Traumatic Injuries of Permanent Teeth Among 6– to 12–year–old Iraqi Children: A 4–year Retrospective Study

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ABSTRACT

Purpose: The purpose of this retrospective study was to identify the types, causes, and other factors associated with traumatic dental injuries (TDIs) in the permanent teeth of children in Mosul, Iraq.

Methods: Data were collected from the dental records of 6- to 12-year-old children with TDIs who attended the Pediatric Dental Clinic at the Mosul University School of Dentistry between October 2006 and October 2010. The gathered data included: demographic information, when and where the injury occurred, type of dental injury, cause of injury, and the time elapsed between the TDI and dental care. Data were evaluated using the chi-square test.

Results: A total of 294 children with TDIs were examined and treated. The highest frequency of TDIs was among 12-year-old children (29%), with more males being affected ($P<.001$). The most common type of injury was enamel-dentin fracture (56%). The most frequent cause of TDIs was falls (53%). The majority of the injuries happened outdoors (55%), and 37% of the cases occurred in the Fall. Only 5% of patients sought dental care within 24 hours of the injury.

Conclusion: This 4-year retrospective study showed that the majority of children with TDIs sought dental treatment after one month of the injury. Educating parents and teachers about the benefits of trauma prevention and immediate treatment of injuries is a must. (J Dent Child 2013;80(1):3-8)

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Dental trauma is a significant global public health problem, particularly among children. Andreasen et al.[1] stated that two thirds of children have encountered traumatic dental injuries (TDIs) before adulthood. TDIs make up a substantial proportion of dental emergency visits, require multiple follow-up appointments, and may cause long-term problems for the developing dentition. Furthermore, TDIs can lead to emotional, psychosocial, and financial challenges not only for children, but also for parents and health authorities.[2,3]

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There is a great variation in the prevalence and incidence of TDIs in permanent teeth from different countries and within countries, which can be explained by the lack of standardized classification of TDIs, environmental variations, socioeconomic differences, and cultural diversity.[4] Iraqi children were found to have a significantly higher rate of injuries and a significantly higher rate of complicated crown factures and avulsion compared to Sudanese children.[5,6]

Individual communities have to analyze data from their own geographic regions so that specific recommendations on management and prevention of TDIs can target the needs of the population.[7] This can provide a better understanding of the environmental and behavioral factors which may play an important role in TDIs. Previous prospective cross-sectional studies reported that a prevalence of TDIs among 6- to 12-year-old Iraqi children ranged from 6% to 8%.[5,8] However, no previous retrospective study has investigated TDIs among Iraqi children.

The purpose of this retrospective study was to identify the types, causes, treatment provided, and other factors associated with permanent TDIs in children attending the pediatric dental clinic at the School of Dentistry, Mosul University, Mosul, Iraq.

METHODS

The Research Ethics Committee of Mosul University School of Dentistry and the Institutional Review Board of Indiana University-Purdue University, Indianapolis, Ind, approved this study. The dental records of all 6- to 12-year-old children who attended the Department of Pediatric Dentistry, School of Dentistry, Mosul University, between October 2006 and October 2010 were reviewed. A retrospective, cross-sectional survey was conducted on all children with traumatized permanent teeth, and data were collected using specific trauma sheets.

The data gathered included the following: age at time of the injury, gender, geographic residency (inner Mosul city, Mosul suburb, or refugee with a temporary residency in Mosul city), where and when (month) the injury occurred, type and number of teeth with an injury, cause of injury (fall, sports, bicycle accident, war accident, road traffic accident, assault, and other causes), the time elapsed between the injury and dental care, whether the patient was referred by another dentist, chief complaint (pain, esthetic, or regular dental check-up), and type of treatment performed. Andreasen's modification of the World Health Organization's dental trauma classification[9] was used in this study to allow comparison of the results with international studies that used the same classification.

The data were analyzed using SAS 9.2 software (SAS Institute, Inc, Cary, NC). Chi-square and Wilcoxon rank sum tests were used to determine the statistical significance. A 5% level of statistical significance was used.

