

An Appraisal of the Prevalence and Attributes of Traumatic Dental Injuries in the Permanent Anterior Teeth among 7–14-Year-Old School Children of North East Delhi

Abstract

Aims: The aim of this study was to assess the prevalence, associated risk factors, characteristics, and pattern of traumatic dental injuries (TDIs) in the permanent anterior teeth among school children of North East Delhi area. **Settings and Design:** A cross-sectional study was done in 3000 school-going children aged 7–14 years. **Materials and Methods:** A detailed case history and clinical examination were performed on the entire sample population. TDIs were recorded according to Andreasen's epidemiological classification of TDIs including World Health Organization codes. **Statistical Analysis Used:** For finding the independent association of the significant variables with outcome, multivariable logistic regression analysis was used. **Results:** A prevalence of 10.7% was observed in the sample being studied. Dental trauma was significantly ($P < 0.05$) associated with male gender, and high statistical significance ($P < 0.001$) was noted with age, participation in sports, lip seal, and overjet. Fall of the child while playing by himself/herself was the most common cause; afternoon and schools were the most common time and place of occurrence of TDIs, respectively. Single tooth enamel fractures in the left maxillary central incisors were most commonly seen. Adhesive restorations were the most frequent form of treatment required. **Conclusions:** Organizing studies addressing the prevention and treatment needs of TDIs and educational programs aimed toward parents and school teachers are of paramount importance. Furthermore, recognizing the tremendous treatment negligence is extremely critical to adequately analyze indifference of the people toward dental trauma and its consequences.

Keywords: *Characteristics, permanent anterior teeth, prevalence, risk factors, traumatic dental injuries*

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Introduction

Oral health is an integral part of general health. Of all patients seeking consultation or treatment for injuries to the oral region, dental injuries are the most common and are seen in as many as 92% of patients presenting with oral injuries.^[1] Traumatic dental injuries (TDIs) encompass injury to teeth or the oral cavity caused by an external impact on the teeth and surrounding tissues. TDIs are known to occur suddenly, circumstantially, and most often require urgent care.^[2]

A “smile” is an inimitable asset that adds tremendously to one's personal self-esteem and social acceptance. TDIs involving the anterior teeth lead to restriction in biting, phonetics, aesthetics and are further complicated by the enormous cost involved in their correction.

Review of recent population-based studies report that the prevalence of TDIs to permanent anterior teeth is high worldwide ranging from 4.1% to 58.6%.^[3] In fact, epidemiological studies reveal that the incidence of TDIs among children will soon exceed that of caries and periodontal disease.^[4] Consequently, TDIs have become a serious public health problem in children.

Thus, a detailed study about TDIs, not only its prevalence and risk factors but also its specific characteristics and pattern, has become imperative.

The aim of this study was to assess the prevalence, associated risk factors, characteristics, and pattern of TDIs in permanent anterior teeth among 7–14-year-old school children of North East Delhi.

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Materials and Methods

This was a cross-sectional study conducted in various primary and secondary schools of North East Delhi.

Based on the previous Indian studies, the prevalence rate of anterior tooth trauma varies from 10% to 15%.^[5-7] Considering a 12% expected prevalence and by taking $\pm 10\%$ error margin with 95% confidence level (CI), a sample size of 2900 children was sufficient. To be on the safe side, it was decided to take 3000 children as the sample size of the study.

The study was approved by the Institutional Ethical Committee. Before enrolling in the study, written consent and informed consent were obtained from the school authorities and the child's parents or caretakers, respectively.

Procedure

A list of primary and secondary schools of North East Delhi area was obtained. A multistage random sampling technique was adopted to select the study population. In the first stage, 15 representative schools from the list of schools of the area were identified randomly. In the second stage, by using a computer-generated random number table based on the enrollment registration number of each student in the school, 200 children were selected randomly from each of the 15 selected schools.

Inclusion criteria

Children of 7–14 years, regularly attending the selected schools, in whom permanent anterior teeth had erupted were included in the study.

Exclusion criteria

Children having the following were excluded from the study:

- Presence of primary anterior teeth
- Presence of supernumerary teeth
- Permanent anterior teeth lost due to caries or any other reason except trauma
- Special needs children
- Previous or current orthodontic treatment
- Developmental defects in teeth
- Children with partial anodontia.

A detailed case history including basic information of the child and the presence/absence of trauma was recorded for the entire sample population.

