

RESEARCH ARTICLE

PREVALENCE AND CAUSES OF TRAUMATIC DENTAL INJURIES TO ANTERIOR TEETH AMONG PRIMARY SCHOOL CHILDREN IN SANA'A CITY, YEMEN

ABSTRACT

This study was conducted to determine the prevalence and causes of traumatic dental injuries to permanent anterior teeth among mixed dentition of schoolchildren in Sana'a City, Yemen. A cross-sectional study was conducted on 1252 schoolchildren aged 7-12 years in three districts of Sana'a city, Yemen. They numbered 700 males and 552 females from 26 randomly selected public and private schools. Clinical Examination of permanent anterior teeth was done according to the classification of Ellis modified by Fried. Prevalence of TDI was 10.30%, with a male ratio of 4.8: female 1, ($P < 0.05$). Most of the children suffered only one damage to the tooth and most of them are in the maxillary central incisors. The TDI increased with older age (10-12 years old) (16.5%) with odds ratio 4.8, $p < 0.05$). Regarding the site of trauma, most injuries occurred in males on the street (44.9%) while in females occurred at home (31.81%) and falls were the main cause of TDI. In both sexes, the most common type of injury was class I (enamel fracture) followed by class II (enamel and dentine without pulp involvement). In conclusion, the prevalence of TDI in permanent anterior teeth among mixed dentition of school children in Sana'a was high, higher in males than in females, with a peak age of 10 to 12 years, falls were the common cause, and occurred mostly on the street for boys and home for females. Accordingly, educational programs should be developed that focus on ways to prevent dental trauma and the benefits of seeking immediate treatment to maintain avulsed and fractured teeth.

KEYWORDS: : prevalence, traumatic dental injuries, TDI, permanent anterior teeth, schoolchildren, Yemen

INTRODUCTION

The child is progressively developing, mentally and physically, characterized by constant change or vigorous activity. Child searches for the ocean, trying to explore, so child's more likely to fall and be injured. Child quality of life is severely affected by her/his health, especially painful injuries that may directly affect aspects of nutrition, speech, social interaction and psychology¹. Traumatic tooth injury represents a sharp transfer of energy to the tooth and its supporting structures, resulting in a fracture and / or displacement of the tooth and the separation or crushing of the supporting tissues (gums, periodontal ligament and bone)².

Dental injuries can be caused by a direct or indirect trauma. Direct trauma occurs when the tooth itself is struck. An indirect shock occurs when the lower tooth arch is firmly closed against the upper part, for example, a blow to the chin. Direct trauma involves injuries in the anterior region, while indirect trauma prefers crown or crown root fractures in the premolar and molar regions as well as the possibility of jaw fractures in the condylar regions and symphysis³. In permanent teeth, traumatic injuries have been reported to have a prevalence rate of 4.1% to 58.6%. The large variation in reported rates can be attributed to several different factors, including study types, trauma classification, methodology, study size and population, geographical location and differences in cultural behavior⁴. Traumatic injuries are on the rise and are the third-largest cause for teeth loss after the caries and periodontal causes⁵.

There is agreement by researchers that traumatic injuries occur more often to the upper jaws than to the lower incisors and that the central incisors are more affected than the lateral incisors⁶. The most common causes of these injuries are falls, sports, biking, and traffic accidents. Factors predisposing to dental trauma can be associated with a person's anatomical features such as increased overjet, or insufficient lip covering of the upper front teeth^{7, 8}. TDI to primary teeth may eventually lead to problems with primary permanent teeth, such as hypoplasia, discolouration, delayed eruption time, and tooth malformation⁹. Delayed treatment of dental injuries in children is common in many countries. This can be attributed to various factors such as short-lived primary teeth, and the lack of attention required because the child may not show any associated signs or symptoms¹⁰. Trauma is not always predictable, but a proportion of injuries can be prevented if risk factors are understood and widespread public awareness allowing the development of necessary preventive strategies to improve planning, decision-making and intervention. Its results can help plan effective educational programmers targeting teachers, school children, and parents. Education should be widely provided to individuals who supervise and care for children and who will be near the scene of the traumatic dental injury (TDI)¹¹. There are few reports available on epidemiology of child dental injuries in developing countries, especially when compared to epidemiological data on tooth decay and periodontal disease¹².

