Traumatic dental injuries in children. Experience of a hospital in the central Anatolia region of Turkey

**ABSTRACT**

**Aim** The purpose of this retrospective study was to identify traumatic dental injuries by using the documentations of children (range 0-14 years, average age: 10.79±2.06) with dental trauma who referred to Cumhuriyet University, Faculty of Dentistry, Department of Pedodontics, in Sivas, Turkey, between January 2007 and June 2012.

**Materials and Methods** A total of 591 children (356 boys and 235 girls) with 1,287 injured teeth (394 primary and 893 permanent teeth) were included in the study. The children were evaluated in terms of gender, age, number of injured teeth, type of trauma, the interval between the traumatic event and time of seeking, and treatment procedures.

**Results** The highest frequency of trauma occurred in the 12-14 year age group (14%). The most common type of injury was enamel-dentin fractures (58%) in primary teeth and complicated crown fractures (39%) in permanent teeth. Falls (30%) were the major cause of dental injury. Direct restoration (27%) without any endodontic treatment was the most common treatment procedure for permanent teeth. The most frequent treatment for primary teeth was examination and follow-up (42%). The upper central incisors (71%) were the mostly affected teeth in both primary and permanent teeth. Most dental trauma occurred in June and July (12%-8%). Only 63 children (11%) were referred to the clinic less than 30 minutes after trauma.

**Conclusion** Traumatic dental injury is considered a serious public health problem especially in children; parents and teachers should be informed on prevention and emergency management of traumatic dental injuries. In addition, the findings showed that initial treatment after dental trauma should be as quick as possible.

**Keywords** Dental trauma; Turkish children.

**Introduction**

Several studies revealed that the prevalence of traumatic injuries in children, which pose a serious problem, has increased during the last few decades [Flores, 2002; Atabek et al., 2013; Gungor, 2013; Zhang et al., 2013]. Epidemiologic researches have indicated a high prevalence of these dental injuries in childhood and their effect on the child’s quality of life [da Siva et al., 2004; Atabek et al., 2013; Bregagnolo et al., 2013]. In different countries, prevalence of traumatic dental injuries has been reported to be between 2.4% [Rodrigues Campos Soares et al., 2013] and 69.2% [Zhang et al., 2013]. The reason behind the great difference between the mentioned rates may be associated with several factors, including type of study, trauma classification, methodology, study size and population, geographical location and differences in cultural behaviour [Altun et al., 2009]. According to the study conducted by Andreasen et al. [1999], Turkey has a high frequency in traumatic injuries. However, information related to dental trauma epidemiology in Turkish children is deficient. While accidents experienced within and around the home are the major reason of injury to the primary dentition, accidents occurring at home and school cause numerous injuries to the permanent dentition [Elisa et al., 2000]. Some differences are observed between studies and countries with respect to the main causes of dental trauma; however, accidents caused by falls are the most common factor for both primary and permanent dentitions. Sports, bicycle and traffic accidents are also among common causes of dental trauma [Bregagnolo et al., 2013; Gungor, 2013; Rodrigues Campos Soares et al., 2013; Zhang et al., 2013].

Toddlers have poor muscle coordination and difficulty walking. In this stage, especially between the ages of 1 and 2 years the children are at risk for trauma. However, the researches [Anrik et al., 2012] indicates the peak in injury at the age of 4 years, when the children's physical activity increases. Primary teeth may show several consequences of dental trauma including enamel discoloration, pulp obliteration, pulp necrosis, root resorption, inflammatory resorption, ankylosis, gingival recession, permanent displacement of primary tooth, and premature loss [Robertson et al., 2000; Humphrey et al., 2003; Hecova et al., 2010; Feldens et al., 2013].
In order to minimise or even prevent damage to the permanent tooth, regular follow-up and radiographs, along with appropriate clinical interventions, may be used. Discolorations of the enamel of white, yellow or brown color, enamel hyperplasia, crown dilaceration, root dilaceration, odontoma-like malformation, root duplication, partial or complete arrest of root formation, sequestration of the permanent tooth germ, and eruption disturbances are common sequelae on permanent teeth caused by trauma to their predecessors [Donaldson et al., 2001; Andreasen and Andreasen, 2007; Feldens et al., 2013]. These teeth are the cause of aesthetic and psychological problems for children. For these reasons, proper treatment is of utmost importance.