Those children with trauma were further interviewed for trauma history. Following this, a thorough clinical examination was performed on the entire sample population. Both case history and clinical examination were done within the school premises. The prevalence of TDIs and the appraisal of the following were accomplished employing the information gathered from the case history, trauma history, and clinical examination of the sample

population [Figure 1]. Before the commencement of intraoral examination, lip coverage of upper incisors was observed in resting position without the awareness of the child. Lip coverage was recorded according to the criteria adopted by Burden.^[8]

Measurement of maxillary overjet was made with the teeth in centric occlusion; the distance from the labial incisal edge of the most prominent maxillary incisor to the labial surface of the corresponding mandibular incisor was measured using the Community Periodontal Index probe, as described in the 1997 World Health Organization (WHO) basic oral health survey guidelines.^[9]

The nutritional status of the children was assessed using anthropometric indicators - weight (kilograms) and height (centimeters). Indicator used was body mass index (BMI) for age according to the WHO Multicenter Growth Reference Study growth standard guidelines.^[10] In this study, the children were classified in only two categories, i.e., obese and nonobese.

In children with TDIs, the teeth which were injured, the total number of traumatized teeth in each child and distribution of teeth in the maxillary and mandibular arch were recorded. Andreasen's Epidemiological Classification of TDIs including WHO codes^[11] was used to record the type of injury.

- Code 0 No injury
- Code 1 Treated dental injury
- Code 2 Enamel fracture only (N 502.50)
- Code 3 Enamel/dentin fracture (N 502.51)
- Code 4 Pulp injury (N 502.52, N 502.53, N 502.54, N 503.20, N 503.21)
- Code 5 Missing tooth due to trauma (N 503.22)
- Code 9 Excluded tooth.

Root fractures were not considered in the study as no radiographs were taken.

The data were statistically analyzed using "Statistical Package for Social Sciences" (SPSS) version 16.0 software (Chicago, SPSS Inc). Data analysis included descriptive statistics (frequency distribution and cross tabulation). The strength of association between the risk factors with the

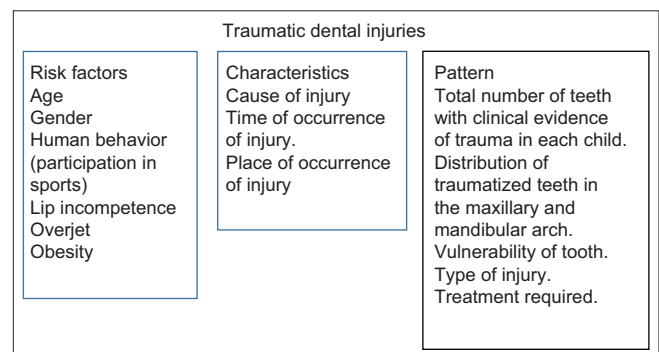


Figure 1: Attributes of traumatic dental injuries evaluated in the study

outcome was calculated by Chi-square test. The level of statistical significance was set at $P < 0.05$.

Variables that showed significant associations ($P < 0.05$) and potential confounders were included in multivariable logistic regression models that were constructed to assess the independent effect of these covariates on the prevalence of TDIs. For the logistic regression analysis, STATA software (version 9.0, StataCorp LP) was used.

Observation and Results

Subsequent to the examination of 3000 school children (1317 girls and 1683 boys), it was observed that 320 (10.7%) children had experienced TDIs. Among risk factors, dental trauma was significantly associated with male gender ($P < 0.05$) while statistically its highly significant association was noted with increase in age, participation in sports activity, incompetent lip seal, and overjet of >3.5 mm ($P < 0.001$) [Table 1]. BMI did not show a statistically significant relation with TDIs in this study ($P > 0.05$) [Table 1]. Table 2 shows the independent association of the significant risk factors with TDIs using multivariable regression analysis model. Males were at 1.29 times higher chances of exhibiting TDIs compared

to females (odds ratio [OR] = 1.29; 95% CI: 1–1.65). Children aged 9–14 years were at 1.18 times greater risk of having TDIs compared to children aged 7–8 years (OR = 1.18; 95% CI: 1.04–1.34). Those who participated in sports activities were at 1.72-fold higher chances of incurring dental injuries (OR = 1.72; 95% CI: 1.3–2.27). Children with inadequate lip seal were 1.94 times more prone to TDIs than those with adequate lip seal (OR = 1.94; 95% CI: 1.16–3.26). Children with overjet >3.5 mm were at 7.25-fold increased chances of having TDIs compared to those with overjet <3.5 mm (OR = 7.25; 95% CI: 5.03–10.46).

