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Original Article

Epidemiology of Traumatic Dental Injury Patients Attending to the Department of Conservative Dentistry and Endodontics

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Abstract

Objective: The aim of this study was to evaluate traumatic dental injuries (TDIs) and factors affecting the permanent dentition of patients with TDIs attending a dental department.

Methods: All patients with TDIs, who attended the Department of Conservative Dentistry and Endodontics, School of Dental Sciences, Chitwan Medical College, Bharatpur, Nepal, over a 5-year period from January 2014 to December 2018, were included in the study.

Results: A total of 274 TDIs patients in the age range of 14–70 years (mean 27.84 years) were included in this study. Evaluation of TDIs by age groups and gender found that the difference was not statistically significant $P = 0.243$. The most common etiology of TDIs was road traffic accidents (RTAs). The difference was not statistically significant ($P > 0.05$) on the assessment of the cause of trauma in terms of age distributions. Similarly, analysis of the frequency of the causes between the genders found no significant differences ($P > 0.05$). The most frequently observed TDIs were subluxation (18.91%) followed by uncomplicated crown fracture (18.43%). Injuries to the hard dental tissues and the pulp comprised 52.60% of injuries, whereas injuries to the periodontal tissues were seen in 47.39% of cases.

Conclusion: TDIs were found to most commonly affect the males of young age groups. RTA was the most common cause of TDIs. The maxillary central incisor was the most frequently injured teeth. Uncomplicated crown fracture was the most frequently observed TDIs. Injuries to the hard dental tissues and the pulp (fracture injuries) were more common than periodontal tissue injury. Therefore, restoration was the most frequently provided treatment.

Key words: Dental trauma, Epidemiology, Permanent teeth, Tooth injuries, Traumatic dental injuries

BACKGROUND

Traumatic dental injuries (TDIs) include injuries to the tooth and its supporting structures. TDIs can range from enamel fractures to avulsion of teeth. Dental trauma comprises about 5% of all bodily injuries with oral injuries being the sixth most commonly injured body part.[1] TDIs may be at the fifth position if it is included in the list of most frequent diseases and injuries.[2]

The incidence of TDIs has risen during the past decades, according to a study by Glendor *et al.*[3] Different studies related to TDIs have shown significant variation in the incidence and prevalence rate of TDIs (6–59%) between studies and countries due to many factors.[4-7] Although TDIs have higher prevalence and incidence rates among children and adolescents compared to adults, different studies demonstrate that nearly one-third of adults experience trauma to the permanent dentition.[7] Due to its high prevalence among young patient, TDIs are considered as a public dental health problem.[3,7,8]

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Although TDIs are more common in young age groups (children and adolescents), it affects all age groups.[9] According to Lam, around 92% of TDIs occur before the age of 34.[10] Males experience TDIs more frequently than females, ratio (1.3–2.5:1).[7,8] TDIs can happen due to daily activities and events, which make it difficult to prevent.[3,11] The etiology of TDIs varies between and within a country.[12-14] TDIs are divided into seven fracture injury types and six luxation injury types.[3] Fracture injuries are frequently observed in permanent dentition, while luxation injuries are more common in the primary dentition.[3,10,15]

TDIs are dental emergencies because they frequently present as severe and complicated injuries. Hence, they require timely diagnosis and proper management to minimize complications and for better prognosis.[16,17] Treatment of TDIs is complicated, expensive, and difficult to predict; therefore, its consequences can impact the patient for a long time.[3,18-20] As a result, treatment of TDIs tends to be neglected and low rates of treatment are observed worldwide.[2]

Clinical studies related to TDIs in adults and permanent dentition is less and most countries lack sufficient data on the epidemiology of TDIs, particularly developing countries, according to the WHO.[21] Information about the epidemiology of TDIs in Nepal is also lacking. Few studies have been done in the field of dental trauma in Nepal, leading to inadequate data.

Therefore, the aim of this study was to evaluate TDIs and factors affecting the permanent dentition of patients with TDIs.

METHODS

This cross-sectional observational study was conducted at Chitwan Medical College, School of Dental Sciences, Bharatpur, Nepal. All patients with TDIs, who were referred to or attended the Department of Conservative Dentistry and Endodontics over a 5-year period from January 2014 to December 2018, were included in the study. A total of 274 patients were included through convenience sampling with a total number of 810 traumatized permanent teeth (and total number of 1036 TDIs) were evaluated during the course of the study. The sample size was determined by considering an alpha of 0.05, a power 0.84, and effect size of 0.18. A detailed history of all the patients was taken followed by a thorough extraoral and intraoral clinical examination. All teeth were carefully evaluated for trauma. During the clinical examination, findings related to TDIs were recorded. Basic radiographic investigations were done as per the need to confirm the diagnosis and the information collected was documented. The patient's age and gender, etiology of trauma, type of trauma, type of traumatized tooth, number of traumatized teeth, and type of treatment provided were recorded from each patient. The type of TDIs was classified and recorded according to Andreasen's classification.[3] The study was carried out with the ethical approval of the Institutional Review Committee No. (Ethical Clearance No: CMC-IRC/F/075/076-117).