The purpose of this study was to investigate the age and gender distributions of patients, monthly distribution, causes, and treatment procedures of dental trauma, number of tooth affected, time elapsed between trauma and the emergency treatment in 0-14 year-old children attending the Department of Paediatric Dentistry of Cumhuriyet University, Sivas, Turkey during 5.5 years.

Materials and methods

This retrospective study was conducted by using the documentations of patients with traumatic dental injuries between January 2007 and June 2012. During this period, 591 children aged 0-14 years (average age: 10.79±2.06) (356 boys and 235 girls), were visited at the Department of Paediatric Dentistry of Cumhuriyet University, Sivas (a city located in Central Anatolia), Turkey. Before examination, the children had not undergone any previous dental treatment. A comprehensive review on all dental records of the trauma patients was completed.

In all examinations, the children were examined clinically by the same researchers who had been trained and calibrated for dental injuries. Historical evidence of dental trauma was collected using a standardised trauma form. The type of dental trauma was classified in accordance with the classification system described by Andreasen & Andreasen [Andreasen et al., 2007]. During the clinical examination, fracture, exposed pulp, mobility and displacement (concussion, subluxation, luxation and avulsion) were recorded on the trauma form. Periapical radiographs and orthopantomograms were used to confirm the diagnosis. Differences among the age groups, genders, month, source of trauma, type of injury on the same tooth was observed in some patients. Assessment in terms of injury type in all age groups except for 0-2 year-olds (Fig. 4). Falls (25%) was the second most frequent cause of trauma. Traumatic injury type and the time elapsed until treatment at the clinic were assessed. More than one type of injury on the same tooth was observed in some patients. Assessment in terms of injury type in permanent teeth: Complicated crown fracture (37%) was the most common injury, while alveolar fracture (0.01%) was the most rarely diagnosed (Table 1).

To conduct all these statistical analyses, $\chi^2$ test was used. The level of significance was set at 0.05.

Results

A total of 591 (356 boys [60.2%], 235 girls [39.7%]) children in the age range of 0-14 years, who were among the 18,973 patients exposed to traumatic tooth injury and attended the Paediatric Dentistry Department of Cumhuriyet University between January 2007 and June 2012, were included in the study. In the 591 children included in the study, were affected by trauma a total of 1,287 teeth (394 primary teeth, 893 permanent teeth).

Comparing the trauma in terms of age groups and gender, the difference was not statistically significant [$\chi^2=5.95; p=0.202$ ($p>0.05$)]. It was found that dental injuries are more frequent in boys in the age group of 9-11 years (17%) and rarely in girls in the age group of 0-2 years (4%) (Fig. 1). Assessment of trauma based on gender and month, showed that dental trauma is observed more frequently in July (19%) and rarely in November (2%) in both genders (Fig. 2).

The permanent teeth most affected by the trauma were the upper central incisors (31%-37%) (Fig. 3). Also, the primary teeth mostly affected by trauma were the upper primary central teeth (47%-32%) (Fig. 3).

Regarding the cause of trauma in terms of age distributions, the difference was statistically significant [$\chi^2=99.32; p=0.001$ ($p<0.05$)]. Collision (30%) was the main cause in all age groups except for 0-2 year-olds (Fig. 4). Falls (25%) was the second most frequent cause of trauma. Traumatic injury type and the time elapsed until treatment at the clinic were assessed. More than one type of injury on the same tooth was observed in some patients. Assessment in terms of injury type in permanent teeth: Complicated crown fracture (37%) was the most common injury, while alveolar fracture (0.01%) was the most rarely diagnosed (Table 1).

![Fig. 1 Distribution of dental trauma according to age and sex.](image-url)
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Tooth Number

36 51 61 71 81 52 62 72 82 73 83 75 84
21 31 41 12 22 32 42 13 14 15 23 24

Fig. 3 Distribution of dental trauma frequency according to tooth number.

Fig. 2 Distribution of dental trauma frequency according to the months and gender.

Fig. 4 Distribution of dental trauma causes according to age groups.

