total of 265 children (89%) suffered a single trauma, and 33 (11%) suffered from repeated DT. A total of 511 teeth (mean 1.7 ± 0.5) experienced dental trauma. Most of the trauma occurred in the 2–3 years range (153 DT, 30%). The most affected teeth were the upper central incisors ($n = 388$; 76%). The DT involved periodontal tissue in 316 teeth (62%) and hard dental tissue in 262 cases (51%). DT in primary teeth is commonly caused by accidental falls at home, occurs most frequently to toddlers' upper central incisors, and usually affects tooth-supporting structures. Clinicians should be aware of the most frequent DT and be updated concerning treatment guidelines.

Keywords: dental trauma; epidemiology; primary teeth



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1. Introduction

Dental trauma (DT) on primary dentition represents a health hazard that may reduce the child and the family's quality of life. Moreover, it is an often-neglected public health issue [1]. A recent meta-analysis showed that DT in primary teeth has a 22.7% worldwide prevalence and stressed the need for worldwide awareness of the importance of recognizing DT that may cause functional impairments according to their severity [2]. Concerning children aged 0–6, oral lesions account for 18% of all physical trauma injuries. The mouth is the second most frequent area affected by trauma after the head [3].

Infants learning to crawl and later walk have a lack of balance and coordination, leaving them at risk of falls that can lead to DT. Falls and collisions at preschool during playtime are the most common causes of DT. A smaller percentage is a consequence of child abuse, car accidents, and other causes [4]. Repeated DT is not infrequent. Periodontal tissue injuries of central and lateral incisors are the most frequently observed. DT and in particular luxation injuries are frequently associated with bleeding and pain and may be the reason behind the first dental visit.

In this context, both DT as well as the negative management of DT may be the cause of dental anxiety and therefore reduced child cooperation. Primary teeth DT may be associated with complications regarding the tooth itself (dyschromia, tooth necrosis, pathologic root resorption, and ankylosis) as well as the corresponding permanent tooth (enamel defects, crown and/or root malformation, ectopic eruption, and tooth formation arrest) as a direct consequence of the impact of the primary root on the developing crown or because of a primary root infection. DT that occurs below the age of 2 years may have

long-term effects on the crown of the developing permanent tooth. In general, unless there has been severe tooth displacement, children with injuries to the primary dentition are often underdiagnosed at the time of injury, and their parents are not aware of the potential sequelae to the developing dentition in the long term [5]. For this reason, enamel defects on anterior permanent teeth must be submitted to a thorough anamnesis including past events of trauma on the corresponding primary teeth to help distinguish such defects from fluorosis and molar incisor hypomineralisation defects [6]. In children over 4 years of age, DT can result in disturbances affecting the root of the developing permanent tooth.

Epidemiology is the key to prevent DT and its complications: knowledge regarding environmental, oral cavity, and social risk factors for DT will allow clinicians to identify patients at risk and to establish primary and secondary prevention measures. A recent bibliometric analysis exploring the profile of articles on DT in primary teeth during the previous 15 years concluded that the number of articles had increased, but remained low. The most common topics were frequency, etiology, and associated factors. The evaluation of the study designs and topics addressed identified gaps that could contribute to the development of new studies on DT in the primary dentition [7]. This retrospective study was carried out through the analysis of dental records with the aim of investigating the epidemiologic profile of DT on primary teeth.

2. Materials and Methods

Two hundred and ninety-eight medical dental records of patients affected by DT on primary teeth that attended the Unit of Dental Care for Special Needs Patients and Pediatric Dentistry, University of Bologna, Bologna, Italy between January 2011 and December 2021 were included. This study was approved by the Ethical Committee of Sant'Orsola Malpighi (PG. N 0019293, 20 June 2014). Two authors, specialists in pediatric dentistry, screened the dental records following strict inclusion criteria: patients that had reported at least one DT to a primary tooth, with an age range of 0–9 years and a fully detailed trauma documentation (teeth involved, proper diagnosis, and radiographic and photographic evidence) were included. Patients with systemic illnesses and/or syndromes, inaccurate documentation, or DT affecting permanent teeth were excluded. In case of doubt, if a dental record could be included, the decision was reached in consensus between the two investigators.

