PREVALENCE OF DENTAL TRAUMA AMONG CHILDREN AGE 2-15 YEARS IN THE EASTERN BLACK SEA REGION OF TURKEY

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Abstract

The aim of the present study was to investigate the prevalence and etiology of dental trauma in children aged 2-15 in the Eastern Black Sea Region of Turkey.

The study evaluated 226 patients (139 boys, 87 girls) with 346 traumatized teeth who were referred to the Department of Pediatric Dentistry at the Faculty of Dentistry of Karadeniz Technical University in Trabzon, Turkey over a one-year period.

Trauma was found to occur most frequently in girls aged 8 years and boys aged 10 years. The majority of injured teeth were permanent teeth (77.2%). Most trauma occurred in the maxillary arch (89.6%), with the maxillary central incisors the most affected tooth in both primary (69.6%) and permanent (83.5%) dentition. Single-tooth injury was predominant in all age groups (64.2%). Children with an overjet greater than 3 mm accounted for a greater percentage of dental injuries (73.9%) than those with an overjet less than 3 mm, but the difference between the two groups was not statistically significant. Moreover, overjet was not found to have a significant effect on the number of teeth involved in a traumatic dental injury. The most common cause of dental trauma was ‘falls’ (48.7%). The most frequent type of injury was enamel-dentin crown fracture without pulpal exposure in permanent dentition (38.8%) and lateral luxation in primary dentition (21.0%).

Families and health-care systems need to provide safe and appropriate first-aid treatment for traumatic dental injuries, with follow-up treatment by dental-health providers.

Keywords: Traumatic dental injuries, permanent teeth, primary teeth.

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Introduction

Traumatic dental injuries (TDI) occurring in childhood are very common among children and account for a significant number of pediatric dentistry patients1-3. Epidemiological information as to the magnitude of the problem has been obtained through studies of prevalence and incidence, and includes research into the etiology of traumatic dental injuries among children4-6.

TDI in children is a source of serious problems that can affect both physical and psychological aspects of daily life7-11. Social activities such as speaking and laughing can be negatively affected by such injuries8, 12, 13. At the same time, treatment of TDIs and the short- or long-term disruption they cause may be a considerable financial burden14.

The costs to injured individuals and to their communities that arise from such injuries are substantial, and understanding the factors that predispose a tooth to fracture is essential for developing a concept of prevention14. Further
research is needed to identify the causes of and the personal and environmental risk factors for dental injuries in order to provide a basis for their prevention.\textsuperscript{14, 15}

The present study is the first to provide epidemiological data in the field of dental and oral trauma in the Eastern Black Sea Region of Turkey. The aims of the study were:

- to investigate the prevalence and etiology of dental trauma in children aged 2-15 in the Eastern Black Sea Region of Turkey (Trabzon, Giresun, Rize, Artvin, Gümüşhane, Ordu) referred to the Department of Pediatric Dentistry at Karadeniz Technical University, in Trabzon, Turkey.
- to determine the relationship between overjet and the number of teeth involved in traumatic dental injuries.

Materials and Methods

The study comprised all episodes of trauma affecting primary and/or permanent teeth in children aged 2-15 years presenting at the Karadeniz Technical University Faculty of Dentistry’s Department of Pediatric Dentistry over a one-year period from July 2005-July 2006. The university is located in northeastern Turkey, bordering on Georgia, a demographically and geographically homogenous region on the Black Sea that is characterized by mountainous woodlands above a narrow coastal strip. The Faculty of Dentistry, which began daily operations in July 2005, is the only dental faculty in the region, and has attracted patients from six provinces in the region (Trabzon, Giresun, Rize, Artvin, Gümüşhane, Ordu).

A total of 226 patients [139 boys (mean age: 9.29± 2.81), 87 girls (mean age: 7.70± 3.05)] with 346 traumatized teeth were evaluated over the course of the study. Clinical and radiographic examinations were performed on all patients, and the following information was recorded:

- Patient sex and age at the time of trauma;
- Time elapsed between the time of traumatic injury and seeking care;
- Etiology of the traumatic incident;
- Affected teeth;
- Number of teeth involved;
- Overjet;
- Type of injury.