RESULTS

Between October 2006 and October 2010, 3,630 6- to 12-year-old children attended the pediatric dental clinic at the Mosul University School of Dentistry, and 294 (8%) patients with 380 traumatized permanent teeth were examined and treated. None of the children had experienced more than 1 traumatic event. The mean age was 10.1±1.6 years. Twelve-year-olds (29%) constituted the group of patients with the highest frequency of dental trauma, followed by 10-year-olds (Figure 1). Boys presented with more TDIs than girls (63% vs 37%; $P<.001$). A total of 210 children (71%) had 1 injured tooth, 78 (27%) had 2 injured teeth, 4 (1%) had 3 injured teeth, and only 2 (1%) had 4 injured teeth. Table 1 shows the distribution of TDIs. The most frequently injured permanent teeth were the maxillary central incisors (87%). No significant difference was found between permanent left and right central incisor injuries ($P=.28$). Furthermore, no significant differences between genders was found regarding the type of injured teeth ($P=.75$).

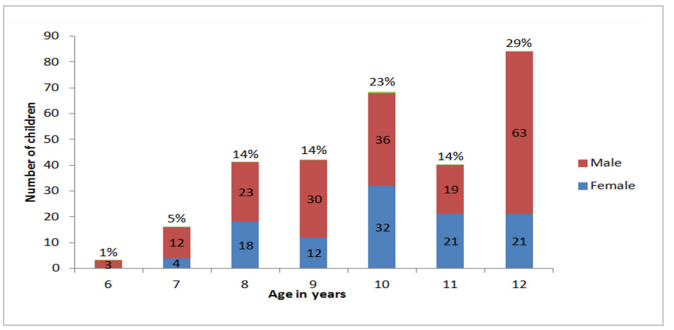

Figure 1. Age distribution of patients.

Table 1. Teeth Affected by Traumatic Injuries

Tooth	n (%)		
	Female	Male	Total
Maxillary Right Lateral Incisor	2 (1)	5 (2)	7 (2)
Maxillary Right Central Incisor	64 (44)	94 (40)	158 (42)
Maxillary Left Central Incisor	66 (45)	107 (45)	173 (45)
Maxillary Left Lateral Incisor	1 (1)	3 (1)	4 (1)
Mandibular Left Lateral Incisor	0 (0)	4 (2)	4 (1)
Mandibular Left Central Incisor	5 (4)	10 (4)	15 (4)
Mandibular Right Central Incisor	5 (4)	9 (4)	14 (4)
Mandibular Right Lateral Incisor	1 (1)	4 (2)	5 (1)
Total	144 (100%)	236 (100%)	380 (100%)

The most frequent injury (Table 2) was enamel dentin fracture (56%), followed by complicated crown fractures (21%) and subluxation (5%). Lower percentages of avulsion, complicated crown fracture, lateral luxation, and subluxation, and higher percentages of enamel-dentin fracture and intrusive luxation were found in females vs males ($P<.001$). The most common causes of TDIs (Figure 2) were falls (53%), sports (15%), war accidents (10%), and bicycle accidents (8%). Falls were significantly more frequent than all other causes of TDIs ($P<.05$). A total of 163 (55%) traumatic injuries occurred outdoors, 79 (27%) occurred at home, and 52 (18%) occurred at schools (Figure 3). The location where the injury happened was significantly different between genders ($P<.001$), with a higher proportion of outdoor injuries in males. Most children with TDIs lived in inner Mosul city (77%), followed by refugees with a temporary residency in Mosul city (12%) and children living in Mosul suburbs (11%).

A total of 109 (37%) injuries occurred between October and December, whereas only 47 (16%) cases occurred between July and September (Figure 4). TDIs during the Fall season were significantly higher than all other seasons ($P<.05$). Only 15 (5%) patients attended the clinic within 24 hours of the TDI, and 72 (24%) were seen after more than 6 months (Figure 5). The main reason for visiting the clinic (Figure 6) was pain (50%), esthetics (32%) and a regular dental check-up (18%). A higher proportion of males came to the clinic due to pain but females were mostly concerned about esthetics ($P<.02$).