There is a paucity of epidemiological data on the prevalence of dental trauma among schoolchildren compared to tooth decay in Yemen. There was only one published data on TDI among schoolchildren in Sanaa, conducted by Al Akwa in 2009. Therefore, this research aimed to study the prevalence and causes of traumatic dental injuries to the anterior teeth among schoolchildren in Sana'a (the Yemeni capital) because dental trauma is a public health concern in Yemen.

SUBJECTS AND LABORATORY METHODS

Study Design: A cross sectional study was conducted.

Study Area: The study was done at public and private schools in Sana'a City, which is the capital city of Yemen, located in the center of it. Sana'a consists of ten districts. We have chosen three districts, randomly selected, from the south Al-Safia District, from the north Al-Thwarh District and from the middle Old Sana'a District.

Study Population: The target population was students of both genders, aged 7-12 years, chosen from public and private primary schools that are located in the three districts.

Inclusion Criteria were all primary public and private schools located in these three districts; and students of both genders with average age of 7-12 years old. However, the exclusion criteria were non-Yemeni children, children with traumatic dental injuries in primary teeth; Children with a type of mental anomaly or systemic disease such as epilepsy patients; and / or child with anterior teeth with flurosis and caries.

Sampling Technique: The sample size was calculated using version 7 of the EPI, based on the following assumptions: 1-Reference students aged 7 to 12 years in three regions according to the Education Office, 2018 in Sana'a was 50,400. 2-Rates of traumatic dental injuries are expected at 50%. 3- Confidence limit = 3%. 4- Confidence level = 97%, so the calculated sample size was 1252.

Sampling Type: Multistage sampling method which the first Stage: from the ten districts we chosen randomly three districts from the south Al-Safia District, from the north Al-Thwarh District and from the middle Old Sana'a District. The second stage: In each district, we considered that all private and public schools are included in the study, then we randomly selected sixteen public schools and ten private schools which represent nearly 10% of total number of schools according to Education, 2018. The Third stage: In all randomly selected school, we considered that all the classes of students aged from 7 to 12 years old are included in the study. Then we randomly selected one class from each level. Finally, all the students in each class were included in the study. Selection from the selected classes was systemically random; so that we can reach the sample size target

Data Collection: Data was collected by face-to-face interviews. The Structured questionnaire was about age, gender, cause of injury, place of injury, type of injury and the tooth involved.

Methods of Examination: Before starting the study, and after it was approved by the Faculty of Dentistry in Sana'a University, ethical matters were taken into considerations. The examination was conducted with permission from the education authorities. Permission was obtained from the Office of Education and the principals of the respective schools, and after obtaining informed consent from parents of the participating children.

Clinical examination was performed using a regular oral mirror and gloves. The necessary tools and materials were packed and sterilized in sufficient quantities for each working day. Dental examination included only the teeth of the permanent upper and lower permanent incisors. The Federation Dentaire Internationale System (FDIS) was used to record the number of all accidental damaged teeth. The examined child was sitting in a straight chair and near the window to use natural daylight during the examination. Dental injuries and hard tissue fractures are classified according to the Modification of the Ellis Classification¹³ as follows:

| | |
|-----------|---|
| Class I | Simple fracture of enamel only |
| Class II | Fracture includes enamel and dentine |
| Class III | Fracture includes enamel, dentine and small pulpal exposure |
| Class IV | Fracture involves a significant amount of pulpal exposure |
| Class V | Fracture involves complete loss of tooth (avulsion) |
| Class VI | A root fracture |
| | |

DATA ANALYSIS

The data was statistically analyzed using SPSS 21. The data were presented by using tables and figures. Percentage (%) was used to describe the qualitative variables. Pearson's Chi-Square test were used to show the significance of the association between the outcomes at the level of significance less than 0.05 (P).