Statistical Analysis

Data analysis was done using descriptive and comparative statistical methods. Chi-square tests were used to compare qualitative data ($P < 0.05$). Statistical analysis was done by Statistical Package for the Social Sciences version 20 (SPSS, IBM SPSS Inc., Chicago, IL).

RESULTS

A total of 274 TDIs patients (199 males [72.62%] and 75 females [27.37%]) presenting with TDIs to the permanent teeth between January 2014 and December 2018, for a period of 5 years, were evaluated in this study. A total of 810 traumatized permanent teeth with 1036 injuries were assessed.

The age of the patients ranged from 14 to 70 years (mean 27.84 years). TDIs were most commonly observed in the 14–20: (n = 84; 30%) year-old patients followed by the 21–25: (n = 64; 23%) year-old patients. Distribution of TDIs, according to age group, did not show any significant differences (P = 0.229) in Table 1. Males were more frequently affected than females. Male:female ratio was (2.65:1). TDIs were more frequent in the age group of 14–20 for both males as well as females. About 76.19% were male and 23.80% were female in this age group. Evaluation of TDIs by age groups and gender showed that the difference was not statistically significant (P = 0.243).

The most common etiology was due to road traffic accidents (RTA) (68.97%) followed by fall (15.69%) in Table 1. Most of the RTA took place in the patient age group 14–20 years

Table 1: Distribution of TDIs according to age groups and gender

Age distribution	*n* (%)	M:F (*n*)	*P*
14–20	84 (30)	64:20	*P*=0.243
21–25	64 (23)	45:19	
26–30	44 (16)	31:13	
31–35	29 (10.5)	19:10	
36–40	16 (5.8)	14:2	
41–50	21 (7.6)	14:7	
51–60	13 (4.7)	8:5	
61–70	3 (1)	3:0	
Total	274	199:75	

Chi-square test (P<0.05). TDIs: Traumatic dental injuries

(28.04%) followed by the 21–25 years old (24.86%). The difference was not statistically significant ($P > 0.05$) between the cause of trauma and age distributions in Table 2. Similarly, analysis of the frequency of the causes between the genders found no significant differences in Table 3. RTA and fall were equally seen more frequently in males.

The most frequently observed TDIs with respect to fracture injury (injuries to the hard dental tissues and the pulp) were uncomplicated crown fracture (18.43%), followed by complicated crown fracture: (14.18%) Irrespective of gender. The distribution of types of TDIs, according to Andreasen's classification, is presented in Table 4. Injuries to the hard dental tissues and the pulp comprised 52.60% of injuries, whereas injuries to the periodontal tissues were seen in 47.39% of cases. Subluxation was the most common injury to the periodontal tissues (18.91%) followed by concussion (14.96%). TDIs included injuries to the hard dental tissues and the pulp 1.109 times more frequently than periodontal tissues.

The most commonly affected tooth was maxillary central incisors. Both the maxillary central incisors were equally affected (23.45% each) followed by the maxillary left lateral incisor (13.58%). The most frequently traumatized tooth was the maxillary left central incisor in case of fracture injury, whereas in case of periodontal tissues injury, the most affected tooth was the maxillary right central incisor. The distribution of TDIs, according to affected tooth type, is presented in Table 5. The maxillary arch (81.97%) was more frequently involved than the mandibular arch (18.02%). The average number of traumatized teeth per patient was 2.95.

A single traumatic episode was found to have injured from one to ten teeth per patient. Most patients were found to have involved two teeth (28.10%) at the time of trauma. Only 58 patients (21.16%) had trauma to a single tooth, whereas 216 patients (78.84 %) suffered trauma to more than one tooth. Similarly, analysis of the type of injuries per patient found two types of injury (33.21%) more common than a single type of injury (28.10%).

The most common treatment provided was a restoration in 238 teeth (39.33%) followed by root canal treatment in 186 teeth (30.74%) in Table 6. No statistically significant differences ($P > 0.05$) were found between the treatments done on the traumatized teeth.