Type of injury was recorded according to Andreasen’s classification, as follows:

1. Enamel crown fracture (including enamel chipping);
2. Enamel-dentin crown fracture without pulpal involvement;
3. Enamel-dentin crown fracture with pulpal involvement;
4. Root fracture;
5. Crown-root fracture without pulpal involvement;
6. Crown-root fracture with pulpal involvement;
7. Concussion;
8. Subluxation;
9. Intrusive luxation;
10. Extrusive luxation;
11. Lateral luxation;
12. Avulsion.

All information was recorded by two clinicians on standardized trauma assessment forms in line with diagnostic criteria previously provided by one of the authors. Both clinicians simultaneously evaluated each patient, and there was no disagreement between clinicians.

Data analysis included frequency distributions and cross-tabulations. Associations between dental injuries and sex/age were statistically assessed by T-test and z proportion test, whereas chi-square goodness-of-fit and z proportion tests were used to assess relations between the causes and types of trauma, tooth type, number of teeth involved and overjet ($P<0.05$).

Results

Over a 1-year period, 226 children [139 boys (61.5%), 87 girls (38.5%)] suffered traumatic injury to a total of 346 teeth, representing an injury rate of 1.53 teeth per traumatic incident.

Children aged 2-7 years accounted for 27.9 percent (n=63) of all TDI cases, children aged 8-10 years accounted for 47.3 percent (n=107), and children aged 11-15 years accounted for 24.8 percent (n=56). When looked at by age group and sex, the incidence of TDI in children aged 2-7 was significantly higher ($p<0.01$) among girls (n=39, 44.83%) than among boys (n=24, 17.27%), whereas in children aged 8-10, the incidence of TDI was significantly higher ($p<0.01$) among boys (n=76, 54.67%) than among girls (n=31, 35.63%). Among children aged 11-15, no significant difference ($p=0.149$) was found in the incidences of TDI among boys.
(n=39, 28.06%) and girls (n=17, 19.54%). The highest trauma rates occurred at age 8 for girls and at age 10 for boys (Figure 1).

Figure 1. Distribution of dental injuries by age and sex.

The distribution of injuries according to affected tooth is presented in Table 1. Of the 346 teeth injured, 79 were primary teeth (22.8%) and 267 were permanent teeth (77.2%). The maxillary arch was more affected (89.6%) than the mandibular arch, with no significant difference between right and left side. The maxillary central incisors were the most frequently affected in both primary (69.6%) and permanent dentition (83.5%).

When the length of time elapsed between a child’s traumatic injury and clinical presentation was examined, it was found that 31.4 percent of parents waited for 12 months or more before seeking care. In 4.0 percent of cases, the parents did not remember exactly when the trauma had occurred (Table 2).

In terms of etiology, falls (48.7%), followed by accidents while playing (19.5%), were found to be the main causes of TDI (Table 3).

From one to six teeth were found to be affected in a single traumatic incident (Table 4). Most injuries involved only one tooth (64.2%), regardless of the age of the child at the time of trauma. The incidence of injury was higher among children with an overjet greater than 3 mm (73.9%) than those with an overjet less than 3 mm; however, this difference was not statistically significant. Moreover, overjet size had no significant affect on whether or not a traumatic injury involved a single tooth or multiple teeth (p=0.717).

The distribution of injuries according to Andreasen’s classification is presented in Table 5. Crown fracture involving both enamel and dentin, without pulpal exposure, was the most frequent type of injury among permanent dentition, whereas lateral luxation was the most frequent among primary dentition. While the majority of teeth (n=325, 93.93%) exhibited only one type of trauma, 21 teeth (6.07%) exhibited more than one type of trauma. Of the latter, 12 involved injury to soft tissue only (7 lateral luxation+intrusive luxation, 5 lateral luxation+extrusive luxation) and 9 involved both fracture and soft-tissue injury (2 enamel fracture+concussion, 7 enamel-dentin fracture without pulpal involvement+ subluxation).
Table 3. The distribution of the injuries regarding the etiology of trauma.