Table 3 shows the specific characteristics of TDIs. Falls followed by sports injury were the most common cause of dental trauma. Among various reasons of falls, fall of the child while playing by himself/herself was the most common. Afternoon was the most common time and schools were the most common place of occurrence of injury. Coming to the pattern of dental trauma, 217 (67.8%) of the children with clinical evidence of trauma had trauma in only one tooth, 91 (28.4%) children had trauma in two teeth, 11 (3.4%) and 1 (0.3%) had trauma in three and four teeth, respectively. Table 4 reveals the total number of

Table 1: Association between traumatic dental injuries and its various risk factors

Variables	Total number of children present	Number of children		P
		With evidence of trauma, n (%)	Without evidence of trauma, n (%)	
Gender				
Girls	1317	119 (9)	1198 (91)	0.012*
Boys	1683	201 (11.9)	1482 (88.1)	
Total	3000	320 (10.7)	2680 (89.3)	
Age (years)				
7-8	699	47 (6.7)	652 (93.3)	0.0001**
9-10	760	72 (9.5)	688 (90.5)	
11-12	832	90 (10.8)	742 (89.2)	
13-14	709	111 (15.7)	598 (84.3)	
Total	3000	320	2680	
Participation in sports				
Participated	1268	188 (14.8)	1080 (85.2)	0.0001**
Not participated	1732	132 (7.6)	1600 (92.4)	
Total	3000	320	2680	
Lip competence				
Competent	2891	278 (9.6)	2613 (90.4)	0.0001**
Incompetent	109	42 (38.5)	67 (61.5)	
Total	3000	320	2680	
Overjet (mm)				
0-3.5	2837	239 (8.4)	2598 (91.6)	0.0001**
3.5-5.5	153	75 (49)	78 (51)	
>5.5	10	6 (60)	4 (40)	
Total	3000	320	2680	
Obesity				
Obese	65	8 (12.3)	57 (87.7)	0.82
Nonobese	2935	312 (10.6)	2623 (89.4)	
Total	3000	320	2680	

*P value significant at a level <0.05 ; **P value highly significant at a level <0.001

teeth with clinical evidence of trauma and the distribution of injured teeth in the maxillary and mandibular arch. The maxillary central incisors were the most while the mandibular canines were reported to be the least vulnerable

Table 2: Multivariate logistic regression model for effect of independent variables on the prevalence of traumatic dental injuries

Variables	OR	SE	P	95% CI
Sex				
Female versus males	1.29	0.17	0.049*	1.00-1.65
Age (years)				
7-8 versus 9-14	1.18	0.08	0.01*	1.04-1.34
Participation in sports activity				
No participation versus participation	1.72	0.24	0.0001**	1.30-2.27
Lip seal				
Adequate versus inadequate	1.94	0.51	0.01*	1.16-3.26
Overjet (mm)				
0-3.5 versus 3.5->5.5	7.25	1.36	0.0001**	5.03-10.46

*P value significant at a level <0.05; **P value highly significant at a level <0.001. OR: Odds ratio; SE: Standard error; CI: Confidence interval

Table 3: Characteristics of traumatic dental injuries

	n (%)
Cause of injury	
Falls	137 (42.8)
Sports injury	105 (32.8)
Peer and sibling fight	33 (10.3)
Traffic accident	17 (5.3)
Struck by an object	14 (4.4)
Collision	12 (3.8)
Accidental biting of hard object	1 (0.3)
Any other	1 (0.3)
How did the child fall	
From bed	18 (13.1)
From stairs	18 (13.1)
During bathing	19 (19)
While playing by himself/herself	29 (21.2)
Knocked down by another child	22 (16.1)
From swing	14 (10.2)
From roof	4 (2.9)
While crossing the road	5 (3.6)
From scooter/bicycle	8 (5.8)
Time of occurrence of injury	
Morning	67 (20.9)
Afternoon	170 (53.1)
Evening	65 (20.3)
Night	18 (5.6)
Place of occurrence	
Home	102 (31.9)
School	131 (40.9)
Street	44 (13.8)
Playground (neighborhood)	41 (12.8)
School bus/rickshaw	2 (0.6)

teeth to TDIs [Figure 2]. Only 36 (8.31%) teeth out of the 433 teeth with traumatic injuries were found to be completely treated. Uncomplicated crown fracture was the most commonly observed form of injury [Figure 3]. Table 5 explains the normative treatment needs of the children of North East Delhi area.