Table 2: Distribution of TDIs according to age groups and etiology of trauma

Age distribution	*n* (%)	RTA:Fall:Assault:Impact:Sports	*P*
14–20	84 (30)	53:13:7:6:5	*P*>0.05
21–25	64 (23)	47:10:5:2:0	
26–30	44 (16)	31:6:3:3:1	
31–35	29 (10.5)	21:5:2:1:0	
36–40	16 (5.8)	11:3:2:0:0	
41–50	21 (7.6)	13:4:1:3:0	
51–60	13 (4.7)	11:2:0:0:0	
61–70	3 (1)	2:0:0:1:0	
Total	274	189:43:18:18:6	

RTA: Road traffic accidents, Chi-square test *P*<0.05. TDIs: Traumatic dental injuries

Table 3:Distribution of TDIs according to gender and etiology of trauma

Gender distribution M:F (*n*)	*n* (%)	RTA:Fall:Assault: Impact:Sports	*P*
64:20	84 (30)	53:13:7:6:5	*P*>0.05
45:19	64 (23)	47:10:5:2:0	
31:13	44 (16)	31:6:3:3:1	
19:10	29 (10.5)	21:5:2:1:0	
14:2	16 (5.8)	11:3:2:0:0	
14:7	21 (7.6)	13:4:1:3:0	
8:5	13 (4.7)	11:2:0:0:0	
3:0	3 (1)	2:0:0:1:0	
Total 199:75	274	189:43:18:18:6	

RTA: Road traffic accidents, Chi-square test *P*<0.05. TDIs: Traumatic dental injuries

DISCUSSION

TDIs are a public dental health problem worldwide with many people having an experience of it. Despite this, TDIs are a neglected condition worldwide.[2,22] Although population-based studies provide more epidemiological evidence compared to clinic- and hospital-based studies, they lack in evidence of causes and effects, discussion about treatment procedures, and classification of TDIs.[11,23,24]

Although TDIs occur in all age groups, it is more frequently seen in children and teenagers, which supports age as a

Table 4: Distribution of TDIs according to the type of injury

Type of TDIs	
Injuries to the hard dental tissues and the pulp	***n***
Enamel infarction	51
Enamel fracture	61
Enamel dentin fracture	191
Complicated crown fracture	147
Uncomplicated crown-root fracture	6
Complicated crown-root fracture	38
Root fracture	51
Total fracture injuries	545
Injuries to the periodontal tissues	***n***
Concussion	155
Subluxation	196
Extrusive luxation	41
Lateral luxation	28
Intrusive luxation	9
Avulsion	65
Total luxation injuries	491
Total no. of injuries	1036

TDIs: Traumatic dental injuries

Table 5: Distribution of TDIs according to affected tooth type

Incisors: (693)	11=190	12=90	21=190	22=110	31=31	32=25	41=32	42=25
Canines: (57)	13=19	23=28	33=4	43=6				
Premolars:(42)	15=7	14=11	24=6	25=4	34=3	35= 4	44=4	45=3
Molars: (18)	17=1	16=3	26= 4	27=1	36=4	37=1	46=3	47=1

TDIs: Traumatic dental injuries

Table 6: Distribution of type of treatments provided

Treatment provided: 605 teeth			
Type of treatment	**Patients (No)**	**Tooth (No)**	**(p)**
Root canal treatment	109	186	*P*=0.220
Restoration	137	238	
Splinting	47	76	
Direct pulp capping	42	47	
Repositioning and splinting	35	57	
Reimplantation	1	1	
Follow-up and monitoring only	20	84	

Chi-square test (*P*<0.05)

risk factor for TDIs.[6,9] Most of the TDIs happen before 30 years of age.[10,25,26] The mean age in our study was 27 years, which validates the same. This finding is in agreement with studies which state the third decade as the most frequent age group for TDIs.[10,25] The most commonly affected age group was 14–20 (30%) year-old patients followed by the 21–25: (23%) year-old patients. About 30% of patients belonged to the age group 14–20 years and 69% of patients were below age 30, which agree with studies showing a higher percentage of TDIs in the younger population. However, the difference observed in the distribution of TDI according to age group was not statistically significant. Analysis of the age group also found a decrease in the frequency of TDIs as age increased.

Higher rate of TDIs in adolescents and young adults could be due to their lifestyle and risk-taking behavior, making them more susceptible to TDIs. The most commonly affected age group in RTA in Nepal is 20–40 years.[27,28] Since RTA was found to be the main etiology of TDIs, the findings are expected.