<table>
<thead>
<tr>
<th>Types of trauma</th>
<th>0-2 age</th>
<th>3-5 age</th>
<th>6-8 age</th>
<th>9-11 age</th>
<th>12-14 age</th>
<th>Total</th>
</tr>
</thead>
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<tr>
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<td>43</td>
<td>21</td>
<td>10</td>
<td>7</td>
<td>32</td>
</tr>
<tr>
<td>Falls</td>
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<td>72</td>
<td>49</td>
<td>93</td>
<td>229</td>
<td>348</td>
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<tr>
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<td>85</td>
<td>61</td>
<td>85</td>
<td>229</td>
<td>348</td>
</tr>
<tr>
<td>Bicycle</td>
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<td>14</td>
<td>11</td>
<td>14</td>
<td>25</td>
<td>40</td>
</tr>
<tr>
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<td>43</td>
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<tr>
<td>Other causes</td>
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TABLE 1 Distribution of trauma types with respect to time elapsed between injury and time emergency treatment. (pr: primary teeth, per: permanent teeth)

*In several cases, some permanent and primary teeth presented over one diagnosis.
Regarding the primary teeth, on the other hand, enamel dentin fracture (34%) was the most common injury type, while crown-root fracture (0.02%) was the most rarely diagnosed (Table 1). Assessment of timing to the clinic after the trauma: interventions on 92 permanent teeth, which had the most frequent complicated crown fracture, were performed on patients who came to the clinic within 30 minutes and 30-60 minutes from the trauma event (Table 1). Among the 34 avulsions observed (28 permanent teeth, 6 primary teeth), only 2 permanent teeth trauma cases came to the clinic within the first 30 minutes, and 6 primary and 4 permanent teeth trauma cases came to the clinic within 30-60 minutes.

The initial emergency treatments performed on the primary and permanent teeth after trauma were assessed, and the difference was statistically significant $[\chi^2=330.56; p=0.001(p<0.05)]$. Direct restoration of permanent teeth (27%), and examination and follow-up on primary teeth (42%) were the most frequent emergency treatment performed (Fig. 5).

### Discussion

There are significant differences between the prevalence of dental trauma as assessed by epidemiological studies [Kargul et al., 2003; Eyuboglu et al., 2008]. The great difference may be associated with trauma classification, dentition studied, geographical and behavioral differences between study locations and countries. Since the most frequently used study method is the classification of Andresen and Andresen [2007], which is also adopted by the World Health Organization, we referred to it for our study.

Number of studies investigating the incidence of dental traumas, related factors and treatment procedures in various geographical regions of Turkey is limited, therefore, this study is conducted [Altay et al., 2001; Saroglu and Sonmez, 2002; Kargul et al., 2003; Sandalli et al., 2005; Eyuboglu et al., 2008; Altun et al, 2009; Atabek et al., 2013].

The clinic where the study was conducted is the only paediatric clinic within the body of the university in the Central Anatolia region. The data of this study were collected only from this centre.

Compared to clinic- and hospital-based studies, population-based studies could introduce more epidemiological evidences [Eyuboglu et al., 2008; Atabek et al., 2013]. However, these studies cannot illustrate the distribution of the treatment procedures or classify the type of trauma. For this reason, the study was conducted using the dental trauma records of the patients who applied to the university pedodontics clinic.

Being important in terms of function and aesthetics, traumatic tooth injuries cause damages that vary from minimal enamel loss to complex fractures affecting the pulp tissue and even loss of the tooth crown and for an accurate therapy, an accurate diagnosis is needed [Zerman and Cavalleri, 1993]. These injuries can damage not only the hard tissues and the pulp of the tooth, but also involve the supporting periodontal structures, which lead to a completely different prognosis [Olsburgh et al., 2002].

The purpose of this research was to identify the types, aetiology, and causes of dento-alveolar injuries among children who sought emergency treatment in Sivas, Turkey.

This study found that 12-14 year-old children were the most affected by traumatic dental injuries. This finding is
in line with the results of few previous studies [Elisa et al., 2000; Kargul et al., 2003]. A study conducted in Brazil concluded that while prevalence rates in the primary dentition reached the highest level at 10-24 months of age, the frequency of trauma to the permanent dentition in school-age children peaked in the age group of 9-15 years [Elisa et al., 2000].

Eyuboglu et al. [2008] reported that the age at which the frequency peak was observed was 5 years for the primary teeth and 10 years for permanent teeth. A possible reason behind this is associated with the fact that children act independently at both school and playground between the ages 6-14.

