



Assessment of Prevalence and Associated Risk Factors for Untreated Traumatic Dental Injuries among 11 - 14 Years Old Indian School Children

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Abstract

Background: The economic costs of treatment of Traumatic Dental Injuries (TDI), its impact on the oral health-related quality of life and the possibility of prevention, have made dental trauma a serious public dental health problem in children.

Aim and Objectives: The purpose of this study was to describe the prevalence and associated risk factors for untreated traumatic injuries of permanent anterior teeth among 11 - 14 year-old school children in New Delhi.

Materials and Methods: A cross-sectional survey was carried out to assess the prevalence of untreated traumatic dental injuries among 11 to 14 years old school children, attending public and private schools of New Delhi. The study recorded the type of dental trauma, size of incisal overjet, and whether lip coverage was adequate or inadequate. The relationship between traumatic dental injuries and other variables were assessed using the chi-square test and binary logistic regression analysis.

Results: The prevalence of traumatic dental injuries among 11 - 14 year school children was 10.9%. The logistic regression model showed that the age of 14 years (2.338), overjet more than 5 mm (1.685), inadequate lip coverage (1.907) and male gender (1.730) and private school (1.759) was found to be significantly associated with the traumatic dental injuries.

Conclusion: The prevalence of untreated traumatic dental injuries was found to be very high. Maxillary central incisors were the teeth most commonly affected with dental injury. Crown fracture involving enamel (Class I) was the commonly reported type of tooth injury.

Keywords: Crown Fracture; Dental Trauma; Prevalence; Tooth Injury

Introduction

Epidemiological studies have shown that dental trauma is a serious public health concern causing psychological, aesthetic, social, and therapeutic problems [1]. Dental trauma can, directly or indirectly, influence people's lives, affecting their appearance, speech, and position of teeth which impact the quality of life [2].

The economic costs of treatment of traumatic dental injuries TDI, its impact on the oral health-related quality of life and the

possibility of prevention, have made TDI a serious public dental health problem in children [3-6]. Some empirical studies showed that children with an untreated TDI, lose time from school for treatment. This problem is further exacerbated by high costs of treatment resulting in most TDIs being untreated [7].

Male gender [8-10], improper position of teeth [11], previous history of trauma [12] have been pointed out as important risk factors for the occurrence of traumatic dental injuries TDI. Traumatic

dental injuries of the anterior teeth in children have a psychological impact on both the parents and the child, Having untreated fractured teeth has been directly related to the emotional state and appearance of children [14,15]. The main cause of dental injuries are fall and collisions, sports related activities, violence, and traffic accidents [16,17].

Reliable and valid data on TDI related events are relevant to further understanding the etiology of TDI and developing effective preventive and therapeutic strategies.

Purpose of the Study

The purpose of this study was to describe the prevalence and associated risk factors for untreated traumatic dental injuries to permanent anterior teeth among 11 - 14 years-old school children from private and public schools in New Delhi.

Materials and Methods

This cross-sectional survey was carried out to assess the prevalence of untreated traumatic dental injuries among 11 to 14 years old school children, attending public and private schools of New Delhi between the months July 2019 to October 2019.

Ethical clearance

The study protocol was approved by Institutional Ethical Review Committee of Genesis institute of dental sciences. A written Informed consent to carry out the study was obtained from the parents/legal guardian of each participant one day prior to clinical examination which was in accordance with the World Medical Association Declaration of Helsinki.

Data collection

A total of 3500 school children (boys and girls) aged 11 - 14 years from public and private schools of Delhi city participated in this study. The children were selected using multi-stage cluster systematic random sampling. The children who returned with signed consent form from the parents and on the day of the examination and who gave the informed verbal consent for oral examination were included in the study. Children with retained deciduous anterior teeth were excluded from the study. A structured pretested proforma was administered to collect the information about patient demographics (name, age, gender).

Clinical examination

Data was collected by the clinical examination using the mouth mirror and a CPI probe. Natural lighting was used, and the subjects were examined at school during class hours. The Ellis classification and as modified by Holland, *et al.* 1988 [16] for traumatic dental injuries was used in the study.

The following information about the untreated traumatic injuries was also collected: place, cause of injury, number and type of teeth affected, its severity, and type of injury. The soft tissue relation such as lip coverage and overjet were also assessed.

Training and calibration

All measurements were performed by a single calibrated dentist. The reliable results were seen with kappa values of 0.87 for the assessment of the different types of traumatic dental injuries.

Statistical analysis

The data were subsequently processed and analyzed using the SPSS software version 25.0. The inferential statistics was carried out using the chi-square test and multivariate binary logistic regression included age, gender, overjet, lip coverage, and school type with the prevalence of dental injuries as the outcome measure. The significance level was set at 5%.