Discussion

This was a population-based epidemiological survey. While the prevalence of TDIs in various parts of the world, as well as India, has been studied extensively, there is no such reported data about Delhi, which is the capital city of India. Furthermore, while most of the other studies focus on the prevalence and risk factors only, this study in addition attempts to define the specific characteristic and pattern of TDIs. However, as it was not feasible to conduct the study in the entire city, a specific area of Delhi (North East) was chosen.

The prevalence of TDIs in the present study was 10.7%. Earlier studies done by Chopra *et al.* (10.2%),^[6] Altun *et al.* (9.5%),^[12] and Al-Khateeb *et al.* (11%)^[13] have also shown comparable prevalence rates. The prevalence in this study was lower than found in studies conducted by Malikaew *et al.*,^[14] Cavalcanti *et al.*,^[15] and García-Godoy *et al.*,^[16] etc., Conversely, the prevalence determined was higher than those observed by Naidoo *et al.*^[17] and Patel and Sujan (8.79%).^[18]

Variations in prevalence of TDIs have been attributed to the environment, the study sites, examination methods, type of dentition, and the TDI classification system used.^[17]

Similar to this study, most of the previous Indian studies have revealed lower prevalence rates (between 6% and 15%)^[7,18,19] when compared to the international studies. This might possibly be due to lack of

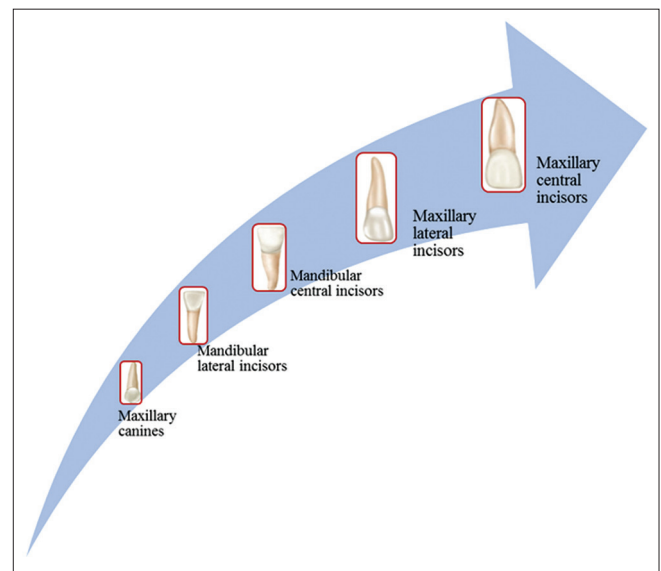


Figure 2: Vulnerability of teeth to traumatic dental injuries in increasing order

exposure of Indian children to contact sports (ice hockey, lacrosse, soccer, and kickboxing) and physical activities such as horse riding and skiing.

In the above study, the prevalence of TDIs increased with the age of the child. This was in accordance with former studies conducted by Gupta *et al.*^[19] and Martins *et al.*^[20] This increasing trend of prevalence with age was a mere reflection of the cumulative nature of TDIs.

Boys were at greater risk of having TDIs compared to girls. This finding has been observed in most of the other studies,^[18,21] done previously. This may be attributed to the fact that boys participate more in sports activities, usually prefer more aggressive type of games, demonstrate more violent behavior, and engage more often in contact sports (with or without appropriate protection). On the contrary, some studies already indicate an increasing trend of dental trauma among girls, because of their increasing participation in sports or activities formerly practiced by boys only.^[22,23]

Thus, in this study, human behavior like participation in sports activity, irrespective of gender was studied as a risk factor of TDIs. Compared to gender, school-based sports activity emerged as a more statistically significant risk factor indicating need for better safety norms in schools.

Like most of the previous studies, TDIs were more frequent among school children with incompetent lip seal compared to those with competent lips.^[7,20] The absence of effective lip seal suggests deficiency in the natural barrier against trauma to the teeth, especially maxillary.

Increased overjet was another very important independent risk factor associated with TDIs in this study. This was clearly because an increased overjet increases the exposure of permanent anterior teeth making them more vulnerable to TDIs. The above observation reiterates the fact that early orthodontic correction of overjet is tremendously required for prevention of TDIs. In the present study, children with obesity had a higher prevalence of TDIs than nonobese children, but this difference was not statistically significant. According to Petti *et al.*,^[24] children with excess weight tend to be less active, with poor physical skills and subsequently more susceptible to losing their balance, thereby suffering more TDIs.

As per the characteristics of TDIs observed in this study, the most common cause of injury in all age groups was falls. This finding was established by many prior studies.^[5,6] Maximum number of children fell while playing by themselves followed by playing with another child.

