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Clinical investigation of traumatic injuries in Yeditepe University, Turkey during the last 3 years

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Abstract – The aim of this study was to evaluate etiology, types of traumatic dental injuries, treatment and to determine the incidence of complications according to dental injuries in patients who referred to Yeditepe University, Faculty of Dentistry, Istanbul, Turkey. The study was based on the clinical data of the 161 traumatized teeth in 92 patients. WHO classification slightly modified by Andreasen & Andreasen for dental trauma was used. The causes and localization of trauma, traumatized teeth classification, treatment and complications were evaluated both primary and permanent teeth. The distribution of complications according to diagnosis and treatment of the injured teeth were evaluated. Of 35 (38%) girls and 56 (72%) boys with a mean age 7.6 ± 3.5 (ranging 1–14.2) participated to study and the mean followed up was 1.72 ± 1.28 years (ranging 0.10–3.8 years). From the 161 affected teeth, 69 (42.9%) were in primary teeth and 92 (57.1%) in permanent teeth. The highest frequency of trauma occurred in the 6–12 year age group. Overall boys significantly outnumbered girls by approximately 1:1.6. The most common type of injury in the primary and permanent teeth was seen as luxation (38%) and enamel fracture (20%) of the maxillary central incisors, respectively. Falls were the major sources of trauma both the primary (90%) and the permanent teeth (84%). In the primary dentition, the most common type of soft tissue injury is contusion (62.5%) and in the permanent dentition, it is laceration (49%). The most of the treatment choice was determined as examination only and extraction in primary teeth (58 and 24.6%, respectively) while it was applied as restoration and pulpectomy in permanent teeth (31.5 and 18.5%, respectively). Complications were recorded on 37 teeth (23%) with a most common type of necrosis (10.5%) and dental abscess (7.4%). Necrosis was more frequent in luxation whereas dental abscess were in crown fracture with pulpal involvement in both dentitions. The study showed that boys were more prone to dental traumas than girls. Falls were more frequent trauma type with a high complication risk. It reveals that the time of the immediate treatment showed the important predisposing factors that increase the success of treatment and decrease the risk of complication. The correct diagnosis of dental injuries is more important for eliminating the occurrence of complications.

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Key words: dental trauma; primary and permanent teeth; complications; alveolar fracture

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Traumatic injuries in children and adolescents are a common problem and several studies have reported that the prevalence of these injuries has increased during the past few decades. The prevalence of traumatic injuries in the primary teeth is between 11 and 30% (1–4) while in the permanent teeth it is varied widely from the lowest rate as 2.6% to the highest as 50% (5–7). The great variation in reported prevalence has been related to the number of different factors such as the type of study, trauma classification, differences in methodology, limited age groups, geographical and behavioral differences between study locations and countries (7–10).

The knowledge of risk factors such as incisal overjet, inadequate lip coverage and the status of socio-economic background, and causes i.e. falls, sporting activities, traffic accident is essential for an effective prevention (4, 9, 11–15). The main objective of diagnosis and treatment of traumatic injuries effecting children with primary and/or permanent dentition are pain management, prevention of possible damage to the developing tooth germ in primary dentition and prevention of periodontal problems and dental abscess in permanent dentition (11–13).

All preventive measures should be based on exact knowledge. Prevention of dental injuries should therefore be founded on reliable dental relating to incidence, diagnosis, and causes. The aim of this study was to evaluate causes, types of traumatic dental injuries, treatment and to determine the incidence of complications according to dental injuries in patients who referred to Yeditepe University, Faculty of Dentistry, Turkey during the last 3-years.

Patients and methods

The study was based on the clinical data of 91 patients referred to Yeditepe University, Faculty of Dentistry, Department of Pedodontics, Istanbul, Turkey with a traumatic injury during 3-years. A total of 161 traumatized teeth in 91 patients (35 girls and 56 boys, mean age 7.6 ± 3.5 (ranging 1–14.2)) were included in the study. The children were examined clinically for their dental injuries by the same investigator (S.C.) in all examinations. Historical evidence of dental trauma was collected. The following informations were recorded; age and gender, number of injured teeth, type of trauma, type of tooth, the time elapsed between injury and seeking of dental care and treatment provided, previous trauma histories and management technique.

The classification of the World Health Organization (WHO) slightly modified by Andreasen & Andreasen was used (16, 17).