Results

The study population consisted of 890 students from private schools and 860 students from public schools of New Delhi. The study population consisted of 49.9% girls and 50.1% boys, from public and private schools (Table 1).

The prevalence of dental trauma among 11 - 14 year school children was 10.9%. The traumatic dental injuries were found to be more among children from private schools (13.5%), 14 years (18.80%), males (13.5%), overjet greater than 5 mm (15.3%) and inadequate lip coverage (16.4%) (Table 2).

The gender-wise comparison of traumatic dental injuries showed that the traumatic dental injuries were found to be significantly ($p < 0.05$) more among males in 12 and 14 years age group (23.6% and 23.3% respectively).

Age groups (in years)	Private schools	Public Schools	Total
11 years	223 (25.1%)	242 (28.1%)	465 (26.6%)
12 years	232(26.1%)	227(26.4%)	459 (26.2%)
13 years	237 (26.6%)	175 (20.3%)	412 (23.5%)
14 years	198 (22.2%)	216 (25.1%)	414 (23.7%)
Total	890 (100.0%)	860 (100.0%)	1750 (100.0%)

Maxillary central incisors (96.32%) were the teeth most commonly affected with left maxillary central incisor (62.63%) more commonly affected than right side (44.21%) followed by the maxillary lateral incisors (2.63%) and mandibular incisors (2.63%). Multiple tooth injuries were found to be significantly more among boys (14.4%) in comparison to girls (8.3%).

Table 1: Distribution of study subjects according to study subjects.

		Trauma		Pearson chi-square value	p-value
		Absent	Present		
Age (in years)	11 years	423 (91.00%)	42 (9.00%)	39.531	< 0.001**
	12 years	414 (90.20%)	45 (9.80%)		
	13 years	387 (93.90%)	25 (6.10%)		
	14 years	336 (81.20%)	78 (18.80%)		
Gender	Female	801 (91.8%)	72 (8.2%)	12.259	< 0.001**
	Male	759 (86.5%)	118 (13.5%)		
	Total	1560 (89.1%)	190 (10.9%)		
Type of school	Private	770 (86.5%)	120 (13.5%)	12.904	< 0.001**
	Public	790 (91.9%)	70 (8.1%)		
	Total	1560 (89.1%)	190 (10.9%)		
Pearson chi- square value = 39.531, P value = < 0.001** Chi-square test ** Highly significant difference (p-value < 0.001)					

Table 2: Distribution of traumatic injuries among study subjects according to age groups, Gender and Type of school.

Enamel Fracture was found among (51.1%) subjects followed by Enamel and dentin fracture (35.8%), Enamel, Dentin fracture involving pulp (12.6%) and Tooth loss due to dental trauma (0.5%) (Table 4).

The most common cause of traumatic dental injury was fall (59.5%) followed by Collision with object or person (20.0%), Sports (7.4%), Violence/fight (3.7%), Road traffic accident (4.7%), Eating/ biting hard food (1.6%) and Self-inflicted injury (1.6%).

		Dental trauma		Pearson chi-square value	P-value
		Present	Absent		
Overjet	Less than 5 mm	134 (9.7%)	1250 (90.3%)	9.441	0.002**
	More than 5 mm	56 (15.3%)	310 (84.7%)		
	Total	190 (10.9%)	1560 (89.1%)		
Lip coverage	Adequate	129 (9.4%)	1250 (90.6%)	15.173	< 0.001***
	Inadequate	61 (16.4%)	310 (83.6%)		
	Total	190 (10.9%)	1560 (89.1%)		
Chi-square test ** Highly significant difference (p-value < 0.001).					

Table 3: Distribution of Traumatic Dental Injuries among study subjects according to overjet and lip coverage.

There was missing information regarding the traumatic dental injury among 1.6% subjects.

The adjusted odd's ratio was calculated after adjusting for the confounding factors such as age, gender, overjet, lip coverage, and school type. Age 14 years (OR = 2.505 (95% CI = 1.655 - 3.792)),

Overjet more than 5 mm (OR = 1.762 (95% CI = 1.102 - 2.875)), inadequate lip coverage (OR=2.052 (95% CI = 1.128-2.987)), Male gender (OR = 1.953 (95% CI = 1.395 - 2.736)) and studying in Private school (OR = 2.223 (95% CI = 1.593-3.101)) were significantly associated with the occurrence of the traumatic dental injury (Table 5).

