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Traumatic injuries to permanent teeth in Turkish children, Ankara

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Abstract – The aim of this study was to identify the types and etiologies of dento-alveolar injuries among patients who were treated for injuries to maxillary and/or mandibular permanent teeth at the Gulhane Medical Academy, Department of Pediatric Dentistry, Center of Dental Sciences in Ankara, Turkey to provide a basis for determining optimal treatment approaches and educational needs. From a total of 4956 children aged 6–12 years (mean age: 8.91 ± 1.95) applying to the Center, 472 children (9.5%) were found to have suffered dental injuries during a period of 2 years. Injuries were classified according to drawings and texts based on the WHO classification system, as modified by Andreasen and Andreasen. Injury rates were highest among children age 6 and ages 8–10. The most frequently injured permanent teeth were the maxillary central incisors (88.2%), and the maxillary right central permanent incisor made up 47.2% of all injured teeth. The most common cause of dental trauma was falling while walking or running (40.3%). Most injuries involved a single tooth (64.8%). The most common type of injury was enamel fracture (44.6%). There was a significant difference in gender, where boys more often suffered from a dental hard tissue and pulp injury than girls ($P = 0.019$), whereas there was no difference in gender ($P = 0.248$) in the distribution of periodontal injuries. Injuries were found to occur more frequently during the summer ($P < 0.001$). Children with increased overjet were 2.19 times more likely to have dental injuries than other children. Considering that the incidence of traumatic dental injury is highest among children ages 6 and ages 8–10 as well as the fact that patients with increased overjet are more prone to dental trauma, preventive orthodontic treatment in early mixed dentition may play an important role in reducing traumatic dental injuries.

Orofacial trauma represents a significant orodental and general health problem that may have medical, esthetic and psychological consequences for children and their parents (1–5). Traumatic injuries in permanent teeth have been reported to have a prevalence rate of between 7.3% and 58.6% (6–8). The great variation in reported rates can be attributed to a number of different factors, including type of study, trauma classification, methodology, study size and population, geographical location and differences in cultural behavior (9).

Injuries to permanent dentition are among the most common types of trauma to occur in the maxillofacial region (2, 10, 11). Traumatic tooth injuries in children are most frequently the result of an accidental fall, although they may also occur as a result of a traffic accident, impact sports or play (12, 13). Because of their exposed position in the dental arch, maxillary incisors are the teeth most commonly involved in dental trauma, and in most cases, damage occurs to the crown (14, 15). Following maxillary incisors, traumatic injuries occur most frequently in the upper and lower lateral incisors and the upper canines; however, the rate of traumatic injury is significantly higher for maxillary incisors than for other teeth (16). Kania et al. (17) found that incisor injury occurred more frequently in male children, children with prognathic maxillae and children with pronounced overjet.

There is a lack of information regarding dental trauma epidemiology in Turkish children and a need for further research into dental trauma for future preventive and management plans. Therefore, this study aimed to identify the types and etiologies of dento-alveolar injuries seen at the Gulhane Medical Academy, Department of Pediatric Dentistry, Center of Dental Sciences in Ankara, Turkey during the last 2 years.

Materials and methods

This cross-sectional survey was conducted at the Gulhane Medical Academy Department of Pediatric Dentistry, Center of Dental Sciences in Ankara, Turkey. The study involved 4956 children (2553 boys, 2403 girls) aged 6–12 years who applied to our clinic over a 2-year period from 2006–2007. None of the children applying during this period were injured more than once. Records showed that of all children applying during this time, 472 children were treated for injuries to maxillary and/or mandibular permanent teeth.