- Enamel fracture (uncomplicated crown fracture): enamel chipping or crack.
- Enamel and dentine fracture (uncomplicated crown fracture), without pulpal involvement.
- Complicated crown fracture involving enamel, dentine and exposure of the pulp.
- Root fracture
- Crown-root fracture, may or may not expose the pulp.
- Injuries to the periodontal tissues (luxation injuries): concussion, subluxation, lateral luxation, extrusive luxation, and intrusive luxation.
- Avulsion.

The causes (bicycle or scooter, falls, traffic accident, striking an object) of trauma, treatment and complications were evaluated on both primary and permanent teeth. During the clinical examination, the fracture, exposed pulp, abnormal mobility, the direction of the displacement (concussion, subluxation, luxation, avulsion) and perioral soft tissue injuries (contusion, abrasion, laceration) were recorded. A 7-day course of antibiotics was given in cases with subluxation, luxation, intrusion and extrusion. Penicillin was the drug of choice but patients who were sensitive to penicillin were prescribed erythromycin. All patients were provided with 0.1% chlorhexidine gluconate mouth rinse.

Data collected at the clinical examination included tooth color, mobility, percussion sensitivity and tone, presence or absence of fistula, and tooth vitality. The vitality of tooth was determined by electrical pulp test (Parkell Electronics Division, Farmingdale, NY, USA). Tooth crown color was evaluated by comparing with the unaffected contralateral tooth. Diagnosis of pulp necrosis was based upon the absence of pulp sensibility and at least one other clinical or radiographic sign (color changes in the crown, periapical radiolucency, presence of a fistula or tenderness to per percussion). Ankylosis was tested by percussing the incisal edge of the tooth with a mirror handle held parallel to the long axis of the incisor. Percussion tone was classified and recorded as normal or anklyosed. Pain on percussion was recorded as present or absent compared with unaffected contralateral tooth.

Periapical radiographs were obtained to confirm diagnosis. Patients with previous trauma histories that the teeth were displaced and supported by a radiographic examination were accepted as an untreated supporting tissue injury. Follow-up included clinical and radiographic examinations and continued at 3–6 weeks, 3 months, 6 months and annually. Dental complications such as resorption, dental abscess, necrosis, tooth loss, anklyosis and esthetic problems were also recorded at follow-up.

Results

The mean age of the girls and boys were 7.84 ± 3.71 (ranging 1.11–14) and 7.43 ± 3.43 years (ranging 1–14.2), respectively. The highest frequency of trauma occurred in the 6–12 year age group (Fig. 1). Overall boys significantly outnumbered girls by approximately 1:1.6. The traumatized teeth in both girls (60%) and boys (53.6%) were more frequent in permanent teeth. Of 161 affected teeth, 69 (42.9%) were in primary teeth and 92 (57.1%) in permanent teeth. The prevalence of the traumatized permanent teeth was found higher than the primary teeth in both sexes. The highest frequency of traumatized teeth in both primary and permanent teeth were observed in boys (48.5 and 51.5%, respectively). The mean followed up is 1.72 ± 1.28 years (ranging 0.10–3.8).

The distribution of dental injuries according to the WHO, which slightly modified by Andreasen & Andreasen, is seen in Table 1. In the permanent teeth the most frequent injuries were enamel chipping or crack (37.3%) and crown fracture without pulpal involvement (20.2%), while it was luxation (39.6%) and enamel chipping or crack (21.4%) in the primary teeth. Crown fracture with pulpal involvement was approximately equivalent in both dentitions (14.5 and 12%, respectively). Eleven (69%) of 16 avulsed teeth were observed in permanent teeth. Four avulsed permanent teeth were seen in one patient with alveolar fracture. The most common types of soft tissue injuries were contusion (43.9%) and laceration (39.6%).

Figure 2a,b shows the distribution of the injured primary and permanent teeth regarding the causes of trauma. Falls were the major sources of trauma both in the primary (90%) and the permanent teeth (84%). Of these, 49 (62%) were in boys.

The maxillary arch including 144 teeth was involved in a higher percentage of cases (89.4%). The more common type of traumatized teeth in both dentitions was in maxillary central incisors (78.9%). Sixty-four (95.7%) of the traumatized primary teeth were in the maxillary arch. In the

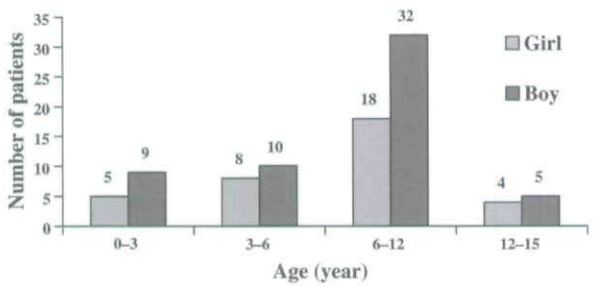

Fig. 1. The distribution of dental injuries according to age.

