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A retrospective study of emergent traumatic dental injuries in permanent teeth in Xi'an, China

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Abstract

Traumatic dental injury is one of the common injuries seen in the emergency department. To determine the distribution features of emergency traumatic dental injuries in Xi'an, China, data from the medical records of 623 patients (aged 6–78 years) were evaluated and analyzed according to age, gender, etiology, factors predisposing teeth to injury, and types of teeth traumatized. The patient records of 397 males (63.7%) and 226 females (36.3%), with a 1.8:1 male-to-female ratio, were included. The total number of traumatized teeth was 1475. The highest frequency of dental trauma was found in the 19- to 30-year age group (30.7%). The greatest frequency of dental trauma injuries was in May (13%). Over one-third of patients with traumatic injuries to permanent teeth (n = 218, 35%) injured 2 permanent teeth. The most commonly affected teeth were the maxillary central incisors (59.3%). The most common type of trauma was concussion (20.4%). There was statistically significant difference among the type composition ratio of age groups ($P < .05$). The most common causes of dental trauma were falls (50.2%). There was statistically significant difference among the etiological composition ratio of age groups ($P < .05$). Combined injuries were present in 120 teeth in 103 patients (16.5%). The epidemiological characteristics of dental trauma in Xi'an shows that the occurrence of dental trauma is closely related to the age, sex, time, type of injury, and cause of injury. There exists cross-correlation among the epidemiological factors. The most common type of trauma is concussion and the most common cause of dental trauma is fall. High incidence of combined injuries needs extra attention.

Abbreviation: TDI = traumatic dental injury.

Keywords: dental trauma, permanent teeth, prevalence, retrospective study

1. Introduction

Traumatic dental injury (TDI) is one of the common injuries seen in the emergency department. A series of surveys in different regions of the world revealed that the prevalence of TDIs to permanent teeth ranged from 4.1 to 58.6% of patients surveyed and that the prevalence of TDIs to primary teeth ranged from 9.4% to 36.8% of patients surveyed.[1,2] In China, previous studies have reported that 4.35% of emergency visits involved TDI in Beijing[3] and that 5.18% of emergency visits involved TDI in Shanghai.[4]

According to previous studies,[5–8] TDIs can not only impact dental health but also lead to esthetic, psychological, social and therapeutic problems, reducing the quality of life of patients and their families. Serious dental trauma can cause symptoms of pulp necrosis, root resorption, ankylosis and obliteration of the pulp canal.[9]

More and more epidemiological data on TDIs are being reported from different countries. Some studies have shown that falls are the most common etiology of dental injuries[7,10,11] and that men have a higher incidence of TDI than women.[12] Numerous studies[13–15] have revealed that maxillary central incisors are the teeth that are primarily affected in both primary and permanent dentition. Most authors report that children have a higher frequency of traumatic injuries than adults. The study of the characteristics of dental trauma and its influencing factors is very important for TDI prevention. Although the distributive features of TDIs have been reported in a host of studies from around the world, however, so far there has only been little epidemiological studies of TDI in China.[3,4] So, the objective of this paper was to investigate and analyze the distributive features of several factors, such as age and gender, etiology, factors predisposing teeth to injury, types of teeth traumatized for patients in Xi'an, China.

2. Materials and methods

2.1. Data sources

The materials included patients referred to the emergency department of the School of Stomatology, Fourth Military

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The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Medical University in Xi'an, China from April 2017 to June 2019. All cases were evaluated by our experienced emergency dentists, who had received vocational training.

Our study consisted of 1475 permanent teeth in 623 patients, aged 6 to 78 years. The analyzed information about emergency TDIs included age, gender, etiology, factors predisposing teeth to injury, and types of teeth traumatized.

2.2. The groups of age

According to developmental psychology and combined with the age division criteria of World Health Organization, patients who had been included in the study were divided into the following 5 groups according to their age stage: Group 1: 6 to 12 years old; Group 2: 13 to 18 years old; Group 3: 19 to 30 years old; Group 4: 31 to 45 years old; and Group 5: >45 years old.