Table 2. Type of Dental Trauma Per Gender

Type of dental trauma	n (%)		
	Female	Male	Total*
Dental hard tissue and pulp injury			
Enamel infraction	1 (1)	0 (0)	1 (<1)
Enamel fracture	4 (3)	7 (3)	11 (3)
Enamel/dentin fracture	92 (62)	127(52)	219 (56)
Complicated crown fracture	25 (17)	59 (24)	84 (21)
Complicated crown-root fracture	4 (3)	3 (1)	7 (2)
Root fracture	5 (3)	1 (<1)	6 (1)
Periodontal tissue injury			
Subluxation	5 (3)	16 (7)	21 (5)
Lateral luxation	1 (1)	15 (6)	16 (4)
Intrusive luxation	8 (5)	6 (2)	14 (4)
Extrusive luxation	3 (2)	3 (1)	6 (2)
Avulsion	0 (0)	7 (3)	7 (2)
Total	148 (100%)	244 (100%)	392 (100%)

** Some teeth had more than 1 type of injury.*

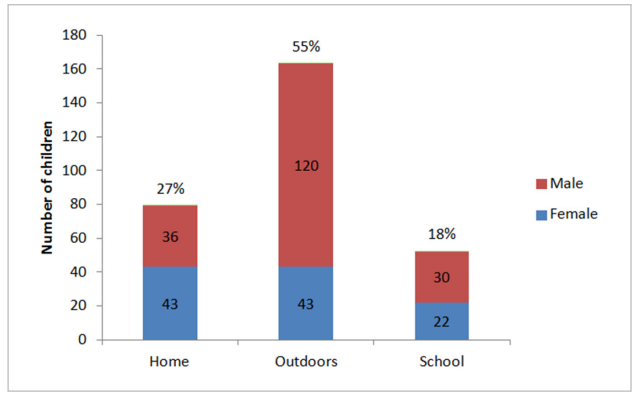

Figure 3. Location where dental trauma occurred.

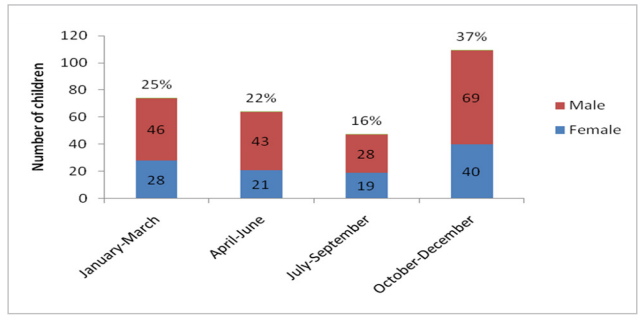

Figure 4. Time of the year (months) when injury occurred.

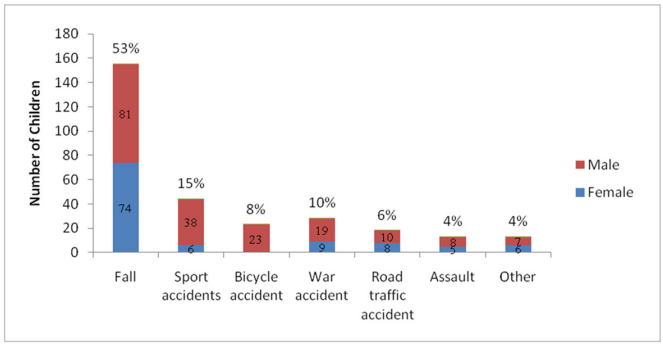

Figure 2. Causes of traumatic dental trauma.

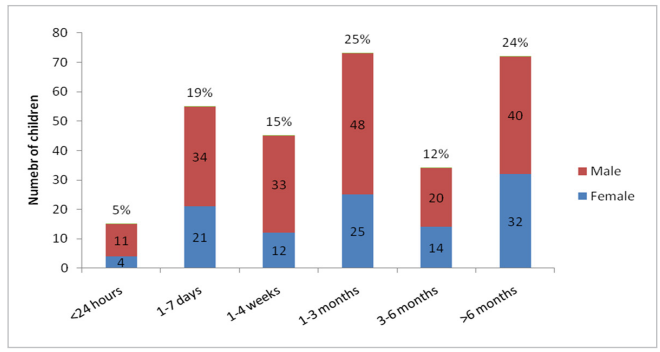

Figure 5. Time elapsed between injury and of seeking dental care after trauma occurred.

The most frequent procedures performed (Table 3) were composite restorations (55%), endodontic treatment (14%), splinting (11%), and apexification (8%). Girls received more composite restorations and fewer apexification procedures than males ($P<.05$). Sixty two patients (21%) with 76 (20%) traumatized teeth were referred by other dentists. Apexification treatment was performed in 23 (30%) of these teeth, whereas 20 (26%) were treated with regular endodontic therapy (Figure 7).