<table>
<thead>
<tr>
<th>Etiology of Trauma</th>
<th>N of Patients</th>
<th>N of Teeth</th>
<th>N of Patients (%)</th>
<th>N of Teeth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls</td>
<td>47</td>
<td>70</td>
<td>47</td>
<td>70</td>
</tr>
<tr>
<td>Play &amp; toy accidents</td>
<td>17</td>
<td>27</td>
<td>17</td>
<td>27</td>
</tr>
<tr>
<td>Collisions</td>
<td>11</td>
<td>13</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Bicycle</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Sports injury</td>
<td>2</td>
<td>11</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Traffic Accident</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
<td>129</td>
<td>87</td>
<td>129</td>
</tr>
</tbody>
</table>

Table 4. Number and percentage of injured teeth per patient.

<table>
<thead>
<tr>
<th>Cases</th>
<th>No. of injured teeth</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3mm</td>
<td>106</td>
<td>64.2</td>
</tr>
<tr>
<td>&gt;3mm</td>
<td>41</td>
<td>35.8</td>
</tr>
</tbody>
</table>

Table 5. The distribution of injuries according to Andreasen classification.

<table>
<thead>
<tr>
<th>Andreasen Classification</th>
<th>Primary Permanent</th>
<th>Primary Permanent</th>
<th>Primary Permanent</th>
<th>Primary Permanent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>2</td>
<td>5</td>
<td>67</td>
</tr>
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<td>2</td>
<td>34</td>
<td>5</td>
<td>17</td>
<td>57</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>1</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
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<td>6</td>
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<td>1</td>
<td></td>
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<tr>
<td>6</td>
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<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>5</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td>4</td>
<td>10</td>
<td></td>
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<tr>
<td>10</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>9</td>
<td>4</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>90</td>
<td>45</td>
<td>196</td>
</tr>
</tbody>
</table>

Discussion

Population-based studies of traumatic dental injuries have been performed throughout Turkey, with the exception of the Eastern Black Sea Region. This lack of regional-specific information regarding traumatic dental injuries is of concern, as the socio-economic and cultural characteristics of the Eastern Black Sea Region differ vastly from those of other regions in Turkey.

Most previous studies of other regions and countries have found higher incidences of traumatic dental injuries among boys than girls. In line with the majority of studies, the present study found that overall, boys (61.5%) sustained more injuries than girls (38.5%); however, in the 2-7 year age group, girls had significantly higher rates of dental trauma than boys. These findings may reflect more vigorous play in general among boys than girls, as well as the fact that boys tend not to begin participating in aggressive play and contact sports until they get older. Earlier studies have found no differences in traumatic injury between the sexes.

In agreement with Skaare and Jacobsen, this study found children aged 8-10 years to have the highest incidence of TDI, with the rate of injury to boys in this age group nearly 2.5 times higher than that of girls. The decrease in the occurrence of TDI after age 10 found in this study may reflect the higher level of social support found in the school environment in general rather than any specific type of physical environment. Moreover, older children are better able to protect themselves from injury than younger children. The present study is in line with previous studies showing dental injuries to be most frequent during the first decade of life and to decrease gradually thereafter.

There is consensus in the literature that anterior teeth are the most commonly traumatized. The present study found the maxillary central incisors to be the most frequently injured teeth in both primary (69.6%) and permanent (83.5%) dentition. This is in agreement with the literature on dental trauma and may be explained by the more proclined position of the upper central incisors in comparison to the lower central incisors, so that the upper teeth tend to be the first to receive a direct blow. Moreover, the lower jaw is flexible and thus tends to reduce the impact of forces directed on the lower anterior teeth, whereas the upper jaw is fixed to the skull and rigid.

Finally, the behavioral characteristics of individual children and other etiological factors may affect the frequency of dental trauma.