2.3. Classification and diagnoses

According to the standards of the International Association of Dental Traumatology Guidelines (2020),[16,17] the following types of TDIs were diagnosed and included in this study: enamel infraction; uncomplicated crown fracture (enamel-only fracture/ enamel-dentin fracture); complicated crown fracture (enamel-dentin fracture with pulp exposure); uncomplicated crown-root fracture (crown-root fracture without pulp exposure); complicated crown-root fracture (crown-root fracture with pulp exposure); root fracture; concussion; subluxation; lateral luxation; intrusive luxation; extrusive luxation; avulsion; and alveolar fracture. The tests and methods we used for diagnosing TDI mainly divided into 2 aspects: clinical examination and radiographic examination. Clinical examination includes tooth percussion, periodontal probing, tooth mobility check, and pulp vitality test. Imaging proof combined the results of radiovisiography image and cone beam computed tomography examination.

2.4. Statistical analysis

In this study, MonteCarlo method is adopted for statistical sampling of various random variables with different distributions to construct a simple and convenient statistical model. Since the important epidemiological characteristics of dental trauma, such as injury type, injury cause, and injury time, which were concerned in the present study, may be affected by age and gender, the MonteCarlo method was adopted in this study to sample various random variables with different distributions in the model according to gender, so as to improve the simulation accuracy and convergence speed. As there were incidence rates <5 in different injury type, injury cause and injury time groups according to different age, the composition ratio of the above statistical characteristics in different age groups was grouped by gender, and Fisher precision probability test was adopted to compare the proportional ratio of injury type, injury cause and injury time in different age groups. Also, Fisher precision probability test based on MonteCarlo modeling was used to analyze the proportional ratio of different damage types under different injury causes. Statistical analyses were carried out using SPSS 17 (SPSS statistical package, Chicago, IL). The level of significance was set at 0.05.

2.5. Ethical approval

This study was approved by the Institutional Review Board (IRB), School of Stomatology, Fourth Military Medical University. The study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The requirement for informed consent was waived owing to the retrospective nature of the study.

3. Results

The 623 patients comprised 397 males (63.7%) and 226 females (36.3%), with a male to female ratio of 1.8:1. As for the age distribution the injury ages ranged from 6 to 78 years, the mean age of these patients with traumatized teeth at the time of examination was 23.7 ± 14.7 years. Most patients were in the 19- to 30-year age group (30.7%), followed by the 6- to 12-year age group (30.5%). There was no significant gender difference in the all-age group ($P > .05$) (Table 1).

As to time of day for TDI, 197 patients (32%) were referred to the emergency department from 20 to 22 hours, followed by 151 patients (24%) from 18 to 20 hours (Fig.1). The distribution of dental trauma from April 2017 to June 2019 revealed that the greatest frequency for dental trauma injuries occurred in May (13%), followed by June (11%) and April (10%). The summer months of July to August and the winter months of December to January had fewer cases than in other months. There was no statistically significant difference among the seasonal composition ratio of age groups ($P > .05$) (Table 2).

By analyzing the number of teeth injured during each incident, we determined that over one-third of patients with traumatic injuries to permanent teeth (n = 218, 35%) injured 2 permanent teeth, whereas 181 (29%) patients injured 1 permanent tooth, and 118 (19%) patients injured 3 permanent teeth. Seventy-two (12%) patients injured 4 permanent teeth, and 34 (5%) patients injured >5 permanent teeth. As to the distribution of the frequencies of dental trauma with regard to tooth number, the most commonly affected teeth were the maxillary central incisors (59.3%), followed by maxillary lateral incisors (21.5%), mandibular central incisors (8.0%), and mandibular lateral incisors (5.2%). The right central incisor (n = 441, 29.9%) was affected more than the left central incisor (n = 433, 29.4%) (Fig. 2).

The distributions of types of trauma by age and gender are shown in Table 3. The most common luxation type of dental trauma was concussion (20.4%). The most common fracture type of dental trauma was complicated crown fracture (15.9%). There was statistically significant difference among the type composition ratio of age groups ($P < .05$). Figure 3 shows the different fractures to luxations ratio according to age. Along with the increase of age, the ratio of the damage of the periodontal tissue and the hard tissue decreased gradually and reached the lowest level in the 19- to 30 year-old group. Then, the ratio increased gradually and reached the highest level in the >45 year-old group.

The sources of TDIs were as follows: falls, 313 patients (50.2%); violence, 104 patients (16.7%); other, 91 patients (13.8%); traffic, 52 patients (8.4%); sports, 38 patients (6.1%);

Table 1

Distribution of traumatic dental injuries by age and gender [n (%)].

