Pattern of Traumatic Dental Injuries and associated Risk Factors: A Hospital-based Study

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ABSTRACT

Introduction: Study of traumatic dental injuries (TDI);a common dental emergencycan facilitate planning of preventive measures, better assessment and carry out treatment effectively.

Objective: To determine the gender and age difference in TDIs, etiology, intra-oral soft-tissue and bony injuries, types of tooth fractures and luxation injuries. Also to find out the association between the type of TDI and malocclusion, overjet and lip competency.

Materials & Method: This cross-sectional study comprised of 121 patients with the history of TDI. Thorough history and clinical examination was done and data were statistically analyzed (confidence interval of 95% and statistical significance set at $p \leq 0.05$).

Result: Males were more prone to injuries with a male-to-female ratio of 1.5:1. Fall and road traffic accidents were the most common cause of injuries and males were more prone to injuries due to fall ($p=0.047$). The main etiologies of TDIs were fall and RTA in children and adults respectively. Children had more luxation injuries, while adults had more tooth fractures.

Permanent maxillary central incisors were most common to sustain tooth fracture and enamel-dentin fracture were the most common types of injuries.

No statistically significant association was found between overjet and tooth fractures ($p=0.19$), luxation injuries ($p=0.24$), soft-tissue injuries and bony injuries ($p=0.42$). Similarly, no significant association was found between lip competency and dental injuries.

Conclusion: Cohort studies must be conducted to associate risk factors and TDIs.

Keywords: dental trauma, overjet, pattern

INTRODUCTION

The common reasons for dental emergencies are dental trauma (66%), followed by dental infections, oral bleeding and temporomandibular joint disorders.[1] The incidence of dental trauma has increased during the last 10-20 years and it has been suggested that it will soon exceed that of dental caries and periodontal disease.[2]

Traumatic force to the teeth or periodontium can cause destruction in a variety of directions and of a variety of magnitudes.[3] Traumatic injuries are classified into various fractures and luxation types, but combination injuries often occur.[3] Furthermore, these injuries are usually associated with other types of maxillofacial injuries and soft tissue injuries. These injuries may affect quality of life (QoL), psychological problem, pain, loss of function, speech, esthetics and may lead to pulpal necrosis and periapical pathosis.

To prevent traumatic dental injuries (TDIs) and their lifelong consequences; recommendations should be provided for prevention and improvement on quality of life (QoL). For minimizing its sequelae, it would be useful to investigate the pattern of TDIs and risk factors.[4]

The objectives of this study was to determine the pattern of TDIs, to assess age and gender difference, etiology, pattern of intra-oral soft tissue and bony injuries, the type and number of teeth injured, the types of tooth fractures and luxation injuries. Also,to find the association between the TDIs andAngle's classification of malocclusion, overjet and lip competency.

MATERIALS AND METHOD

This cross-sectional study was conducted in the Dental Department of Dhulikhel Hospital, Kavre from March 2015 to June 2016. This study was approved by the Institutional Review Committee of Kathmandu University School of Medical Sciences. A total of 121 patients with the history of traumatic dental injuries were included in the study which comprised of 153 tooth fractures and 112 luxation injuries. Patients who sustained traumatic dental injuries during the earth quake of April, 2015 were excluded from the study to avoid any bias. After obtaining the written consent from patient or guardian; history was taken and clinical examination was done under dental operating light. The type of soft tissue injury, bony injury, tooth fracture and luxation injury was classified according to Andreason.[2] Overjet was measured using a graduated periodontal probe. Clinical photographs and radiographs were taken wherever necessary. All demographic and clinical findings were entered in a proforma.

Collected data were entered in SPSS Version 20.0. Descriptive statistical analysis and Chi-square test was done at confidence interval of 95% at the level of significance set at $p \leq 0.05$.

RESULT

A total of 121 patients with 265 traumatized teeth were assessed. It was found that, males (n=74) were more prone to injuries than females (n=47) with the male-to-female ratio of 1.5:1. Fall and road traffic accidents (RTA) were the most common causes of injuries. In RTA cases, females were more prone for TDI than males (p=0.047) (Table 1). Males and females were almost equally prone to tooth fracture with 59.5% and 61.7% of occurrence respectively. Females (63.8%) were more likely to sustain luxation injuries than males (45.9%), however, it was statistically insignificant (p=0.055).

Table 2 shows distribution of age group and pattern of injury. The main etiology of TDIs were fall and RTA in children and adults respectively (p<0.01). Table 3 shows distribution of tooth fractures, luxation injury and soft-bony injuries in different age groups. Statistical difference was seen in occurrence of tooth fracture and age group (p<0.01). Among those patients, most common type of injuries were soft tissue injury (43.8%), bony injury (10.7%) and combination injury (3.3%).