Dental records were examined for the following variables by two pediatric dentists: age, gender, DT cause and setting, type of lesion according to Andreasen classification [8], and teeth involved.

Statistical Analysis

The results of the analysis were presented as a percentage (frequency). Categorical variables were compared using the Chi-Squared Test. Statistical significance was set a priori at $p < 0.050$. Statistical analysis was performed using SPSS for Windows (Statistical Package for the Social Sciences, version 27.0; SPSS Inc., Chicago, IL, USA).

3. Results

3.1. DT Recorded

During the observation time and following our inclusion and exclusion criteria, 298 dental records of children were included, 194 males (65%) and 104 females (35%) ($p < 0.001$; chi-squares test), with a mean age of 3.2 ± 1.2 . Two-hundred and sixty-five (89%) suffered from a single DT, whereas 33 (11%) suffered from recurring DT. Three-hundred and thirty-one DT events were recorded: 210 cases (63%) affected a single tooth, 86 (26%) affected two teeth, and 35 (11%) affected three or more teeth. The number of teeth involved per child varied from 1 to 7 teeth and was on average 1.7 ± 0.5 .

3.2. DT Distribution According to Age and Gender

The total number of traumatized teeth was 511: 320 (62%) in males and 191 (38%) in females. Figure 1 shows the association between age and DT frequency.

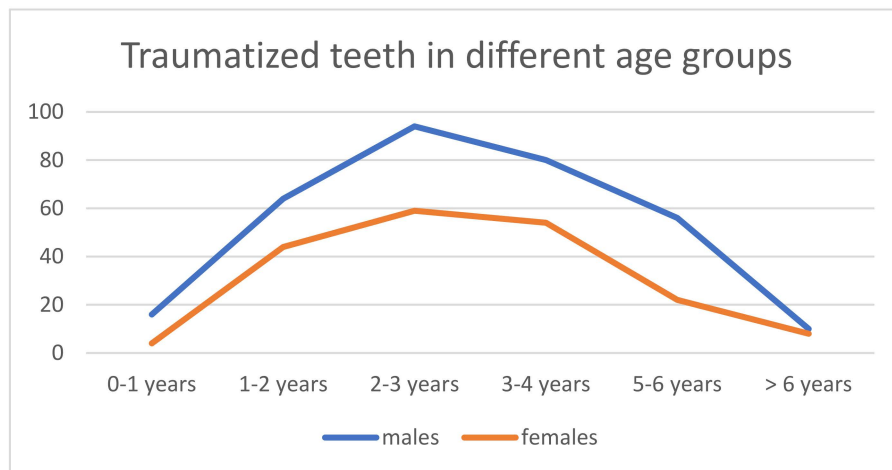


Figure 1. Association between age and DT.

DT occurred most frequently during the first four years of life ($n = 395, 77\%$), with a peak between 2–3 years ($n = 153, 30\%$). No statistically significant differences regarding DT frequency were found when comparing gender at different age groups, ($p = 0.874$; chi-squared).

3.3. Injured Teeth

The upper central incisors were the most frequently affected teeth, followed by the upper lateral incisors. Figure 2 describes in detail the injured teeth.