In corroboration with the finding of Malikaew *et al.*,^[14] most of the TDIs were recorded to have occurred in the afternoon (12:00 pm and 4:00 pm). The higher incidence

Table 4: Distribution of injured teeth in the maxillary and mandibular arch

Arch	n (%)
Maxillary Arch	
11	152 (35.1)
21	195 (45)
12	17 (3.9)
22	39 (9)
13	1 (0.23)
23	5 (1.15)
Total teeth	409 (94.45)
Mandibular Arch	
41	10 (2.3)
31	4 (0.93)
42	3 (0.7)
32	5 (1.15)
43	1 (0.23)
33	1 (0.23)
Total teeth	24 (5.54)
Total teeth injured in both arch	433 (100)

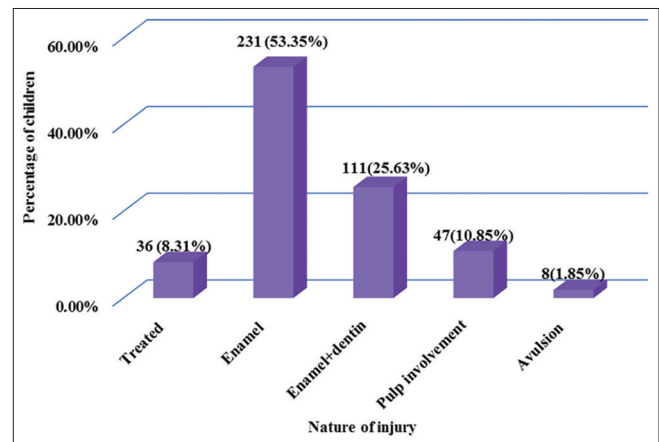


Figure 3: Nature of injury

Table 5: Normative treatment needs according to the clinical evaluation of the examiner

Type of trauma	Number of teeth affected (%)	Treatment needs
Enamel fracture	231 (58.1)	Adhesive restoration
Enamel + dentin fracture	111 (28)	Pulp lining and adhesive restoration
Pulp involvement	47 (11.8)	Direct pulp capping/root canal treatment/apexogenesis/apexification with either simple adhesive restoration/crown/veneering/bleaching
Avulsion	8 (2)	Prosthesis
Total number of untreated teeth	397	

in the afternoon may be related to the reduced level of supervision, at this time of the day. Children are either having their recess or going back to their home from the school and hence usually excited and involved in a lot of unsupervised playful activities. When the place of occurrence of TDIs was taken into consideration, schools followed by homes were the most frequent places. On contemplation, that schools and homes are the most frequent place of occurrence of trauma, while falls and sports injury are the most recurrent cause, one can formulate certain preventive strategies for TDIs. More closed and careful supervision of the children by parents and teachers, provision of specific and appropriate places for leisure and sports activities containing impact absorbing surfaces around the items from and on which children are most likely to fall may help. Mouth protection should be made mandatory for children during sports activities.

Studying the pattern of anterior tooth trauma, it was found that the most common nature of injuries were uncomplicated crown fractures, usually affecting a single tooth. This is in agreement with most of the epidemiological studies on TDIs.^[21,25]

Reaffirming the data of many previous studies, most TDIs involved the maxillary teeth with the maxillary central incisor being the most frequently involved.^[26,27] Simple adhesive restorations were the most commonly indicated form of dental treatment, which is in agreement with the finding reported in some former studies.^[20,28] An important finding in this study was that only 8.3% of the total teeth with TDIs were observed to be completely treated by a dentist. Nearly, 91.7% of the teeth with TDIs were untreated. Such data show the enormous treatment negligence among the population being studied. As dental trauma is not a disease, parents may not pay sufficient attention to TDIs. Limited access to dental treatment, particularly among the lower income groups, is a well-known problem. The relatively minor severity of dental trauma may also contribute toward a negligent attitude. Thus, organizing studies addressing the prevention and treatment needs of TDIs and educational programs aimed toward parents and school teachers are of paramount importance.

Recording both treated and untreated TDIs added an advantage to this study that is not found in hospital-based and clinical-based studies resulting in a more accurate presentation of TDIs' prevalence in the population studied.

Conclusions

Evaluating the specific characteristics and pattern of anterior tooth trauma along with its prevalence and risk factors will tremendously enhance the planning of its preventive strategies. Furthermore, recognizing the enormous treatment negligence is extremely critical to

adequately analyze indifference of the people toward dental trauma and its consequences.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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