Gender is also considered a risk factor for TDIs. Experience of TDIs among males has been found to be twice as often as females (male-to-female ratios ranging from 1.3 to 2.78:1) in permanent dentition.[8] This has been associated with the involvement of more males in sports and physical activities and also due to their way of living and tendency of taking risks. Nevertheless, these days gender differences in TDIs are decreasing and individual activities of the person are considered to have a more important part in TDIs than gender or age.[6]

Males (72.62%) experienced a significantly higher incidence of TDIs compared to females (27.62%). The male:female ratio was (2.65:1), which reveals that females were less affected and exposed to TDIs than males.

Males are also more exposed to TDIs risk factors due to outdoor activities such as RTA, risky work, and sports, which make them more prone to TDIs. The results approve that gender is still one of the predisposing and risk factor for TDIs. A higher incidence of RTA among males in Nepal also explains the findings.[27,28]

Etiologies of TDIs vary between and within countries among studies due to many factors.[5,12,13,14] However, the most common cause of TDIs in developed countries is sports or falls, whereas in developing and underdeveloped countries, RTA is more common.[5]

The etiologies of TDIs agree with other studies conducted in the region. The main causes of TDIs were RTA (68.97%) followed by fall (15.69%), which again may be due to the high rate of RTA, in Nepal.[27,28] Very few cases of TDIs were related to sports injury (2.18%), which correlates with the studies conducted in the region. Sports-related injuries are a common cause of TDIs in developed countries, where many young people participate in sports activities due to the availability of good sports facilities. Studies from developing countries have very few numbers of TDIs related to sports injury.

Etiology of TDIs is very much related to the age of the patient as it varies according to age group. RTA is the most common cause of TDIs in adults, whereas fall injury is more commonly observed in children.[5,12,29] However, RTA was found to be the main cause of TDIs in all the age groups analyzed, which disagrees that etiology of TDIs varies with the age group. Evaluation of age groups with respect to etiology did not find any variation. This could be due to the high rate of RTA in Nepal.[27,28] The results are similar to studies from underdeveloped countries where RTA is very common.

The classification of TDIs used is based on the criteria proposed by Glendor *et al.*[3] Uncomplicated crown fracture without pulp exposure is the most common type of TDIs found in permanent dentition.[30]

A total of 1036 injuries were seen in 274 patients. Uncomplicated crown fracture: (Fracture of enamel and

dentine, without the involvement of the pulpal chamber) (18.43%) was the most frequently seen type of fracture injury (injuries to the hard dental tissues and the pulp) followed by complicated crown fracture: (14.18%) (Fracture of enamel and dentine, with the involvement of the pulp), among both the genders. The ratio of the most common TDIs (uncomplicated crown fracture) in our study was (29.24%), which agrees with the international literature, where it is ranged between 20.2% and 51.6%.[9,10,29,31] Similarly, the percentage of complicated crown fracture (fracture of enamel and dentine, with the involvement of the pulp) was 26.97%, which is near to the rate described by Glendor *et al.* (26–76%).[3] Complicated cases of TDIs are generally seen more in studies done in a hospital set-up.

Luxation injuries are more common TDIs in primary dentition, whereas fracture injuries are frequently seen in permanent dentition.[32,33] Subluxation was the most frequent periodontal injury type (injuries to the periodontal tissues) (18.91%) followed by concussion (14.96%). However, some studies show a very low prevalence of concussions or subluxations.[29] Avulsion injury in permanent teeth is observed in 0.5–3% of all TDIs.[34,35] However, it was slightly higher (6.27%). This could be because the majority of TDIs cases were due to RTA and also due to the study being conducted in a hospital set-up. Intrusive luxation was the least common type of injury.

The range of luxation injuries varies between 15% and 61% in permanent dentition, according to Glendor *et al.*[3,10] The rate of luxation injuries in this study was 47.39%. Fracture injuries (injuries to the hard dental tissues and the pulp) were more common than luxation injuries (injuries to the periodontal tissues) (52.60% vs. 47.39%). Similarly, fracture injuries were involved 1.109 times more frequently than luxation injuries. Likewise, two types of injury (33.21%) per patient were more common than a single type of injury (28.10%).

Maxillary teeth are more commonly involved than mandibular teeth in TDIs.[11,12] Likewise, the maxillary central and lateral incisors are the most commonly injured teeth.[6,11] Maxillary central incisor was the most commonly traumatized tooth with both central incisors being equally affected (23.45%), followed by the maxillary left lateral incisor (13.58%) which is similar to other studies in the literature.[6,7,9,19,36,37] In cases of fracture injury, the most commonly injured tooth was the maxillary left central incisor (24.40%), whereas in cases of luxation injury, the maxillary right central incisor (27.12%) was the most affected tooth. The prominent and vulnerable positioning, inadequate lip coverage, exposed nature, and frequent protrusion of the maxillary teeth are responsible for their frequent involvement in TDIs.[38] The teeth on the left side were more frequently injured than the right side. Similarly, maxillary teeth were commonly traumatized than mandibular teeth.