RESULTS

This study was conducted on 1252 schoolchildren, 700 males and 552 females. The children were divided into two age groups 7-9 and 10-12 years as shows in table (1). Trauma was found in 129 children (10.30%); 107

males (15.28%) out of 700 and 22 females (3.98%) out of 552 with ratio of approximately (male: female) of 4.8:1. There was a statically significant association between traumatic injury and gender. Males were associated OR 4.3 times (95% CI = 2.7- 7.1) more prone to traumatic dental injuries compared to females ($p < 0.001$) as illustrates in table (2). The number of traumatized teeth was 155, (103 children had a single traumatized tooth, and 26 children had multiple traumatized teeth), but there was no statistically significant difference between gender and the number of traumatized teeth as illustrates in table (3). The results revealed a significant statistical correlation between gender and location of injuries among school children. Most injuries of 129 children occurred at street (41.6%), followed by home (37.9%), school (16.3%) and then park (3.9%). Most injuries in males occurred at street (44.9%) out of 107 and in females at home (31.81%) out of 22, as shows in figure (1). The most leading cause of injury in both genders was falling (62.01%) out of 129 traumatic children. For males, falling was the leading cause (59.8%) out of 107, followed by sport (21.5% of which 23 children were involved in football accidents), then traffic (10.3%), after that violent fighting (6.5%), and finally collisions with people or inanimate objects (1.9%). For females, the chief cause was falling (72.7%) out of 22, followed by sport (18.2%), and finally collisions and traffic (4.5%). The girls did not suffer from injuries caused by violent fighting as shown in figure (2). The results presented that the tooth most affected was the upper left central incisor (44.96%), followed by upper right central incisor (37.49%), then lower left Central incisor (5.75%). Both lower right central incisor and upper right lateral incisor were (2.8%) and both lower right and left lateral incisors were (1.55) as shows in figure (3). The distribution of dental injuries according to the classification of Ellis modified by Fried showed that the most common type of injury was enamel fracture (51.6%), followed by enamel and dentine (36.1), then enamel and dentine with extensive exposure of pulp (7.1%), then fracture involving complete loss of tooth (avulsion) (2.6%), followed by enamel and dentine with early exposure of pulp (1.9%), and finally a root fracture (0.6%) and no statistical significant difference between them and gender (Table 5).

DISCUSSION

A traumatic tooth injury (TDI) is not a result of the disease but a result of certain factors that accumulate throughout life if not treated properly. Age was chosen between 7-12 years in this study, where during this period there is the maximum physiological growth and development in the life cycle of children whose activities mostly occur in the outdoor¹⁴. TDI that includes only anterior teeth may not only restrict biting, phonetics, and aesthetics but also have an impact on a child's personality and quality of life. Of the 1252 students from 7 to 12 years examined in Sana'a, 129 children (10.3%) suffer from traumatic dental injuries to the front teeth. This result was higher than other studies previously conducted among schoolchildren in Yemen, India, Iraq, and Jordan¹⁵⁻¹⁹. However, the current result almost agrees with studies in Africa, Tamilnadu and India by Govindarajan *et al.*,²⁰; Kulkarni and Raje,²¹; and Ogordi *et al.*,²². The difference in TDI prevalence is associated with many factors such as study design, sample size, sampling procedure, diagnostic criteria, limited age groups, geographical differences and study locations²³. On the other hand, many studies showed higher results than the current study (up to 58%)^{5,24}. The current study showed that out of 129 children with dental injuries, 107 (82.9%) were males and 22 (17.1%) were females at approximately 4.8: 1 (Table 2). The gender difference was statistically significant, which coincides with most previous studies^{12, 25, 26, 27}. The cause of increased trauma among boys is their participation in recreational and sports activities or because of their more aggressive nature than girls, and the rates of puberty growth in boys and girls are more mature in nature^{14,28}. However, in studies by Rajesh *et al.*,²⁹, and Ain *et al.*³⁰ there was no significant difference in TDI between male and female, and this result may be due to social changes in the study area that have led to increased participation of girls in sports, which can lead to dental injuries.