Table 1. The number of frequency of injuries in primary and permanent dentitions

Diagnosis	Primary dentition [*n* (%)]	Permanent dentition [*n* (%)]	Total [*n* (%)]
None	1 (1.4)		1 (0.6)
Enamel crack	15 (21.4)	34 (37.3)	49 (30.2)
Fracture of crown without pulpal involvement	–	19 (20.2)	19 (11.6)
Fracture of crown with pulpal involvement	10 (14.5)	11 (12)	21 (13)
Fracture of root of tooth	1 (1.4)	–	1 (0.6)
Fracture of crown and root of tooth	–	–	–
Luxation	28 (39.6)	11 (12)	39 (24.1)
Intrusion	2 (2.9)	2 (2.2)	4 (2.5)
Extrusion	4 (5.8)	–	4 (2.5)
Subluxation	4 (5.8)	–	4 (2.5)
Avulsion	5 (7.2)	11 (12)	16 (9.9)
Alveol fracture	–	4 (4.3)	4 (2.5)
Soft tissue			
None	1 (2.5)	3 (5.9)	4 (4.4)
Contusion	25 (62.5)	15 (29.4)	40 (43.9)
Abrasion	3 (7.5)	8 (15.7)	11 (12.1)
Laceration	11 (27.5)	25 (49)	36 (39.6)

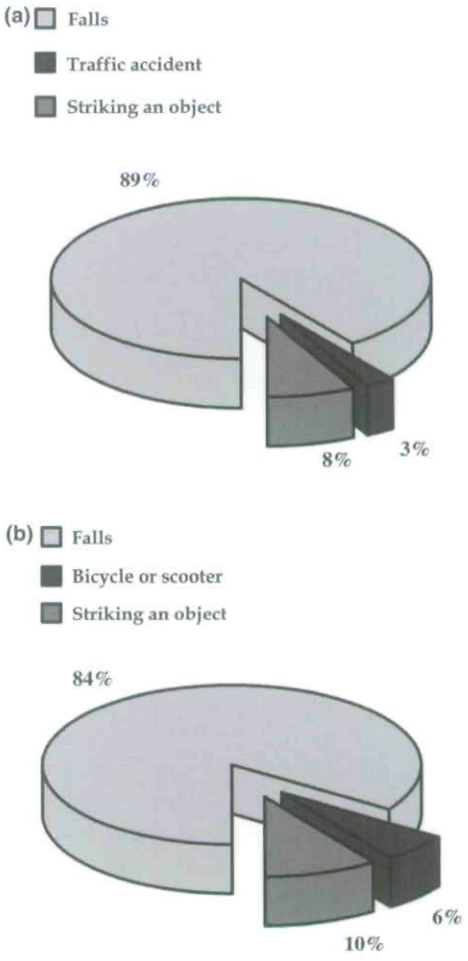

Fig. 2. The distribution of injured (a) primary and (b) permanent teeth regarding the causes of trauma.

Table 2. Treatment modalities of all traumatized teeth

Treatment	Primary dentition [*n* (%)]	Permanent dentition [*n* (%)]	Soft tissue [*n* (%)]
Exam only	40 (58)	24 (26.4)	4 (4.4)
Debride/clean		–	11 (12)
Medication	7 (10)	4 (4.3)	40 (43.9)
Sutures		–	36 (39.6)
Restoration	2 (2.9)	29 (31.5)	
Kuafaj and restoration	–	6 (6.5)	
Cvek pulpotomy	–	1 (1)	
Pulpectomy	3 (4.5)	17 (18.5)	
Apexification	–	3 (3.3)	
Reposition	–	–	
Reimplatation	–	2 (2.2)	
Splint	–	4 (4.3)	
Extraction	17 (24.6)	–	
Forced eruption		1 (1)	
Space maintainer		1 (1)	

Table 3. The frequency of dental complications on follow-up period

	Primary dentition [*n* (%)]	Permanent dentition [*n* (%)]	Total [*n* (%)]
None	49 (71)	75 (81.5)	124 (76.6)
Resorption	1 (1.4)	2 (2.2)	3 (2)
Dental abscess	6 (8.8)	6 (6.5)	12 (7.5)
Necrosis	11 (15.9)	6 (6.5)	17 (10.5)
Tooth loss	2 (2.9)	1 (1.1)	3 (2)
Anklyosis	–	1 (1.1)	1 (0.7)
Esthetic problems	–	1 (1.1)	1 (0.7)
Total	69	92	161

traumatized permanent teeth, 78 (84.8%) were in maxillary arch and 14 (15.2%) in mandibulary arch.