DISCUSSION

In the present study, the highest frequency of dental trauma was among 12-year-old children, which is in agreement with previous studies from Iraq.[5,8] Studies from other countries, however, reported that the peak for TDIs was between 8 and 10 years of age.[10-12] TDIs in this study were significantly higher in boys ($P<.001$), which agrees with other studies.[8,13] However, some found no gender predilection.[14,15] Boys are usually involved in more vigorous activities and sports compared to girls, which may explain the gender difference. The majority of patients in this study had single tooth trauma (71%); this is comparable with previous studies, which suggest that only 1 tooth is involved in the traumatic injury between 62% to 75% of the time.[16-18] Wright et al.,[13] however, found that most TDIs involved multiple teeth (64%).

The current study showed that maxillary central incisors were the most frequently injured teeth (87%), which is in accordance with previous studies.[7,16,19,20] Furthermore, the most common type of injury observed was enamel-dentin fracture (56%), which also agrees with other retrospective studies[13,19-22] but not all. [8,10] Subjects who sustained enamel fracture may not seek dental treatment as long as the tooth is asymptomatic. Therefore, only a small percentage of children with enamel fracture present to the dentist; when they do, the chief complaint is mainly a sharp tooth edge of a tooth or esthetics. Teeth with concussion injuries may have been underestimated in this study because simple injuries may not require immediate treatment. Furthermore, most patients delayed seeking dental care even in cases of a severe TDI.

The main cause of TDIs reported in this study was a fall, followed by sports-related injuries, which generally agrees with other studies from Iraq[8,23] and other countries.[7,13,20] Most TDIs (55%) occurred outdoors, which is comparable to Wright et al.[13] Other studies, however, found that home was the most common place where TDIs happened.[8,24] Outdoor injuries were more common in boys whereas girls had TDIs mostly at home. This could be explained by the cultural customs in Iraq, as girls are mainly involved in home activities, whereas boys are more involved in outdoor activities. In this study, 37% of cases with TDIs occurred from October through December, which was significantly higher than other seasons. The Fall season is the start of

Table 3. Type of Treatment Provided

Treatment	No. of Treatments Performed n (%)		
	Females	Males	Total *
Sharp edge removal	4 (3)	4 (2)	8 (2)
Composite restoration	89 (60)	126 (52)	215 (55)
Cvek pulpotomy	7 (5)	6 (2)	13 (3)
Endodontic treatment	22 (14)	33 (14)	55 (14)
Apexification	6 (4)	26 (11)	32 (8)
Splinting	13 (9)	30 (12)	43 (11)
Prosthetic replacement	0 (0)	7 (3)	7 (2)
Extraction and prosthetic replacement	5 (3)	3 (1)	8 (2)
Orthodontic treatment	1 (1)	3 (1)	4 (1)
Examination and follow-up only	1 (1)	6 (2)	7 (2)
Total	148(100%)	244(100%)	392(100%)

** Some teeth had more than one type of treatment.*

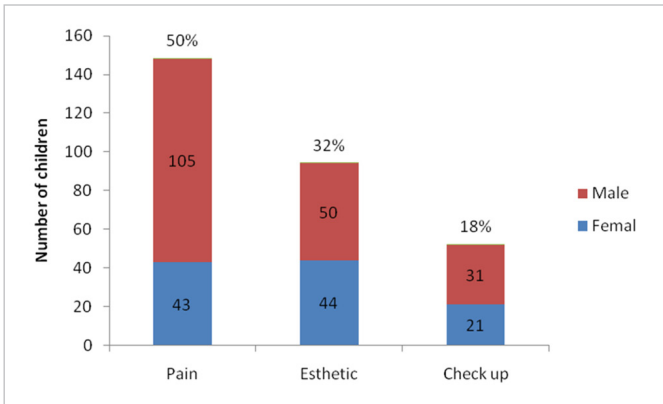

Figure 6. Chief complaint reported by children with dental injuries during their dental visit.