Age (yr)	Male	Female	Total
6–12	122 (64.2)	68 (35.8)	190 (100)
13–18	54 (70.1)	23 (29.9)	77 (100)
19–30	125 (65.4)	66 (34.6)	191 (100)
31–45	62 (60.8)	40 (39.2)	102 (100)
>45	34 (54.0)	29 (46.0)	63 (100)
Total	397 (63.7)	226 (36.3)	623 (100)

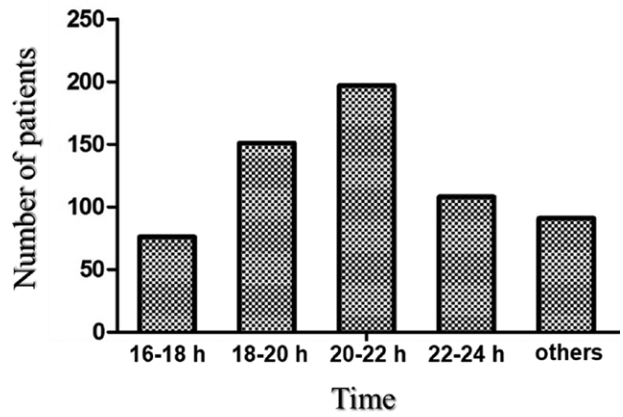

Figure 1. Number of patients with traumatic dental injuries related to time of the day.

and collisions, 25 patients (4.0%).The proportion of falls in different age groups were as follows: 69.0% (6–12), 49.4% (13–18), 41.4% (19–30), 42.1% (31–45), and 31.9% (>45). The proportion of violence in different age groups were as follows: 4.7% (6–12), 14.2% (13–18), 17.2% (19–30), 33.3% (31–45), and 27.0% (>45). The results indicated that violence and sports were more frequent causes of injury for males than for females. There was statistically significant difference among the etiological composition ratio of age groups ($P < .05$) (Table 4).

Table 5 shows the types of TDI according to etiology. The most frequent types were complicated crown fracture, concussion, uncomplicated crown fracture in falls, which is similar to the traffic. The most frequent types in violence were concussion, avulsion, and extrusive luxation. However, there was no statistically significant difference in the types of TDI caused by different causes ($P > .05$).

For 623 patients, 1475 permanent teeth were injured, and 1567 diagnoses were made. There was a single diagnosis for 1324 teeth in 520 patients (83.5%). Combined injures were present in 120 teeth in 103 patients (16.5%). One hundred seventeen teeth had 2 diagnoses, and 3 teeth had 3 diagnoses. Table 6 gives the distributions of periodontal traumatized teeth with a combination of enamel, dentin, pulp, or alveolar fractures. It shows that infarction and concussion, uncomplicated crown fracture and subluxation and concussion were most frequently accompanied injuries. Among the combining injuries, 2 teeth had a combination of uncomplicated crown fracture and root fracture, 2 teeth had a combination of uncomplicated crown fracture, extrusive luxation and alveolar fracture, and 1 tooth had a combination of complicated crown fracture, subluxation and alveolar fracture.

4. Discussion

The occurrence of dental trauma is closely related to urban residents' levels of medical care, age and gender structure distributions and habits. Therefore, the epidemiological characteristics of dental trauma have obvious geographical characteristics. There is much epidemiological data on dental trauma, but a series of characteristics, such as age, gender, etiology, factors predisposing teeth to injury, types of teeth traumatized, are still lacking research and evidence in China's northwestern region. Therefore, the results of this study can be used to enrich the database for international dental trauma and to provide a basis for the prevention and treatment of dental trauma in northwest China, which is represented by Xi'an.

This investigation found the incidence of dental trauma in males to be higher than the incidence of trauma in females, which is in agreement with many studies.[12,18–24] The reason may be that males take risks and participate in more high-risk activities than females.[8] Our male to female ratio of 1.8:1 was somewhat decreased compared with the results reported by some studies[13,25,26] which may be explained by the fact that more females currently participate in what were originally male activities. Such female participation increases their risk of injury. The peak incidence of TDIs was in the 19- to 30-year age group. Performing a comparison with earlier studies is difficult as each study has different age ranges and age groups.[27]