Most of the children who had dental injuries in this study had only one damaged teeth, 103 out of 155 infected teeth (Table 3), and the most affected teeth are maxillary central incisors (82.45%) (Figure 3). This result coincides with previous studies^{12,15,18,19,30-32}. Perhaps this vulnerable position relates to maxillary central incisors. In addition, these teeth are often protruded and may have insufficient lip coverage²⁴. The study showed that the prevalence of dental injuries increases with the age of 7 to 12 years. The highest exposure to dental trauma occurred in sixth grade (32.56%). The distribution of children's age groups showed that the highest prevalence of dental trauma occurred in the 10-12 age group (16.5%) out of 635, followed by the 7-9 years (3.9%) age group of 617 (Table 4). The results showed statistically significant differences between groups, consistent with other studies^{20, 33,34}. The incidence of dental injuries increases during the very active age range because of bicycle riding, skateboarding, and playground and sports accidents³⁵.

Regarding the trauma site, most TDI occurred on the street (Figure 1). For males (44.9%), this may be due to the presence of a lot of devastating holes and platforms on the streets during play time. In addition, most of the fighting between males took place on the street, causing students to fall, while for females most injuries occurred at home (31.81%) due to Yemeni society traditions that disagree with spending females outside their times as homes. Moreover, the results revealed a significant statistical correlation between sex and place of injuries

among children (Figure 1). This finding is consistent with other studies^{36,37}, whereas in other studies,^{18,21,32, 38} most of the injuries occurred at home.

In the current study, the most common cause of trauma was falls (62.01%) for both sexes (Figure 2). This result was according to many previous studies^{18, 30,31,39,40} that mentioned the particular importance of health policy makers for developing preventive strategies to reduce facial injuries or trauma. The main activities that caused the fall of children were play, cycling, running and other activities. The percentage of injuries resulting from sports activities (20.93%). This result can be explained by the fact that sports facilities are not widely available to schoolchildren in Sana'a schools. Violence was found in the current study to be the cause of dental trauma in males but not females. This is generally due to the privacy of Yemeni society. However, other previous studies, specifically Bastone *et al.*,⁴¹; and Vuković *et al.*,⁴² studies showed that accidents for adolescents were the chief cause of traumatic teeth.

Concerning the distribution of dental injuries in this study according to the classification of Ellis modified by Fried, class I (enamel fracture) as the most common type of fracture and accounted for (51.6%) of the total fractures, followed by class II fractures involving (enamel-dentine) with (36.1%) (Table 5). These results were in accordance with most of the previous studies^{16,20, 30,43}. While a few other studies have shown that the class II is the most common type of fracture^{29,32,36,40}. Total traumatized teeth were 155 as shown in (Figure 3). This result disagrees with study by Akinyamoju *et al.*,⁴⁴ because severe impacts, such as those resulting from traffic accidents, may increase the number of teeth involved with periapical lesion, which are better represented in hospital and institution-based studies⁴⁵. As the present study was conducted in schools and not in the hospitals, less severe cases involving only enamel fractures were more evident.

CONCLUSIONS

In conclusion, the prevalence of traumatic dental injuries to permanent anterior teeth among mixed dentition of schoolchildren in Sana'a City was high, higher in males than in females, falling was the common cause of trauma, followed by sports in both genders. The peak age DTI was between 10 to 12 years old, most injuries occurred at street for males and at home for females. Most of the children who experienced dental injuries had only one tooth damaged, and the most commonly affected teeth were the maxillary central incisors and Class I (enamel fracture) was the most common class.

Accordingly, educational programs need to be instituted emphasizing the ways of prevention of dental trauma and the benefits of seeking immediate treatment for conservation of avulsed and fractured teeth. Such programs should be directed at the community level as well as in the schools. Continuing educational programs about the latest technologies in the management of traumatized teeth should also be arranged for the dental and medical practitioners.