Injuries were classified according to drawings and texts based on the WHO classification system, as modified by Andreasen and Andreasen (2). Records were examined for the following: (i) Age (at time of injury to the permanent tooth); (ii) Sex; (iii) Number and type of teeth injured; (iv) Cause of injury (falling while walking or running, bicycle/tricycle accident, impact against a hard object, or other causes, including traffic accidents, self-inflicted injury, earthquake and unknown causes); (v) Type of injury [dental hard tissue and pulp injuries (crown discoloration, enamel fracture, enamel/dentin fracture, enamel/dentin/pulp fracture, root fracture, crown/root fracture, crown/root/pulp fracture), periodontal tissue injuries (subluxation, lateral luxation, intrusive luxation, extrusive luxation, avulsion)]; (vi) Time of year (month) the injury occurred; (vii) Occlusion [normal overjet, 0–3 mm (group I) and increased overjet, >3 mm (group II)]. Occlusion was recorded according to Angle's classification, and overjet was measured as the distance between the lingual surface of a maxillary incisor and the labial surface of the opposing mandibular incisor. Data was entered into a computer using patient names and identification numbers. Statistical analysis was carried out using the SPSS (SPSS Inc., Chicago, IL, USA) software program. Chi-square tests were used to determine significant differences in data ($P < 0.05$).

Results

Of the 4956 children in the study with an age range of 6–12 years (mean age: 8.91 ± 1.95 years), 2553 (53.9%) were boys and 2403 (46.1%) were girls. Of these, 472 children [268 boys (56.8%), 204 girls (43.2%)] had injured a total of 654 permanent teeth. None of the children had experienced more than one traumatic event; however, some children had injured more than one tooth during that event. Nearly two-thirds of children with traumatic injuries to permanent teeth ($n = 306$, 64.8%) had injured one permanent tooth, 154 (32.6%) had injured two permanent teeth, eight (1.7%) had injured three permanent teeth and four (0.8%) had injured four permanent teeth. The most frequently injured permanent teeth were maxillary incisors (88.2%). The right central permanent incisor made up 47.2% of all injured teeth (Table 1).

Causes of injuries were recorded as follows: Falling while walking or running: 190 children (40.3%), 258 teeth (39.4%); Impact against a hard object: 144 children (30.5%), 206 teeth (31.5%); Bicycle/tricycle accident: 120 children (25.4%), 162 teeth (24.8%); Other (traffic accident, self-inflicted injury, unknown): 18 children (3.8%), 28 teeth (4.3%) (Table 2).

Boys were found to have suffered traumatic injuries at significantly higher rates than girls ($P = 0.003$). Injury rates were highest among children age 6 (16.9%) and ages 8–10 (age 8: 16.5%; age 9: 17.8%; age 10: 15.7% respectively) (Table 3). The most common dental injury was an enamel fracture (44.6%) (Table 4). There was a significant difference in gender, where boys more often suffered from a dental hard tissue and pulp injury than girls ($P = 0.019$), whereas there was no difference in gender ($P = 0.248$) in the distribution of periodontal injuries.

Records showed that while overall patient volume remained consistent throughout the study period [except for July, which was significantly busier than other months ($P < 0.05$)], the incidence of trauma showed seasonal variations. The greatest number of trauma cases were seen in the summer months of May to July (238 cases; 50.4%) (Fig. 1). The difference between the

Table 1. Distribution of injured permanent teeth ($n = 654$)

Tooth, FDI system	13	12	11	21	22	23
NO	0	17	309	268	14	0
NO	2	4	10	22	8	0
Tooth, FDI system	43	42	41	31	32	33

FDI, Federation Dentaire Internationale.

Table 2. Causes of injury to permanent dentition

Cause of injury	No. affected children (%)	to teeth (%)
Falling while walking or running	190 (40.3)	258 (39.4)
Impact with a hard object	144 (30.5)	206 (31.5)
Bicycle/tricycle accident	120 (25.4)	162 (24.8)
Other	18 (3.8)	28 (4.3)
Total	472 (100)	654 (100)