The most of treatment choice was determined as examination only and extraction for primary teeth (58 and 24.6%, respectively) while it was applied as restoration and pulpectomy in permanent teeth (31.5 and 18.5%, respectively). None of the teeth received extraction in permanent teeth (Table 2).

Complications were recorded on 37 teeth (23%) in follow-up period. The most common complications were necrosis (10.5%) and dental abscess (7.5%). Nine of 11 primary teeth with necrosis were seen in luxation (15.9%) whereas in permanent teeth with necrosis the homogene distribution was seen in enamel crack, crown fracture without pulpal involvement and luxation. Fourteen (35.9%) of 39 luxations had complications such as pulp necrosis, dental abscess and root resorption. Dental abscess were observed after crown fracture with pulpal involvement in five primary teeth and three permanent teeth and, in two permanent teeth with enamel crack. All teeth with subluxation were seen in primary teeth, pulp necrosis was recorded in 2.9% of teeth. Three of 16 avulsed teeth were lost; one of them was in permanent teeth (Tables 3 and 4).

Discussion

Studies have indicated that the prevalence of dental traumas was highest between 6–9 and the 10–12, and that it decreases with age (14, 18–21). In this study, the age distribution of the subjects was between 6 and 12 years. Gender distribution studies have demonstrated that boys have showed to be more often injured than girls (9, 18, 20). The female to male ratio are 1:2.3 (20–23). In this study, the female to male ratio was 1:1.6. It was also found that the highest frequency of traumatized teeth in both primary and permanent teeth were observed in boys

Table 4. The distribution of dental injuries according to the complications in both dentitions

	Primary dentition							Permanent dentition							
Diagnosis	None	Resorption	Dental abscess	Necrosis	Tooth loss	Anklyosis	Esthetic problems	None	Resorption	Dental abscess	Necrosis	Tooth loss	Anklyosis	Esthetic problems	Total
Enamel crack	15	–	–	–	–	–	–	30	–	2	2	–	–	–	49
Crown fracture without pulpal involvement	–	–	–	–	–	–	–	16	1	–	2	–	–	–	19
Crown fracture with pulpal involvement	5	–	5	–	–	–	–	8	–	3	–	–	–	–	21
Root fracture	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Crown and root fracture	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Luxation	17	1	1	9	–	–	–	8	–	1	2	–	–	–	39
Intrusion	2	–	–	–	–	–	–	1	–	–	–	–	1	–	4
Extrusion	4	–	–	–	–	–	–	–	–	–	–	–	–	–	4
Subluxation	2	–	–	2	–	–	–	–	–	–	–	–	–	–	4
Avulsion	3	–	–		2	–	–	8	1	–	–	1	–	1	16
Alveol fracture	–	–	–	–	–	–	–	4	–	–	–	–	–	–	4
Total	49	1	6	11	2	–	–	75	2	6	6	1	1	1	161

(8.5 and 51.5%, respectively). This might be explained by observations that boys participate in more aggressive type of games, more violent behavior and contact sports.

Uncomplicated crown fracture without pulp exposure is the most common injury to the permanent dentition in most studies (14, 18, 22–24). However, subluxations and complete luxations are the most frequently occurring injuries particularly in the primary dentition (9, 10, 12, 25). Although it is possible for primary teeth to be fractured, intrusion, luxation or avulsion injuries are more common, the root and alveolar bone support of the primary teeth are minimal and may predispose the primary dentition to avulsion and luxation injuries. The permanent teeth are more firmly embedded in alveolar bone and may be more likely to fracture (25–27). In our study, fracture of crown with pulpal involvement was found equivalent frequency in both dentitions. Enamel crack or chipping was mostly seen in both dentitions compared the frequency of other types of trauma. The most common type of injuries in permanent teeth, like that of most studies (6, 7, 15, 20, 21, 24) was the fracture of crown without pulpal involvement (20.2%).

Prevalence of traumatized permanent incisor teeth varied from the lowest rate as 2.6% to the highest rate as 50% (3, 4, 22, 23, 27). In primary dentition it has been reported between 11 and 30% (1, 2). In present study, the maxillary central incisors were the most frequently traumatized teeth consistent with the finding of the studies for both the primary and permanent dentitions. The second most frequently traumatized teeth were maxillary lateral incisors in all studies except that by Forsberg and Tedestam (23) where mandibular central incisors were the second most frequently traumatized teeth. The majority of the injuries noted in present study involved the maxillary incisors for both the primary and permanent teeth, a finding consistent with the literature on dental trauma.