ACKNOWLEDGMENTS

Authors acknowledge the financial support of Sana'a University, Yemen.

CONFLICT OF INTEREST

"No conflict of interest associated with this work".

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Table 1: Distribution of the sample by age and gender

| Age in years | Gender | | | | | |
|--------------|--------|-------|------|-------|-------|-------|
| | Female | | Male | | Total | |
| | N | % | N | % | N | % |
| 7-9 | 272 | 49.28 | 345 | 49.29 | 617 | 49.28 |
| 10-12 | 280 | 50.72 | 355 | 50.71 | 635 | 50.72 |
| Total | 552 | 100.0 | 700 | 100.0 | 1252 | 100.0 |

Table 2: Prevalence of trauma among gender

| Gender | Traumatic cases | | | | Total | X ² | P-value | OR | CI | |
|---------------|-----------------|-------|-------|-------|-------|----------------|---------|-----|-------|-------|
| | Yes | | No | | | | | | Lower | Upper |
| | freq. | % | freq. | % | | | | | | |
| Male | 107 | 15.29 | 593 | 84.71 | 700 | 42.6 | <0.001* | 4.3 | 2.7 | 6.9 |
| Female | 22 | 3.99 | 530 | 96.01 | 552 | | | | | |

*Based on Pearson's Chi-Square test. Significant at P- value<0.05, OR: Odd Ratio, CI: Confidence Interval, Ref: Reference Value

Table 3: Association between numbers of traumatized teeth among gender

| The Tooth | Gender | | | | Total | X ² | P-value |
|-----------|--------|-------|--------|------|-------|----------------|---------|
| | Male | | Female | | | | |
| | freq. | % | freq. | % | | | |
| Single | 84 | 81.55 | 19 | 18.6 | 103 | 1.21 | 0.3* |
| Multiple | 46 | 88.5 | 6 | 11.5 | 52 | | |

*Based on Pearson's Chi-Square test.

Table 4: The distribution of TDI according to the age groups

| Age Groups | Traumatic cases | | | | Total | X ² | P-value | OR | 95% CI | |
|------------|-----------------|------|-------|------|-------|----------------|---------|-----|--------|-------|
| | Yes | | No | | | | | | Lower | Upper |
| | freq. | % | freq. | % | | | | | | |
| 7-9Y | 24 | 3.9 | 593 | 96.1 | 617 | 54.1 | <0.001* | Ref | | |
| 10-12Y | 105 | 16.5 | 530 | 83.5 | 635 | | | 4.8 | 3.1 | 7.9 |

*Based on Pearson's Chi-Square test, Significant at P- value<0.05, OR: Odd Ratio, CI: Confidence Interval, Ref: Reference Value

Table 5: Distribution of dental injuries according to the classification of Elis modified by Fried among gender

| Classes | Gender | | | | Total | X ² | P-value |
|-----------|--------|------|--------|------|-------|----------------|---------|
| | Male | | Female | | | | |
| | freq. | % | freq. | % | | | |
| Class I | 68 | 85.0 | 12 | 15.0 | 80 | 1.19 | 0.9* |
| Class II | 47 | 21.9 | 9 | 16.1 | 56 | | |
| Class III | 2 | 66.6 | 1 | 33.3 | 3 | | |
| Class IV | 9 | 81.8 | 2 | 18.2 | 11 | | |
| Class V | 3 | 75 | 1 | 25 | 4 | | |
| Class VI | 1 | 100 | 0 | 0.0 | 1 | | |

*Based on Pearson’s Chi-Square test.