The occurrence of dental trauma has the obvious time characteristic. The injuries are more likely to occur in the late evenings. For children, they will play together after school to play or take part in physical exercise together; for adults, after work, people have more free time available, there are more opportunities for outdoor activities, these factors increase the risk of children and adult teeth trauma occurrence. This study also found that dental trauma mostly occurred in May in Xi'an. However, the summer months of July and August and the winter months of December and January showed less visits to the emergency department, which may be related to the climate in Xi'an as the summer months of July and August are too hot, and the winter months of December and January are too cold. This revealed an obvious seasonal variation in dental trauma, which may differ profoundly in different countries and different areas.[15,18–21,26,28] The residents chose to stay indoors instead of participating in outdoor activities and sports. The warm climate in April and

Table 2

Distributions of month of occurrence by age and gender [n (%)].

Month	Male*					Female†					Total‡				
	6–12	13–18	19–30	31–45	>45	6–12	13–18	19–30	31–45	>45	6–12	13–18	19–30	31–45	>45
Jan	9 (7.4)	4 (7.4)	5 (4.0)	3 (4.8)	1 (2.9)	5 (7.4)	1 (4.3)	5 (7.6)	3 (7.5)	4 (13.8)	14 (7.4)	5 (6.5)	10 (5.2)	6 (5.9)	5 (7.9)
Feb	9 (7.4)	1 (1.9)	6 (4.8)	4 (6.5)	3 (8.8)	3 (4.4)	5 (21.7)	9 (13.6)	4 (10.0)	2 (6.9)	12 (6.3)	6 (7.8)	15 (7.9)	8 (7.8)	5 (7.9)
Mar	5 (4.1)	4 (7.4)	13 (10.4)	4 (6.5)	3 (8.8)	10 (14.7)	1 (4.3)	4 (6.1)	7 (17.5)	2 (6.9)	15 (7.9)	5 (6.5)	17 (8.9)	11 (10.8)	5 (7.9)
Apr	14 (11.5)	5 (9.3)	13 (10.4)	9 (14.5)	3 (8.8)	5 (7.4)	2 (8.7)	6 (9.1)	3 (7.5)	3 (10.3)	19 (10.0)	7 (9.1)	19 (9.9)	12 (11.8)	6 (9.5)
May	20 (16.4)	8 (14.8)	17 (13.6)	9 (14.5)	1 (2.9)	10 (14.7)	2 (8.7)	6 (9.1)	4 (10.0)	3 (10.3)	30 (15.8)	10 (13.0)	23 (12.0)	13 (12.7)	4 (6.3)
Jun	15 (12.3)	4 (7.4)	14 (11.2)	7 (11.3)	5 (14.7)	11 (16.2)	1 (4.3)	6 (9.1)	1 (2.5)	2 (6.9)	26 (13.7)	5 (6.5)	20 (10.5)	8 (7.8)	7 (11.1)
Jul	2 (1.6)	1 (1.9)	8 (6.4)	2 (3.2)	3 (8.8)	3 (4.4)	2 (8.7)	6 (9.1)	3 (7.5)	2 (6.9)	5 (2.6)	3 (3.9)	14 (7.3)	5 (4.9)	5 (7.9)
Aug	13 (10.7)	3 (5.6)	6 (4.8)	4 (6.5)	4 (11.8)	4 (5.9)	2 (8.7)	7 (10.6)	2 (5.0)	0 (0.0)	17 (8.9)	5 (6.5)	13 (6.8)	6 (5.9)	4 (6.3)
Sep	10 (8.2)	8 (14.8)	12 (9.6)	6 (9.7)	4 (11.8)	8 (11.8)	2 (8.7)	2 (3.0)	4 (10.0)	3 (10.3)	18 (9.5)	10 (13.0)	14 (7.3)	10 (9.8)	7 (11.1)
Oct	10 (8.2)	5 (9.3)	13 (10.4)	5 (8.1)	2 (5.9)	2 (2.9)	0 (0.0)	9 (13.6)	5 (12.5)	2 (6.9)	12 (6.3)	5 (6.5)	22 (11.5)	10 (9.8)	4 (6.3)
Nov	9 (7.4)	5 (9.3)	7 (5.6)	7 (11.3)	2 (5.9)	3 (4.4)	1 (4.3)	3 (4.5)	3 (7.5)	1 (3.4)	12 (6.3)	6 (7.8)	10 (5.2)	10 (9.8)	3 (4.8)
Dec	6 (4.9)	6 (11.1)	11 (8.8)	2 (3.2)	3 (8.8)	4 (5.9)	4 (17.4)	3 (4.5)	1 (2.5)	5 (17.2)	10 (5.3)	10 (13.0)	14 (7.3)	3 (2.9)	8 (12.7)
Total	122 (100)	54 (100)	125 (100)	62 (100)	34 (100)	68 (100)	23 (100)	66 (100)	40 (100)	29 (100)	190 (100)	77 (100)	191 (100)	102 (100)	63 (100)