The assessment of frequency of trauma in terms of gender, determined that boys are exposed to trauma more frequently than girls and these results are in agreement with previous studies [Kargul et al., 2003; Sandalli et al., 2005]. This study found that 49.9% of all traumatic injuries occurred during the summer. This result is in line with the study conducted by Altun et al. [2009], in which the distribution of traumatic dental injuries in temperate climates shows a seasonal change with an increase in the number of episodes occurring in warmer weather. This difference was also noted in the studies conducted by Altay et al. [2001], Saroglu and Sonmez [2002] and Kargul et al. [2003] on Turkish children. Among the studies there are some differences between countries in terms of the predominant reasons of dental trauma, although the fall is always the most common factor [Olsburgh et al., 2002]. This study concluded that the upper incisor were the teeth most affected by trauma, followed by the lower incisors, which is in agreement with previous studies [Altay et al., 2001; Saroglu and Sonmez, 2002; Kargul et al., 2003; Zuhal et al., 2005; Altun et al., 2009; Atabek et al., 2013].

In the present study, in the permanent teeth enamel and the enamel-dentin fractures are the most commonly observed fracture types, followed by complicated crown fractures. In literature, enamel fractures make up for most of the crown fractures observed in primary dentition [Kargul et al., 2003; Gungor, 2013]. However, we found the enamel-dentin fractures are mostly seen in the primary dentition. In case of enamel fracture of permanent teeth, the risk of pulp necrosis, pulp canal obliteration, and root resorption has been reported to be 1.7%, 0.5% and 0.2%, respectively [Gungor, 2013]. Enamel-dentin fractures are more severe than simple enamel fracture type due to the tubular structure of dentin. The number of exposed dentinal tubules is a major point of concern, as they are a potential pathway of invasion for bacteria and subsequent pulpal disease. The successful treatment of these fractures can be accomplished with the use of proper adhesives and composites.

Studies in the literature reveal that the most common type of injury of the permanent dentition is crown fracture [Altun et al., 2009]. In the present study, complicated crown fracture was the most frequently seen type of trauma in the permanent dentition. Examination and follow-up was the emergency intervention performed more often on primary teeth after trauma, with a rate of 30%, which is in line with the results of the study of Kargul et al. [2003].

Bakland and Andreasen [2012] showed that the extension of the traumatic pulp exposure has a relatively low importance on the prognosis. The healthy pulp tissue, regardless of how much tissue is exposed, has a great ability to survive as long as it can be protected from the oral bacteria [Bakland and Andreasen, 2012; Gungor, 2013]. Pulp perforations are usually prone to infection, as there is no self-healing capacity, and the wound must be properly dressed with a material, such as MTA or calcium hydroxide [Murray et al., 2003; Bakland and Andreasen, 2012; Gungor, 2013]. Murray et al. [2003] indicated that the reparative activity of the pulp tissue occurs more readily beneath capping materials that prevent bacterial microleakage, which favours the use of MTA. In light of the above-mentioned considerations, MTA may be preferred to calcium hydroxide in a variety of clinical situations.

Since the follow-ups of emergency interventions performed in this study are still ongoing, information regarding the treatment outcomes are not given for all of the patients; however it was determined that in the vital treatments (pulpotomy, cvek pulpotomy) performed on patients who had immature root of permanent teeth with a complicated crown fracture and came to the clinic within the first 60 minutes after the trauma, the pulp sustained its vitality in 97% of the cases during radiological and clinical examinations. This percentage of high achievement is the best indicator of the need for an immediate emergency intervention following the trauma in complicated crown fractures, which involve the pulp.

We reported that 87% of all the avulsion cases (in permanent teeth) were examined as early as 1 hour after trauma and for this kind of injuries the success rates of treatment begun to reduce after 1 hour. The primary aim in treating this type of injury is to preserve and treat the supporting tissues of the tooth. The most important factor is the time elapsed between avulsion and treatment. The long term success depends on the treatment given at the site of the injury, storage conditions and treatment of the root-surface area administered immediately upon arrival at the clinic [Atabek et al., 2013].

**Conclusion**

In consideration of all the above, we believe that parents at home, teachers at school, emergency medical doctors and practitioner dentists at emergency
medical centres should have appropriate information on traumatic injuries. Such training should be provided by paediatric dentists in a simple, visual manner at schools and healthcare organizations (hospitals, healthcare centers, etc.) and everyone should be informed about the fact that it is an important health problem for children. The prognosis and long-term outcome of the treated trauma cases should be emphasised by further researches.

Conflict of interest

The authors declare that they have no conflicts of interest.

References