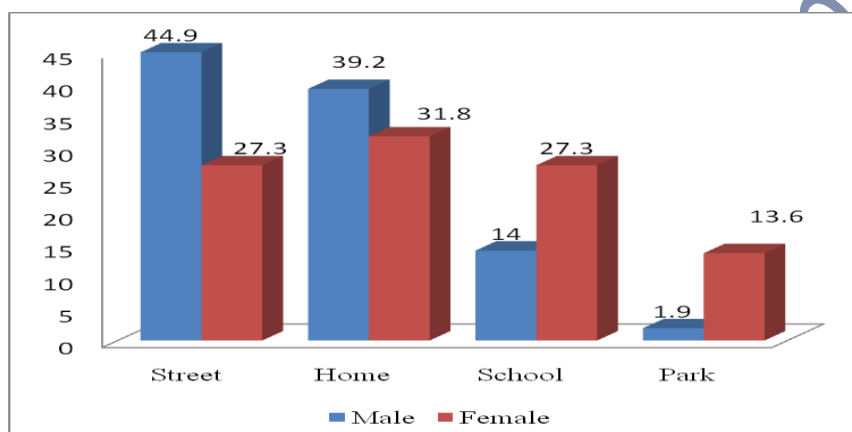


Figure (1): Distribution of trauma according to gender and location of Injuries among schoolchildren

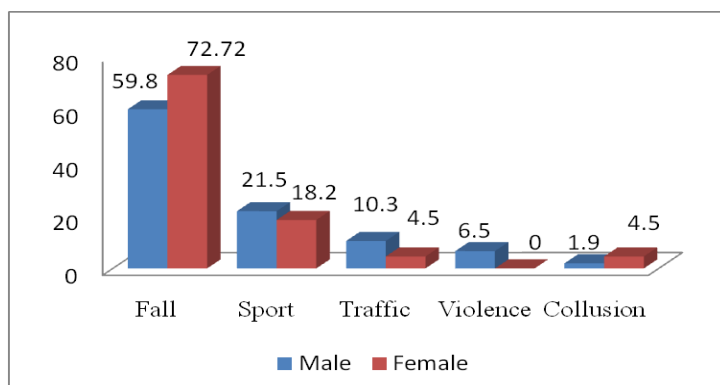


Figure (2): Bar chart showed distribution of trauma according to gender and cause of injury among schoolchildren

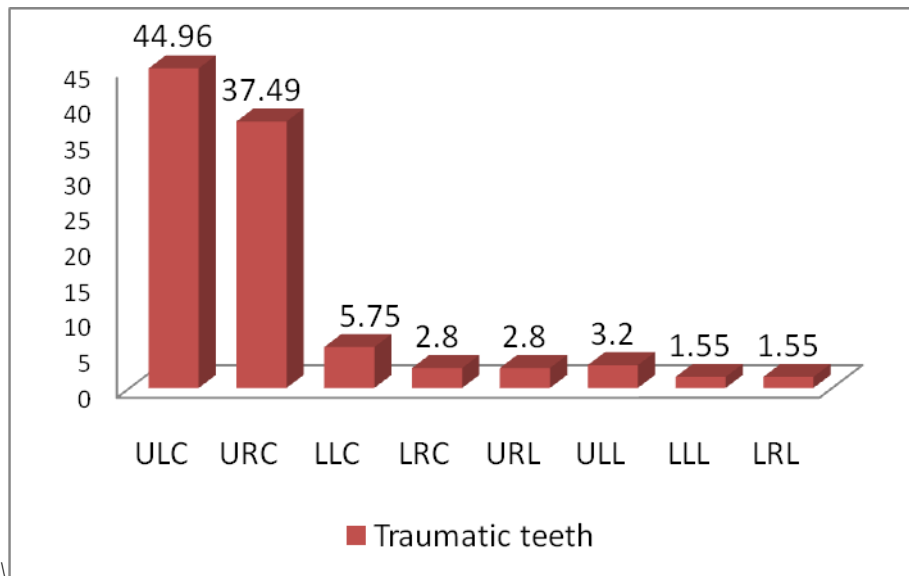


Figure 3: Distribution of trauma in relation to affected teeth among schoolchildren

ULC: Upper left central incisor, URC: Upper right central incisor, LLC: Lower left central incisor, LRC: Lower right central incisor, URL: Upper right lateral incisor, ULL: Upper left lateral incisor, LLL: Lower left lateral incisor, LRL: Lower right lateral incisor

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