*$\chi^2 = 33.413$, $P = .305$, †:$\chi^2 = 44.745$, $P > .05$, ‡$\chi^2 = 34.693$, $P = .606$.

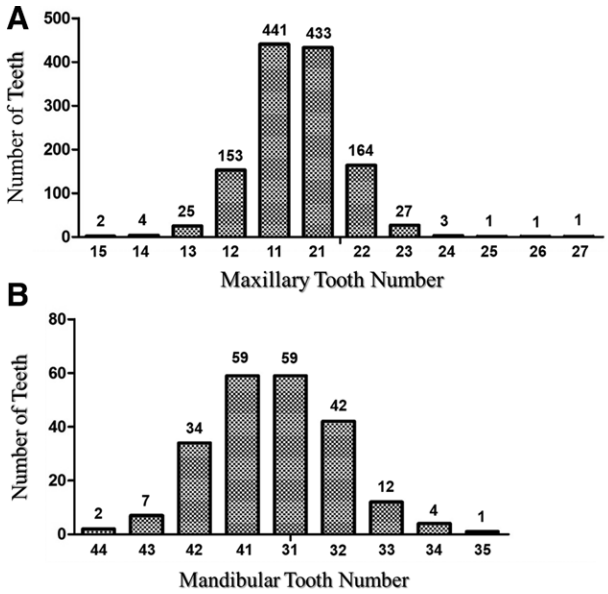

Figure 2. Number of injuries per permanent tooth: (A) Traumatized maxillary teeth. (B) Traumatized mandibular teeth.

June encouraged potential injury sufferers to engage in more activities, increasing their risk of dental trauma.

According to this study, the majority (35%) of patients with traumatic injuries had 2 damaged teeth, whereas 29% had 1 injured tooth. In addition, 19% of patients had 3 injured teeth, whereas 12% of patients had 4 injured teeth, and 5% of patients had >5 injured permanent teeth. This distribution is different than that reported in the literature.[29,30] However, this result still showed that dental trauma was always harmful to multiple adjacent teeth. It was noted that dental trauma commonly occurred in the maxillary incisors. This corroborates the findings of some previous studies.[26,31–33] One of the possible reasons for this result may be that the exposed position of the maxillary incisors in the dental arch exerted a protective effect on the mandibles during occlusion.[11,12]

Regarding causes of dental trauma, our study showed that falls were the main reason for TDIs for both genders, which was consistent with the findings of the other investigations.[13,15,21,22,25,26,28–32,34,35] Table 4 indicates that falls with age showed a downward trend, however, violence with age showed an upward trend. Because, human body coordination increased with age and social activities increased at the same time. Males participated in violence and sports than females because males are more aggressive and eager to participate in physical activity. In this study, the most common type of TDI was concussion for both genders. This result is inconsistent with those of some studies[11,15,21–23,25,26,28–32]; however, some other studies[13,36] reported the same result. This can be explained by the fact that concussion usually accompanies other types of TDIs; however, it is easy to overlook atypical symptoms. The study found these findings may be explained by the resilience of bones, the ability of periodontal ligaments to absorb energy[11,28,37] and the degrees of root and crown development. The density of the alveolar ligament and the toughness of the periodontal ligament in males are superior to those in females. More luxations such as avulsion and extrusive luxation were found in patients of younger ages because of the resilience of bones, small crowns and immature roots. With aging, fractures such as complicated crown fractures and uncomplicated crown fractures were common in permanent dentition. Fractures were more common in the falls and traffic and luxations were more common in the violence. Perhaps compared to the falls and traffic, violent injury more easily occured to the face.

One hundred twenty teeth of the 1475 traumatized permanent teeth in this study suffered combination injuries. The prevalence of combination injuries was similar to those of the small number of previous studies[36,38] that reported on the occurrence of combination injuries. A high prevalence of 31.5% for combination injuries had been reported by Lauridsen et al.[38] Crown

Table 3

Distributions of types of trauma by age and gender [n (%)].