There is some variation between the studies and countries regarding the predominant causes of dental trauma, although falls appear to be the most common factor (2, 4, 7–9, 12, 18, 22, 27). The prevalence of traumatic injuries in the 0–6 year segment varies from 11 to 30% (2, 3, 23, 25). When the child starts walking alone, between 18 and 30 months, the risk of trauma increases with incidence twice as high as the average incidence for all children (2, 11). Consistent with the finding of the former investigations, fall was the single most frequent cause of dental trauma for both primary and permanent teeth in the present study (86.8%).

Children with primary teeth are most frequently affected by luxation injuries (9, 10, 25) and healing without any treatment normally follows (25). In follow-up controls, it is possible to observe healing of the periodontal ligament (PDL) (26). Regarding pulp survival, pulp canal obliteration following luxation injuries is a common finding. In a histological study of hard tissue formation, performed on 123 primary teeth (28), it was found that changes in dentin were represented by occlusion of the dentinal tubules and deposition of tertiary dentin. It was classified as either dentin-like, bone-like, or fibrotic (28, 29). From the same study, intrusion was the most common diagnosis in children aged 9–108 months and in almost half of the teeth studied, the degree of obliteration was less than one-fourth of the pulpal lumen (29). Extraction has generally been the treatment of choice for luxated teeth (11, 30). Traumatic dental injuries are associated with damage to surrounding soft tissues, such as laceration, erosion, or contusion of lips, gingiva, internal mucosa, or tongue (8, 10, 31). In present study, like that of Perez (10), Altay (9), Saroglu (18) and Soporowski (26), the most common type of injuries in primary teeth was luxation (39.6%) and examination only and extraction was the main treatment choice. These findings are in contrast to Kargul et al. (20) that the most treatment for primary teeth is examination and follow-up only. This might be related to the number of teeth with luxation is lower than our study.

Fractures without pulp exposure have been shown to result in less pulp necrosis in 1.2% of cases; luxations in 6.8% of cases, whereas fractures with pulp exposure have not shown pulp necrosis; luxation in 1.2% of cases. Andreasen et al. (32) showed that concussion and subluxation have a good prognosis, whereas luxations increase the risk of pulp necrosis. In this study, although the number of teeth with subluxation was limited ($n = 4$) and only seen in primary teeth, pulp necrosis was seen on 2.9% primary teeth with subluxation. Fourteen (35.9%) of 39 luxations had complications such as pulp necrosis, dental abscess and root resorption. The survival of PDL has been shown because of the degree of luxation that subluxation present a better prognosis for PDL, compared with lateral luxation (33). Subluxation, or loosening is an injury to the tooth supporting structures with abnormal loosening but without clinically or radiographically demonstrable displacement of the tooth with no risk of pulpal necrosis and a minimal risk of root resorption (33). In this study, root resorption of two teeth was observed in the primary teeth with luxation and permanent teeth with crown fracture without pulpal involvement. Although the possible cause of root resorption appear to be the longer period of dry storage. The causes of its in present study were to be luxated primary teeth and, avulsed and to have the crown fracture without pulpal involvement

permanent teeth. The present study showed that dental abscess was seen eight (38%) of 21 teeth with fracture of crown with pulpal involvement. The possible cause of the abscess in injured teeth is the direct exposure of the pulpal tissues to the oral cavity providing an entry route for bacteria.

Abnormalities in the appearance and function of the structures of the face and mouth have been shown to place patients at risk of developing problems with self-image and self-acceptance, and may lead to development of abnormal psychosocial behavior patterns (21). It is, therefore important that every effort should be made to preserve the integrity and function of the teeth and dentoalveolar structures. In our study, one patient had alveolar fracture caused by traffic accident and also seriously esthetic problem caused by lost of all maxillary incisors and by impeding the development of maxilla.

Conclusions

- The age distribution of the subjects was between 6 and 12 years, and the female to male ratio was 1:1.6.
- The highest frequency of traumatized teeth in both dentitions was observed in boys.
- Falls accounted for 87% of injury sources in the children.
- The most common type of injury in the primary and permanent teeth was seen as luxation (38%) and enamel fracture (20%) of the maxillary central incisors.
- Examination only and extraction were the main treatment choice in primary dentition. It was applied as restoration and pulpectomy in permanent teeth.
- After traumatic injuries to the primary dentition, the most common complications were necrosis and dental abscess.
- The correct diagnosis of dental injuries is more important for eliminating the occurrence of complications.

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