More than one tooth was injured in a single episode of TDIs in the majority (78.84%) of patients, which agrees with studies demonstrating injury of multiple teeth more common than a single tooth.[39] About 21.16% of patients had an injury to a single tooth, whereas 28.10% of patients had an injury to two teeth. Two patients presented with involvement of ten teeth. The average number of traumatized teeth per patient was 2.95.

The number of injured teeth is determined by many factors and varies according to the etiology and extent of the injury. Most studies show that TDIs frequently involve multiple teeth, especially in cases of severe injury such as RTA and violence which increase the number of injured teeth.[3,5,11,29,36] Since RTA was the most common etiology of TDIs in the majority of the cases, injury to multiple teeth was frequently seen. Injuries to multiple teeth are also found more frequently in hospital-based studies.

There are different types of TDIs and each type has its own treatment protocols.[40] However, various studies support that treatment of TDI is often neglected and treatment needs of TDIs are not adequately met in both developing as well as developed countries.[2] Patients tend to come for treatment only when symptoms begin due to a lack of awareness of the treatment of TDIs and its long-term consequences.[11,19] Immediate treatment can provide a better prognosis for injured teeth. Even simple crown fractures can lead to pulp necrosis due to late treatment.[41,42] Therefore, it is essential to provide urgent and correct treatment to maximize the favorable outcome of TDIs.[16,17] Delayed treatment frequently results in unfavorable prognosis.[31,43]

The most frequent treatment provided was restoration (39.33%) which could be due to the fact that the majority of patients had uncomplicated crown fracture which required restorative treatment, followed by root canal treatment (30.74%). This may be due to many of the injuries being a complicated crown fracture. In addition, combination injuries (fracture injuries along with luxation injuries or vice versa) increase the chance of pulp necrosis.[44-46] Splinting was provided to the teeth with periodontal tissue injury with increased mobility. Repositioning and splinting were done in extrusion, intrusion, and lateral luxation injury. Direct pulp capping was performed in patients who reported early for treatment and in young patients. An avulsion is considered a serious injury and the prognosis depends on prompt management.[34,35] However, almost all patients with avulsion injury reported for treatment with already

lost avulsed tooth which may be due to lack of knowledge and awareness of treatment of avulsed tooth. Therefore, reimplantation could be done in a single case only. Follow-up and monitoring are very important in the management of TDIs. All teeth with TDIs must be kept on long-term follow-up according to the guidelines.[47] Therefore, patients with complicated injury and luxation injures were advised for regular follow-up visits and long-term monitoring.

TDIs related findings have significant differences due to variations in study methodology, experimental design, trauma classification, dentition studied, demographics, and geographical location.[4] Very few studies have similarities; therefore, a comparison between them is difficult and should be done judiciously.[48] Despite the lack of studies for comparison, the results of this study correlate with studies related to TDIs in the region.

This study is important due to the shortage of data on TDIs in the permanent dentition of the Nepalese population. One of the limitations of this study is the lack of follow-up of TDIs patients. However, it provides information about the frequency of TDIs in the area. Studies based on clinical outcomes, complications, efficacy of treatment protocols, and the long-time prognosis can be conducted with the help of follow-up of TDIs patients in future. Such prospective studies can significantly help to evaluate the effectiveness of treatment procedures and long-term complications. They can also facilitate a better understanding of the effects of TDIs, treatment plans, and prognosis.

TDIs are a well-known global public dental health problem.[8] An increase in the prevalence of TDIs has been predicted. TDIs happen in normal life situations, which make it basically inevitable. However, efforts for the prevention of TDIs and the benefits of early treatment cannot be ignored. Similarly, the role of correct and timely management of TDIs in the prevention and reduction of complications, costs, and time cannot be underestimated.[43]

CONCLUSION

RTA was the most common cause of TDIs followed by fall. TDIs were found to most commonly affect the males of young age groups. This may be for the reason that RTA was the most common cause of TDIs seen in young age groups. The maxillary central incisor was the most frequently injured teeth. The uncomplicated crown fracture was the most frequently observed TDIs. Injuries to the hard dental tissues and the pulp (fracture injuries) were more common than periodontal tissue injury. Therefore, restoration was the most frequently provided treatment.

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