Injury type	Male*					Female†					Total‡				
	6–12	13–18	19–30	31–45	>45	6–12	13–18	19–30	31–45	>45	6–12	13–18	19–30	31–45	>45
Enamel infraction	5 (2.6)	4 (3.6)	10 (4.5)	3 (2.7)	0 (0.0)	3 (2.4)	4 (8.2)	5 (4.2)	2 (2.9)	0 (0.0)	8 (2.5)	8 (5.0)	15 (4.4)	5 (2.8)	0 (0.0)
Uncomplicated crown fracture	29 (14.8)	12 (10.9)	21 (9.4)	7 (6.3)	1 (1.7)	15 (12.1)	7 (14.3)	14 (11.9)	11 (16.2)	4 (8.2)	44 (13.8)	19 (11.9)	35 (10.3)	18 (10.0)	5 (4.6)
Complicated crown fracture	39 (19.9)	14 (12.7)	31 (13.9)	12 (10.7)	6 (10.2)	12 (9.7)	8 (16.3)	21 (17.8)	4 (5.9)	3 (6.1)	51 (15.9)	22 (13.8)	52 (15.2)	16 (8.9)	9 (8.3)
Uncomplicated crown–root fracture	2 (1.0)	1 (0.9)	5 (2.2)	4 (3.6)	1 (1.7)	0 (0.0)	1 (2.0)	2 (1.7)	0 (0.0)	0 (0.0)	2 (0.6)	2 (1.3)	7 (2.1)	4 (2.2)	1 (0.9)
Complicated crown–root fracture	12 (6.1)	11 (10.0)	33 (14.8)	10 (8.9)	3 (5.1)	8 (6.5)	3 (6.1)	12 (10.2)	6 (8.8)	3 (6.1)	20 (6.3)	14 (8.8)	45 (13.2)	16 (8.9)	6 (5.6)
Root fracture	5 (2.6)	5 (4.5)	21 (9.4)	14 (12.5)	6 (10.2)	4 (3.2)	1 (2.0)	4 (3.4)	3 (4.4)	7 (14.3)	9 (2.8)	6 (3.8)	25 (7.3)	17 (9.4)	13 (12.0)
Concussion	33 (16.8)	22 (20.0)	34 (15.2)	19 (17.0)	13 (22.0)	12 (9.7)	8 (16.3)	15 (12.7)	11 (16.2)	9 (18.4)	45 (14.1)	30 (18.9)	49 (14.4)	30 (16.7)	22 (20.4)
Subluxation	12 (6.1)	7 (6.4)	15 (6.7)	11 (9.8)	5 (8.5)	15 (12.1)	2 (4.1)	11 (9.3)	8 (11.8)	5 (10.2)	27 (8.4)	9 (5.7)	26 (7.6)	19 (10.6)	10 (9.3)
Lateral luxation	7 (3.6)	6 (5.5)	8 (3.6)	6 (5.4)	4 (6.8)	1 (0.8)	4 (8.2)	7 (5.9)	9 (13.2)	4 (8.2)	8 (2.5)	10 (6.3)	15 (4.4)	15 (8.3)	8 (7.4)
Intrusive luxation	6 (3.1)	1 (0.9)	4 (1.8)	1 (0.9)	0 (0.0)	11 (8.9)	0 (0.0)	4 (3.4)	1 (1.5)	5 (10.2)	17 (5.3)	1 (0.6)	8 (2.3)	2 (1.1)	5 (4.6)
Extrusive luxation	22 (11.2)	16 (14.5)	20 (9.0)	9 (8.0)	3 (5.1)	17 (13.7)	6 (12.2)	11 (9.3)	4 (5.9)	5 (10.2)	39 (12.2)	22 (13.8)	31 (9.1)	13 (7.2)	8 (7.4)
Avulsion	21 (10.7)	9 (8.2)	19 (8.5)	12 (10.7)	14 (23.7)	23 (18.5)	4 (8.2)	10 (8.5)	8 (11.8)	3 (6.1)	44 (13.8)	13 (8.2)	29 (8.5)	20 (11.1)	17 (15.7)
Alveolar fracture	3 (1.5)	2 (1.8)	2 (0.9)	4 (3.6)	3 (5.1)	3 (2.4)	1 (2.0)	2 (1.7)	1 (1.5)	1 (2.0)	6 (1.9)	3 (1.9)	4 (1.2)	5 (2.8)	4 (3.7)
Total	196 (100)	110 (100)	223 (100)	112 (100)	59 (100)	124 (100)	49 (100)	118 (100)	68 (100)	49 (100)	320 (100)	159 (100)	341 (100)	180 (100)	108 (100)

*: $\chi^2 = 73.332$, $P = .006$; †: $\chi^2 = 67.159$, $P = .014$; ‡: $\chi^2 = 97.711$, $P = .000$.