Permanent maxillary central incisors (MCI) (n=83, 54.24%) were the most common teeth to sustain tooth fracture, followed by permanent maxillary lateral incisors (MLI) (n=26, 16.9%). Similarly, permanent MCI (n=38, 33.92%) were most common to have luxation injury followed by deciduous MCI (n=29, 25%). Out of 147 permanent teeth with tooth fractures, 22 (14.9%) were posterior teeth. Table 2 shows the distribution of type of tooth fractures and luxation injuries. Table 4 shows the distribution of tooth fractures in permanent and deciduous teeth. Enamel-dentin fracture was the most common in permanent dentition. Concussion and subluxation were the most common types of injuries in permanent and deciduous dentition respectively.

Compared to patients who had trauma with Class I (69%) and mesial shift (28%) occlusion, patients with Class II (83%) and Class III (100%) were more prone to sustain tooth fractures. No statistically significant association was found between overjet and tooth

Table 1. Etiological factors of TDI

Etiology	Gender		Total	*p*-Value
	Male	Female		
Fall	34 (28.1%)	19 (15.7%)	53 (43.8%)	0.47
Road traffic accident	28 (23.1%)	23 (19%)	51 (42.1%)	
Sports	10 (8.3%)	1 (0.8%)	11 (9.1%)	
Assault	2 (1.7%)	4 (3.3%)	6 (5%)	
Total	74 (61.2%)	47 (38.8%)	121 (100%)	

Table 2. Pattern of injury and age group

Age	Mechanism of tooth injury					*p*-Value
	Fall	RTA	Sports	Assault	Total	
Children	31 (25.6%)	0(0%)	3 (2.5%)	1(0.8%)	35 (28.9%)	0.01*
Adolescent	8 (6.6%)	10 (8.3%)	6 (5.0%)	2(1.7%)	26 (21.5%)	
Adult	14 (11.6%)	41 (33.9%)	2 (1.7%)	3(2.5%)	60 (49.6.5)	
Total	53 (43.8%)	51 (42.1%)	11 (9.1%)	6(5.0%)	121 (100%)	

**Statistically significant at p<0.05*

Table 3.Ooccurrence of TDIs with age group

Age	Tooth fracture		Luxation injury		Soft Tissue/Bony injury			
	None	Present	None	Present	None	Soft	Bony	Both
Children	28	7	11	24	12	19	2	2
Adolescent	8	18	15	11	12	13	1	0
Adult	12	48	31	29	27	21	10	2
Total	48	73	57	64	51	53	13	4
p-Value	0.01*		0.77		0.15			

Table 4. Occurrence of tooth fractures and luxation injuries in permanent and deciduous teeth

Diagnosis	Permanent		Deciduous		Total
	Anterior	Posterior	Anterior	Posterior	
Fractures					
Infarction	12	0	0	0	12 (7.8%)
Enamel	16	3	1	0	17 (11.11%)
Enamel-dentin	51	15	2	0	68 (44.44%)
Enamel-dentin-pulp	11	2	1	0	14 (9.1%)
Crown-root	5	1	2	0	8 (5.2%)
Crown-root-pulp	15	1	0	0	16 (10.4%)
Cervical root	4	0	0	0	4 (2.6%)
Middle root	7	0	0	0	7 (4.57%)
Apical root	7	0	0	0	7 (4.57%)
Total	125	22	6	0	153 (100%)
Luxation					
Concussion	18	0	2	0	20 (17.85%)
Subluxation	17	0	14	0	31 (27.67%)
Lateral luxation	14	0	10	0	24 (21.42%)
Intrusion	1	0	7	0	8 (7.14%)
Extrusion	1	0	6	0	7 (6.25%)
Avulsion	17	0	5	0	22 (19.64%)
Total	68	0	44	0	112 (100%)

Table 5. Occurrence of TDIs with respect to overjet

Overjet	Tooth fracture		Luxation injury		Soft Tissue/Bony injury			
	None	Present	None	Present	None	Soft	Bony	Both
≤3mm	39	55	46	48	41	41	9	3
>3mm	3	12	8	7	8	5	2	0
NA*	6	6	3	9	2	7	2	1
Total	48	73	57	64	51	53	13	4
p-Value	0.19		0.24		0.42			

**NA: Not applicable- could not be assessed because of missing, extruded, intruded or avulsed anterior teeth*

fractures (p=0.19), luxation injuries (p=0.24), soft tissue injuries and bony injuries (p=0.42). However in patients having more than 3mm overjet; the occurrence of tooth fracture was higher. Similarly, there was no significant difference in association between lip competency and TDI (Table 5).