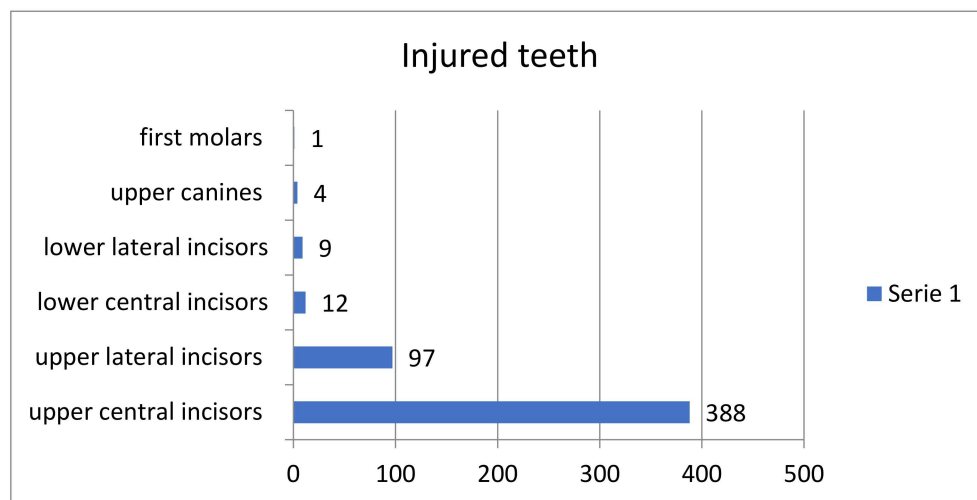


Figure 2. Injured teeth.

3.4. Type of DT

Concerning the type of tissue involved, 316 (62%) cases presented periodontal tissue damage, whereas 262 (51%) presented hard dental tissue damage. Following Andreasen’s classification (Figure 2), 444 (87%) teeth were affected by a single tissue lesion, and 67 (13%) were combined. Root fracture was the most frequent hard dental tissue injury ($n = 80$ out of 262, 31%), and concussion was the most frequent periodontal injury ($n = 108$ out of 316; 35%). Figure 3 shows DT according to Andreasen’s classification.

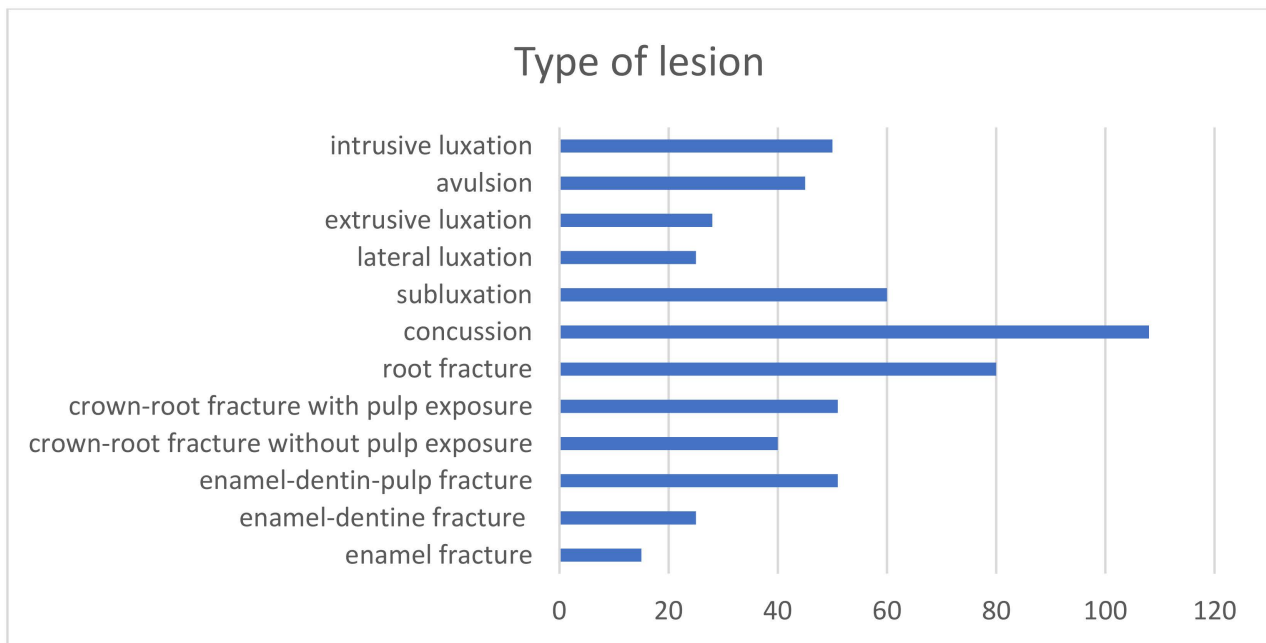


Figure 3. Distribution of DT according to Andreasen's classification.