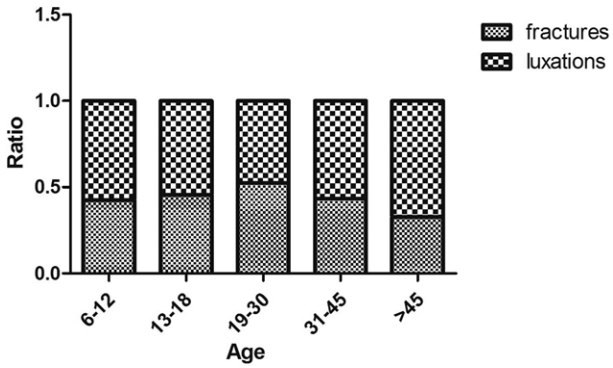

Figure 3. Ratio of fractures to luxations according to age.

fractures were more prevalent in teeth with minor luxation injuries, such as concussion and subluxation. A crown fracture will absorb the majority of the energy of the impact, thereby preventing major damage to the periodontal ligament.[38] Luxation injuries, such as avulsion and extrusion, usually occurred in combination with alveolar damage due to the energy of impact that was transferred to alveolar bone.

Certainly, the present study also has some limitations. Firstly, as a large stomatological hospital in northwest China, the patients who come to our hospital are generally complicated cases, while the simple cases basically flow to primary dental institutions. Therefore, the case samples in this study are inevitably complicated to a certain extent. Secondly, as we cannot rule out that some patients with dental trauma may not see a doctor in time due to time, economy, disputes and other reasons, this study can only represent the epidemiological characteristics of patients attending emergency dental trauma in our institution during the observation period, which can just reflect the overall characteristics of dental trauma in northwest China to some extent. The exact epidemiological characteristics of dental trauma in China still need further researches with larger sample size and wider range of investigation.

5. Conclusions

The present retrospective study show us the epidemiological characteristics of dental trauma in Xi'an, with the occurrence of dental trauma being closely related to the age, sex, time, type of injury, and cause of injury. There exists cross-correlation among the epidemiological factors. The most common type of trauma is concussion and the most common cause of dental trauma is fall. Moreover, high incidence of combined injuries needs extra attention.

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Table 4

Distributions of cause of injury by age and gender [n (%)].

Cause of injury	Male*					Female†					Total‡				
	6–12	13–18	19–30	31–45	>45	6–12	13–18	19–30	31–45	>45	6–12	13–18	19–30	31–45	>45
Falls	79 (64.7)	25 (46.3)	45 (36.0)	25 (40.3)	8 (23.5)	52 (76.5)	13 (56.5)	34 (51.5)	18 (45.0)	14 (48.3)	131 (69.0)	38 (49.4)	79 (41.4)	43 (42.1)	22 (34.9)
Violence	6 (4.9)	10 (18.5)	24 (19.2)	23 (37.1)	14 (41.2)	3 (4.5)	1 (4.3)	9 (13.6)	11 (27.5)	3 (10.3)	9 (4.7)	11 (14.2)	33 (17.2)	34 (33.3)	17 (27.0)
Traffic	4 (3.3)	3 (5.6)	14 (11.2)	4 (6.5)	4 (11.8)	2 (2.9)	4 (17.4)	10 (15.1)	5 (12.5)	2 (6.9)	6 (3.2)	7 (9.1)	24 (12.6)	9 (8.8)	6 (9.6)
Sports	10 (8.2)	4 (7.4)	17 (13.6)	1 (1.6)	0 (0.0)	2 (2.9)	2 (8.7)	2 (3.1)	0 (0.0)	0 (0.0)	12 (6.3)	6 (7.8)	19 (9.9)	1 (1.0)	0 (0.0)
Collisions	7 (5.7)	2 (3.7)	2 (1.6)	2 (3.2)	1 (2.9)	2 (2.9)	0 (0.0)	2 (3.1)	3 (7.5)	4 (13.8)	9 (4.7)	2 (2.6)	4 (2.1)	5 (5.0)	5 (7.9)
Other	16 (13.2)	10 (18.5)	23 (18.4)	7 (11.3)	7 (20.6)	7 (10.3)	3 (13.1)	9 (13.6)	3 (7.5)	6 (20.7)	23 (12.1)	13 (16.9)	32 (16.8)	10 (9.8)	13 (20.6)
Total	122 (100)	54 (100)	125 (100)	62 (100)	34 (100)	68 (100)	23 (100)	66 (100)	40 (100)	29 (100)	190 (100)	77 (100)	191 (100)	102 (100)	63 (100)