Table 3. Distribution of dental injuries and affected teeth by age and sex

Age and sex	Dental injuries, *n* (%)	Affected teeth, *n* (%)
6 Years		
Boys	48 (10.2)	64 (9.8)
Girls	32 (6.8)	46 (7.0)
All	80 (16.9)	110 (16.8)
7 Years		
Boys	22 (4.6)	28 (4.3)
Girls	20 (4.2)	30 (4.6)
All	42 (8.9)	58 (8.9)
8 Years		
Boys	34 (7.2)	48 (6.9)
Girls	44 (9.3)	56 (8.6)
All	78 (16.5)	104 (16.0)
9 Years		
Boys	54 (11.4)	84 (12.8)
Girls	30 (6.3)	38 (5.8)
All	84 (17.8)	122 (18.6)
10 Years		
Boys	40 (8.5)	52 (7.9)
Girls	34 (7.2)	50 (7.6)
All	74 (15.7)	102 (15.6)
11 Years		
Boys	26 (5.51)	38 (5.8)
Girls	26 (5.51)	32 (4.9)
All	52 (11.0)	70 (10.7)
12 Years		
Boys	44 (9.3)	62 (9.5)
Girls	18 (3.8)	26 (3.97)
All	62 (13.1)	88 (13.4)
Total		
Boys	268 (56.8)	376 (57.5)
Girls	204 (43.2)	278 (42.5)
All	472 (100.0)	654 (100.0)

Table 4. Distribution of diagnosis of injured teeth by type of injury (n = 654)

	Boys, *n* (%)	Girls, *n* (%)	Total, *n* (%)
Dental hard tissue and pulp injury			
Crown discoloration	2 (3.4)	12 (1.8)	34 (5.2)
Enamel fractures	180 (27.5)	112 (17.1)	292 (44.6)
Enamel/dentin fracture	82 (12.5)	42 (6.4)	124 (19.0)
Enamel/dentin/pulp fracture	12 (1.8)	24 (3.7)	36 (5.5)
Crown/root fracture	2 (0.3)	4 (0.6)	6 (0.9)
Crown/root/pulp fracture	2 (0.3)	4 (0.6)	6 (0.9)
Root fracture	2 (0.3)	0 (0.0)	2 (0.3)
Periodontal tissue injury			
Subluxation	20 (3.0)	20 (3.0)	40 (6.1)
Lateral luxation	36 (5.5)	32 (4.9)	48 (7.3)
Intrusive luxation	50 (7.6)	38 (5.8)	88 (13.4)
Extrusive luxation	10 (1.5)	6 (0.9)	16 (2.4)
Avulsion	10 (1.5)	8 (1.2)	18 (2.7)
Total[1]	376 (57.5)	278 (42.5)	654 (100.0)

[1]Total figures reflect the fact that some teeth had more than one type of injury.

incidence of traumatic injuries occurring in summer and other times of year was statistically significant ($P < 0.001$).

Over two-thirds (68.6%) of children suffering traumatic dental injury had an overjet of more than 3 mm. Children with increased overjet (>3 mm) were 2.19 times more likely to suffer dental injuries than children with slight or no overjet (≤ 3 mm); this difference was found to be statistically significant ($P < 0.001$).

Discussion

The aim of this study was to identify the types and etiologies of dento-alveolar injuries among patients who were treated for injuries to maxillary and/or mandibular permanent teeth in Turkish children, Ankara. In the present study, children ages 6 and ages 8–10 were found to be the most affected by traumatic dental injuries. This is in agreement with some earlier studies (18–20). This study also found boys presented more traumatic injuries than girls. This corroborates the findings of some previous studies (18, 21–27), although others have reported an equal distribution of traumatic injuries between the sexes (1, 23). The higher incidence of injuries found among boys may be explained by more vigorous play in comparison to girls.

Because of their exposed position in the dental arch, upper central incisors are affected by traumatic injury at significantly higher rates than other teeth. With a statistical gap in incidence, the upper and lower lateral incisors and the upper canines are the next-most frequently affected by traumatic injuries (10, 28). Of the injured teeth evaluated in this study, 88.2% were central upper incisors. This rate is comparable with the rates reported in the literature (6, 21, 23, 29). This study found the majority (64.8%) of children with traumatic injuries had one traumatized tooth, 32.6% had two damaged teeth, 1.7% had three damaged teeth and 0.8% had four damaged teeth. This distribution is also similar to that reported in the literature (9, 23, 30, 31).