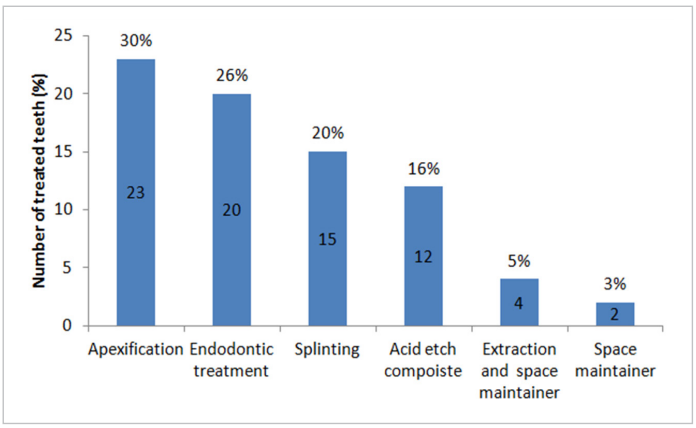

Figure 7. Dental treatment provided for patients referred from other dentists by type of treatment performed.

the primary school year in Iraq, when children may be more involved in physical activities through physical education classes and activities outside the classroom. Additionally, the relatively acceptable weather during these months may lead to increased outdoor activities and, hence, increased numbers of TDIs. On the other hand, summer months had the lowest incidence of TDIs (16%). The scorching summer weather in Iraq may render children less physically active, thus reducing the incidence of injuries. Studies from other countries with a different weather pattern found the peak incidence of TDIs to be during summer[13,16] or winter months.[25]

Only 5% of patients presented to the pediatric dental department within 24 hours of the TDI, whereas 61% of patients were seen after 1 month from the time of injury. In Turkey, 19% to 35% of TDI patients were seen on the day of the injury.[17,22] In Hungary and in Sweden, 49% and 66% of the patients were seen within the first 24 hours of the injury, respectively.[26,27] The delay of presentation of the patients in this study is an indicator of the poor knowledge among parents and teachers regarding the advantages of immediate diagnosis and treatment of TDIs. Targeting the parents and schoolteachers through specific dental trauma prevention programs may be helpful. Furthermore, clear and simple informational campaigns through newspapers, television, brochures, and posters are helpful strategies to raise the public awareness.[28]

Half of the study patients said the main reason for visiting the pediatric dental department was pain, which shows that they usually wait until symptoms arise to seek care. Esthetic concerns were the main reasons for seeking help among 32% of children. The proportion of boys who visited the clinic for pain was significantly higher than girls, who visited the clinic mainly for esthetic reasons. This finding may be explained by the higher percentage of enamel/dentin fracture among girls (62%) vs boys (52%). Furthermore, females are usually more concerned about their teeth than males.[29]

The most frequent treatment for traumatized teeth was composite restoration (55%), which is comparable to other studies.[20,22] Additionally, various pulp therapy approaches (endodontic treatment, apexification, Cvek pulpotomy) were used in 25% of the cases. A complicated crown fracture was not the only reason for commencement of pulp therapy. The delayed presentation of patients with enamel/dentin fracture and various luxation injuries may have adversely affected dental pulp tissue integrity, leading to pulp therapy. During this study's 4-year period, there was no reimplantation of an avulsed tooth or reattachment of a fractured piece of tooth structure.

Soft tissue injuries were not reported in this study. Traumatic injuries to the soft tissues usually heal quickly in children. The delayed presentation time of the majority of children with TDIs made it extremely difficult to note soft tissue injuries. Finally, it is noteworthy to mention that parents may have chosen to seek care at the university pediatric dental department because they lived in nearby neighborhoods, they may have had financial issues impeding them to go to a private dentist, or because they were referred by general dentists. Therefore, the children with TDIs in this study may not accurately represent the normal 6- to 12-year-old population in Mosul city.

CONCLUSIONS

Based on this study's results, the following conclusions can be made:

1. The most frequent injury reported was enamel-dentin fracture and the most frequently injured teeth were the maxillary central incisors.
2. The majority of children sought dental treatment one month after the injury.
3. The Fall season had significantly higher number of TDIs compared to other seasons.
4. TDIs that occurred outdoors were more common in boys whereas those that occurred at home were more common in girls.
5. The majority of TDIs referred to the department of pediatric dentistry from other dentists were treated with apexification, regular endodontic therapy, or splinting.

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