DT causes are shown in Table 1. The most common were accidental falls and collisions. No significant differences in DT causes and setting were found regarding gender (Table 1). In addition, most DT occurred at home (Table 2).

Table 1. Distribution of DT depending on the cause.

DT Cause	Females <i>n</i> (%)	Males <i>n</i> (%)	<i>p</i>
accidental falls	84 (55)	123 (69)	0.532
collisions (people)	53 (34)	39 (23)	
collisions (objects)	10 (6)	9 (5)	
sport-related DT	3 (2)	5 (3)	
road accidents	3 (2)	1 (0.5)	
abuse	1 (1)	0 (0)	

Table 2. Distribution of DT regarding the setting.

DT Setting	Females <i>n</i> (%)	Males <i>n</i> (%)	<i>p</i>
home	85 (55)	95 (54)	0.8929
school	33 (21)	44 (25)	
playground	29 (19)	30 (17)	
other	7 (5)	8 (4)	

4. Discussion

The systematic literature review with meta-analysis performed by Petti et al. showed that one third of preschool children experienced some type of DT to primary dentition [2]. Depending on the country, DT prevalence ranged from 6.2% to 41.6% [9,10]. Some groups of society are particularly at risk, in particular children with special health care needs (e.g., affected by visual and/or hearing deficiency, ambulation disorders, epilepsy, psychiatric impairment, and cerebral palsy) [11]. Particularly in children with intellectual disability, self-inflicted DT has also been reported [12]. Interestingly, a previous study conducted in Italy showed a high frequency (30.4%) of DT in children and adolescents suffering from autism, with a significant difference between autism and the remaining groups of diseases.

Children with autism were often described as hyperactive. This could be related to the associated comorbidity of Attention-Deficit/Hyperactivity Disorder. Self-injuries are also common findings; these include movements, such as head banging [11].

Our results agree with a recent meta-analysis [13] showing a higher prevalence of DT in males that could be attributable to their vivacious tendency. In contrast, many studies [14–16] have found a lack of gender prevalence. Toddlers encounter DT in the same settings, and they occur during the same activities independent of gender. The vast majority of DT takes place between the ages of 1 and 4 with a peak at 2–3 years, coinciding with the development of motor skills, such as crawling and first steps as well as preschool enrollment, where social interaction and games are more frequent, thus justifying our finding that DT occurs most frequently at home and during school time.

Sport activities are rare in preschoolers, and therefore sport-related DT was infrequently reported. Contrarily, during adolescence, sport-related DT is a frequent finding on permanent teeth.

In our sample, one case of DT was connected to physical abuse. Compared to the face and neck, the oral cavity is less frequently affected by obvious lesions, although it is described by some authors as a privileged target of the abuser due to its role in communication skills, nutrition, and erotism. Lesions of the oral cavity are present in about 4% of child victims of abuse; about half of the victims are less than one year old, and approximately 40% of the victims are in the 1–3 years range [17]. The most frequent lesions involve the lips and frenula, as a consequence of physical abuse, sexual abuse, or severe neglect. Injuries to the pillars and tonsils have also been reported. A case of tongue biting by a parent was also documented in a ten-month-old female [18]. In any case of oral trauma, attention must be paid to the congruence between the parental explanation of the trauma dynamic and the type of lesions present on the child. The oral cavity must be carefully examined in search of signs of bleeding, healing lesions of the frenula (upper and lower labials), dental fractures, dichromic teeth, multiple injuries, injuries in different stages of healing, or a discrepant history should arouse suspicion for abuse. The American Academy of Pediatric Dentistry highlights the importance for health care providers (including dental providers) to be aware that physical or sexual abuse may result in oral or dental injuries or conditions. Health care providers should be aware of when and how to document suspicious injuries and how to obtain laboratory evidence, photo documentation, and/or consultation with experts when appropriate [19].