In several previous studies, parental levels of education and awareness of oral health care have been reported to influence the length of time elapsed between the incidence of dental trauma and seeking professional care for the child. Traebert et al noted that parents lack awareness regarding treatment and follow-up protocols designed to observe possible sequelae to teeth, bones and soft-tissues following minor enamel-dentine fractures. The study also found that the cost of private dental treatment, which was unaffordable to the majority of the population,
and the lack of complex treatment available through public services, contributed to a delay in seeking treatment. Similarly, although the Eastern Black Sea region has numerous dentists in private practice, some are unable to cope with complex dental trauma, and prior to the opening of the Faculty of Dentistry, there were no pediatric dentistry specialists available. As a result, more than half of the patients (51.3%) in the present study delayed seeking professional dental treatment for at least 4 months following injury. Effective and timely treatment, as well as raising public awareness about the importance of proper management of traumatic dental injuries, has been shown to help reduce or avoid later complications, costs and time for patients, parents and dental health care providers.\(^{18,35}\)

In line with earlier studies\(^{2,7,11,29,30}\), the present study found falls (48.7%), followed by accidents during play (19.5%) and collisions (12.8%), to be the main cause of traumatic tooth injuries.

Other authors\(^{2,11,20,21}\) have demonstrated that most traumatic injuries involve a single tooth, although Wright et al. (36) found the majority of dental trauma to affect multiple teeth. In the present study, more than half of children (64.16%) had only one traumatized tooth.

The present study also found the majority of children (73.9%) with traumatic tooth injuries had an overjet of more than 3 mm. There is disagreement in the literature as to what value should be used to define ‘increased overjet’. Whereas some studies use a value greater than 3 mm\(^{37,38}\), others use a value greater than 5 mm\(^{10,13,39}\).

Nguyen et al.\(^{40}\) compared the results of several studies assessing the relationship between overjet and dental injuries and concluded that children with an overjet greater than 3mm are at approximately twice the risk of dental trauma as those with an overjet of less than 3mm. Soriano et al.\(^{13}\) found a significant association between dental trauma and overjet and concluded that an overjet of more than 5mm and inadequate lip coverage were predisposing factors for TDI\(^{41}\).

Järvinen\(^{42}\) found injury rates of 14.2 percent among children with normal overjet (0-3 mm), 28.4 percent among children with increased overjet (3-6 mm) and 38.6 percent among children with extreme overjet (>6 mm). He also determined that the range of injuries increased in relation to the degree of overjet. The present study found no significant differences in incidences of dental trauma or multiple-tooth versus single-tooth injuries between children with an overjet in excess of 3mm and children with an overjet less than 3 mm.

According to data in the literature, luxation injuries occur more frequently in primary dentition, while hard-tissue injuries are more commonly seen in permanent dentition\(^{16,17,18,21,29,41,43}\).

In agreement with the literature, the present study found lateral luxation to be the most prevalent type of injury among primary dentition and enamel-dentin fracture without pulpal exposure to be most prevalent among permanent dentition. The high frequency of lateral luxation in primary dentition can be explained by the facts that young children lack sufficient motor co-ordination to minimize injuries when their faces strike an object and that the resiliency of supporting tissue tends to result in tooth displacement\(^{5,7,44}\).

A study conducted in Northern Sweden also found crown fractures dominated among permanent dentition\(^{18}\).

**Conclusions**

In some countries where the incidence of dental caries is declining, dental trauma has become a major oral health issue among children, and studies are beginning to look at different methods of prevention in an effort to minimize related developmental disturbances\(^{4,16,45}\).

In view of the potential that traumatic dental injuries have for affecting children’s daily life by causing physical as well as psychological pain and discomfort, specific public health policies are needed to lower the high prevalence of traumatic dental injury among children and minimize their effects on children’s quality of life\(^{8,46}\).

Families also need to be educated about the significance of traumatic dental injuries, and health-care systems need to provide safe and appropriate first-aid treatment for traumatic dental injuries, with follow-up treatment by dental-health providers.

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Declaration of Interest

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