The main causes of injuries in this study were falling while walking or running (40.3%), which is similar to those of previous studies (21, 32, 33). Considering that accidents occurring during play may account for a large number of traumatic injuries resulting from falls, in addition to those related to bicycle/tricycle accidents, more supervised play may help to reduce the incidence of such traumatic injuries (34–36).

According to the literature, crown fracture is the most common type of injury to permanent dentition (10, 37, 38). The present study found the most common injuries to be enamel and enamel/dentine fractures. This finding is similar to other studies conducted in Turkey (9, 18, 21).

This study found that 44.1% of all traumatic injuries occurred during the summer months. This finding is in line with a study by Kargul et al. (18) showing a seasonal variation in the distribution of traumatic dental injuries in temperate climates, with an increased number of episodes occurring in warmer weather. This difference was also noted by Altay et al. (9) and Saroğlu-Sönmez (21) in studies of Turkish children.

Finally, this study found that 68.6% of children 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 (14, 39) to define increased overjet, others use a value greater than 5 mm (6, 25, 40). Nguyen et al. (41) compared the results

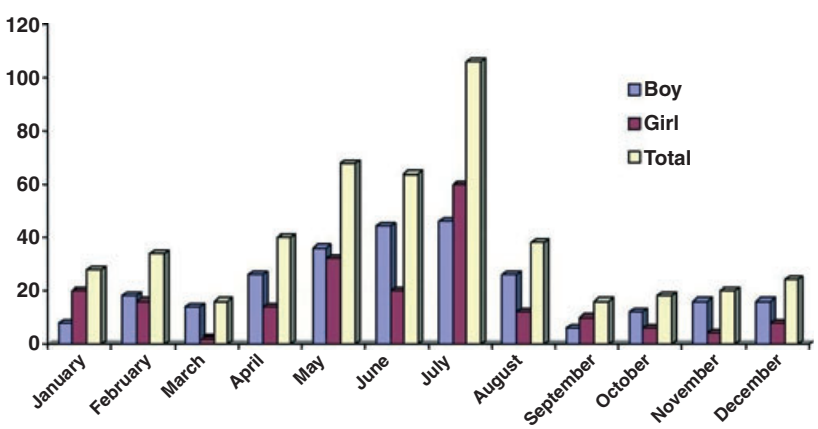

Fig. 1. Distribution of injured teeth by time of injury (month).

of several studies assessing the relationship between overjet and dental injuries and concluded that age and gender confound this relationship. Kania et al. (17) found that the incidence of traumatic dental injury was higher among children with prognathic maxillae and increased overjets, and it was also higher among boys than girls. Järvinen (42) found injury rates of 14.2% among children with normal overjet (0–3 mm), 28.4% among children with increased overjet (3–6 mm) and 38.6% among children with extreme overjet (> 6 mm). He also found that the range of injuries increased in relation to the size of overjet. Burden (34) found that both inadequate lip coverage and increased overjet were significant risk factors for maxillary incisor trauma. Finally, Soriano et al. (6) found a significant association between dental trauma and overjet when it presented a value higher than 5 mm, corroborating the assertion that the frequency of dental trauma increases proportionally in relation to an increased overjet (11). The present study showed a significant association between dental trauma and an overjet in excess of 3 mm, with the risk of traumatic injury 2.19 times greater among this group when compared with those with an overjet of 3 mm or less.

Conclusion

There is a high risk of dental and oral injury during childhood and adolescence. To understand the complexities of dental trauma epidemiology and implement preventive strategies that can help reduce the frequency of trauma, more epidemiological studies with representative populations using standardized trauma classifications are required. Children with increased overjet were found to be significantly more likely to experience traumatic dental injury than other children; therefore, initiating and completing preventive orthodontic treatment in such children before the age of 12 may be helpful in reducing traumatic injury related to increased overjet.

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