In accordance with the literature, our data highlight that multiple DT is present during a single traumatic event; the child's smaller mouth and the developing supporting tissues contribute to a higher exposed surface and impact severity [20,21]. Due to their exposed position during impact, central and lateral incisors are most frequently involved. One case of DT involved a primary molar because of trauma to the chin.

Most cases affected the tooth-supporting tissues, in agreement with previous studies [14,21,22]. Lesions to the tooth-supporting tissues are more frequent than mineralized tissues due to a lower mineralization and higher elasticity of infant bone structure [23].

In accordance with a Chinese study [24], root fracture was the most frequently affected mineralized structure; contrarily to our findings, and Patnana [13] reported crown fracture as the most frequent. Root fracture frequently entails displacement of the coronal fragment causing occlusion interference and pain. On the contrary, crown fracture is frequently asymptomatic. For this reason, we may hypothesize a larger prevalence of dental visits due to root fractures rather than crown fractures, the latter resulting in being underdiagnosed.

It is fundamental that clinicians are able to diagnose and treat DT correctly as these events frequently occur in insurance-covered places and on the grounds that a correct clinical approach influences both the primary and permanent tooth prognoses. In 2020, the International Association of Dental Traumatology updated its previous DT guidelines (2012) [25,26]. The main novelties concerned the most frequent lesions in primary teeth: intrusive luxation and lateral luxation. With regards to intrusive luxation, the previous guidelines suggested immediate extraction whenever the root was found dislocated toward

the developing permanent tooth bud. In absence of signs and symptoms of infection, novel guidelines indicate a watch-and-wait approach for up to 1 year irrespective of the direction of the displacement and be left for spontaneous repositioning, thus avoiding the risk of iatrogenous trauma to the developing crown.

Regarding lateral luxation in minimal or the absence of occlusal interference, new guidelines suggest a watch-and-wait approach, allowing for the tooth to reposition itself. However, to avoid ingestion/aspiration in cases of severe dislocation, two possible options are suggested: tooth extraction or, if the child's level of cooperation allows it, manual repositioning and a flexible splint for four weeks if unstable.

Tooth avulsion is more frequent in primary dentition than permanent dentition due to the higher elasticity of infant bone structure. The treatment guidelines between the two dentitions are completely different. While in permanent dentition, immediate tooth replantation is strongly recommended, in primary dentition, avulsed teeth should not be replanted. The IADT Guidelines consider primary tooth replantation a significant treatment burden (replantation, splint placement and removal, and root canal treatment) for a young child and emphasize the potential of further iatrogenic damage to the permanent tooth bud due to an inaccurate procedure. Furthermore, even in cases of correct replantation, the absence of a splint could lead to a medical emergency resulting from aspiration of the tooth [27].

The major limitations of the present study were the monocentric setting, the retrospective nature of the study, and the sample size. Despite these limitations, the data provide a contribution to the epidemiological profile of primary teeth dental traumatology. Multicenter study data would make the results more objective.

5. Conclusions

Clinicians must be aware of the most frequent types of DT in primary dentition to provide the correct clinical approach.

Author Contributions: S.B. and G.P.: conceptualization; R.F. and M.M.: methodology; R.F. and S.B.: investigation; M.M. and S.B.: data curation; R.F., G.P., E.C. and S.B.: writing—original draft preparation; E.C. and S.B.: writing—review & editing. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethical Committee of Sant'Orsola Malpighi (PG. N 0019293, 20 June 2014) for studies involving humans.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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