* $\chi^2 = 71.523$, $P = .000$, † $\chi^2 = 36.527$, $P = .004$, ‡ $\chi^2 = 94.958$, $P = .000$.

Table 5

The types of TDIs according to etiology [n (%)].

Injury type	Falls	Violence	Traffic	Sports	Collisions	Other
Enamel infraction	18 (3.2)	7 (3.8)	4 (3.5)	2 (2.8)	0 (0.0)	5 (3.4)
Uncomplicated crown fracture	73 (13.1)	12 (6.6)	16 (14.0)	5 (6.9)	4 (11.1)	11 (7.4)
Complicated crown fracture	85 (15.3)	16 (8.8)	13 (11.4)	8 (11.1)	5 (13.9)	23 (15.5)
Uncomplicated crown–root fracture	10 (1.8)	2 (1.1)	0 (0.0)	2 (2.8)	0 (0.0)	2 (1.4)
Complicated crown–root fracture	51 (9.2)	8 (4.4)	11 (9.6)	8 (11.1)	2 (5.6)	21 (14.2)
Root fracture	27 (4.9)	21 (11.5)	7 (6.1)	5 (6.9)	1 (2.8)	9 (6.1)
Concussion	75 (13.5)	35 (19.2)	21 (18.4)	12 (16.7)	10 (27.8)	23 (15.5)
Subluxation	45 (8.1)	17 (9.3)	6 (5.3)	10 (13.9)	3 (8.3)	10 (6.8)
Lateral luxation	26 (4.7)	8 (4.4)	6 (5.3)	1 (1.4)	3 (8.3)	12 (8.1)
Intrusive luxation	21 (3.8)	2 (1.1)	5 (4.4)	3 (4.2)	0 (0.0)	2 (1.4)
Extrusive luxation	53 (9.5)	23 (12.6)	9 (7.9)	8 (11.1)	5 (13.9)	15 (10.1)
Avulsion	62 (11.2)	27 (14.8)	13 (11.4)	5 (6.9)	3 (8.3)	13 (8.8)
Alveolar fracture	10 (1.8)	4 (2.2)	3 (2.6)	3 (4.2)	0 (0.0)	2 (1.4)
Total	556 (100)	182 (100)	114 (100)	72 (100)	36 (100)	148 (100)

TDI = traumatic dental injury.
$\chi^2 = 70.327$, $P = .104$.

Table 6

Distribution of teeth with combinations of luxations and fractures (n = 115) [n(%)].

	Enamel infraction	Uncomplicated crown fracture	Complicated crown fracture	Complicated crown–root fracture	Root fracture	Total
Concussion	12 (10.3)	24 (20.7)	4 (3.4)	0 (0)	1 (0.9)	41 (35.3)
Subluxation	8 (6.9)	15 (13.0)	7 (6.0)	1 (0.9)	3 (2.6)	34 (29.3)
Lateral luxation	3 (2.6)	3 (2.6)	0 (0)	2 (1.8)	6 (4.1)	14 (12.2)
Intrusive luxation	0 (0)	3 (2.6)	2 (1.8)	1 (0.9)	1 (0.9)	7 (6.0)
Avulsion	0 (0)	4 (3.4)	2 (1.8)	0 (0)	3 (2.6)	9 (7.8)
Extrusive luxation	0 (0)	4 (3.4)	4 (3.4)	0 (0)	3 (2.6)	11 (9.4)
Total	23 (19.8)	53 (45.7)	19 (16.4)	4 (3.4)	17 (14.7)	115 (100)

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