DISCUSSION

The present study showed that males had greater risk for TDIs, which is in agreement with other studies.[4-11] Higher prevalence in males can be attributed to their active involvement in sports, outdoor activities and violent

behavior. Among various causes, fall and RTA were more common as found in other studies.[4-11] Females were more prone to TDIs because of RTA and most of them sustained luxation injuries compared to male counterparts. Adhikari *et al*. showed that, females sustained TDIs owing to falls and males due to RTA.[11]

Children were more prone to injuries due to fall and adults to RTA. Children during the development of milestones learnto walk and involve actively in sports; are prone to fall and adults generally involve in outdoor activities could the reasons for these occurrences. The adults sustained more tooth injuries than children, which was statistically significant ($p<0.01$), and children had more luxation injuries. It could be due to higher elasticity of the bone in children that has the ability to absorb more energy of impact favoring luxation injuries. Secondly, smaller crown and roots favor dislocation rather than fractures.[12]

Soft tissue injuries are usually not recorded in other studies and this study has shown that 43.8% and 10.7% had soft tissue and bony injuries respectively. Though Ekanayake's[8] study showed lower prevalence of 14%, Skaricic *et al*[13] and Vuletic *et al*[14] has shown higher prevalence of soft tissue injuries (45.4%and 55.5.% respectively) in children. Therefore, these parameters must be given equal importance in TDIs. Previous studies done in Nepal and outside have shown that MCI followed by MLI in both permanent and deciduous dentition are the most commonly affected tooth by TDIs.[10,11] This is because of the position and protrusion of the maxillary incisors in the oral cavity, they are more prone to TDIs and this study has shown that mostly permanent and deciduous MCI and MLI sustained tooth fractures and luxation injuries. Previous studies have shown the pattern on injuries in anterior teeth only. Here, 14.9% of the total fractured permanent teeth were posteriors, which are often overlooked. More studies must be conducted to assess the prevalence of injury in posterior teeth as well. In this study, it was observed that enamel-dentin fracture and subluxation were the most common type of TDIs. The result resembled other studies done in Brazil, Denmark, Turkey and Nigeria.[6,7,15,16] In context to Nepal, incidence of complicated tooth fractures and avulsions were more.[10,11] Minor injuries, though common, maybe underrated because patients with minimal complaint may not report to the hospital or may go unnoticed.

A systematic review of Nguyen *et al* concluded that children with overjet more than 3mm are approximately two times at greater risk of TDIs in anterior teeth.[17] Similarly, a meta-analysis concluded that large overjet may double or triple the risk for TDI to anterior teeth.[18] A study concluded that an increased overjet and anterior openbite is associated with TDIs only when inadequate lip coverage is also present because lips can partly absorb the impact of trauma.[19] Koroluk *et al* suggested that orthodontic intervention aimed at reducing trauma should begin early, though the injuries tended to be minor, and the expected treatment cost of traumatized incisor was small compared to expected additional cost of orthodontic intervention.[20] In our study, there was no significant difference in the occurrence of tooth fractures and luxation injuries in the groups with overjet ≤3 mm and overjet >3 mm, though there was higher incidence of tooth fractures in second group. Likewise, there was no significant difference in occurrence of TDIs in patients with competent and incompetent lips.

Our study showed that Angle's Class II, Class III showed higher incidence of TDIs. In India, maximum TDIs were seen in children having Angle Class II Div 1 molar relationship and/or overjet greater than 5.5 mm.[21] Kramer *et al* demonstrated that more than twofold greater probability of TDI among adolescents with an abnormal molar relationship and the effect remained even after controlling the overjet, demonstrating an independent effect of this malocclusion in the antero-posterior direction.[22] Therefore, rather than cross-sectional studies, longitudinal study is essential to observe the effect of orthodontic treatment on reducing risk of TDIs.

Due to the cross-sectional nature of this study, temporal relationship of the cause and effect could not be shown. The results of this study must be interpreted within the limitations of this study and further cohort studies including larger samples must be done. Such study should include other associated parameters like environmental factors, human behavior, illness (epilepsy, cerebral palsy), physical limitations, learning difficulties, abuse, etc. Additionally, it is necessary to assess treatment seeking behavior, treatment needs, financial burden and QoL in patients with TDIs.

CONCLUSION

TDIs are common in males and falls and RTA being common cause. Children are prone to sustain luxation injuries due to fall, while adults show more tooth fractures due to RTA. Enamel-dentin fractures and subluxation injuries are common and MCI are most frequently affected. Trauma to soft tissue and posterior teeth are common and must not be overlooked. Though no association is observed between occurrence of TDIs and malocclusion, overjet and lip competency, higher incidence are seen in patients with Class II and overjet >3mm.

OJN

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