Type of Ellis fracture	SEX		Total	Chi-square value	p-value
	Female	Male			
Enamel fracture	31 (43.1%)	66 (55.9%)	97 (51.1%)	5.074	0.166 [#]
Enamel and dentin fracture	28 (38.9%)	40 (33.9%)	68 (35.8%)		
Enamel and dentin fracture with pulp III	13 (18.1%)	11 (9.3%)	24 (12.6%)		
Total tooth loss VI	0 (0.0%)	1 (0.8%)	1 (0.5%)		
Total	72 (100.0%)	118 (100.0%)	190 (100.0%)		
Chi-square test [#] Non-significant difference (p-value > 0.05)					

Table 4: Distribution of the type of traumatic dental injury according to gender.

Discussion

Traumatic injuries to the teeth constitute the most serious dental condition experienced by children [17]. Oral health promotion programs need to prevent such injuries in communities, where, they are either frequent or severe [18].

The prevalence of trauma among the over-all study population was 18.8%. which was more than the studies conducted by Soriano, *et al.* [20] where the prevalence of dental injuries among 12-year-old schoolchildren was 10.5%, Traebert., *et al.* [21] (10.7%) among 11 to 13-year-old school children, David., *et al.* [7] (6%) among 12-year-old schoolchildren in Kerala, Faus-Damiá., *et al.* [22] (6%)

		Unadjusted OR (95.0% C.I.)	p-value	Adjusted OR (95.0% C.I.) ^b	p-value
Age	11 years	1.000 (Ref)		1.000 (Ref)	
	12 years	1.095 (0.704 - 1.703)	0.688	1.103 (0.681 - 1.787)	0.690
	13 years	0.651 (0.389 - 1.088)	0.101	0.483 (0.280 - 0.833)	0.009**
	14 years	2.338 (1.565 - 3.493)	< 0.001**	2.505 (1.655 - 3.792)	< 0.001**
Gender	Female	1.000 (Ref)		1.000 (Ref)	
	Male	1.73 (1.269 - 2.357)	0.001**	1.953 (1.395 - 2.736)	< 0.001**
Type of school	Public	1.000 (Ref)		1.000 (Ref)	
	Private	1.759 (1.289 - 2.400)	< 0.001**	2.223 (1.593 - 3.101)	< 0.001**
Overjet	Less than 5 mm	1.000 (Ref)		1.000 (Ref)	
	More than 5 mm	1.685 (1.205 - 2.357)	0.002**	1.762 (1.102 - 2.875)	0.001**
Lip coverage	Adequate	1.000 (Ref)		1.000 (Ref)	
	Inadequate	1.907 (1.372 - 2.649)	< 0.001**	2.052 (1.128 - 2.987)	< 0.001**

Table 5: Logistic regression to estimate the Unadjusted Odds ratio for the various factors related to the traumatic dental injuries.

**^a: P-value < 0.01.

^b: Adjusted for Age, Overjet, Lip coverage, Gender, Type of School.

among 6 - 18 year old in Valencia, Taivo and Jalo [14] (15.2%) and Gupta., *et al.* [23] (13.8%) among children of South Kanara District.

Almost similar prevalence was reported in the studies by Francisco., *et al.* (18.8%) [24], Ravishankar., *et al.* [10] (15.1%) among 12 year old school children in Davangere, Garcia-Godoy [25] (18.1%) and Huang., *et al.* [26] (19.9%).

Whereas comparatively higher prevalence was reported by Navabazum and Farhani [27] (27.56%), Sanchez., *et al.* [28] prevalence of traumatic dental injuries was 28.4% among 3 - 13-year-old boys, Hunter., *et al.* [29] (15.3% among 11 - 12-year-old South Wales school-children), Ramos-Jorge., *et al.* (34.3% among 11-14 year old) [12] and Altay., *et al.* (33.7%) in Ankara, Turkey [30].

Variation in prevalence has been related to many factors, such as type of study, trauma classification, sample and diagnostic criteria, limited age groups, and geographic and behavioural differences between study locations and countries [3].

In the present study, the dental trauma was significantly more among school children in the age group of 14 years (18.80%), followed by 11 years (9.0%), 12 years (9.8%) and least in the 13 years age group (6.1%). This was quite similar to the study by Ferreira., *et al.* [31] the prevalence of dental injuries increased with age, Chen., *et al.* [32] 3% at 8 years and 10% at 12 years, Vanka., *et al.* [33] and Ivancic Jokic., *et al.* [34] The characteristics of traumatic injuries convey that the measurement of this type of dental injury is cumulative.

In the present study, binary logistic regression analysis showed that males reported more dental injuries as compared to females (OR = 1.953 (95% CI = 1.395 - 2.736)). This was similar to the studies by Francisco *et al.* (boys experienced double the number of injuries as compared to girls) [24], Schatz., *et al.* [35] in which, Boys were 1.35 times (95% CI $\frac{1}{2}$ =1.41 - 2.16) more likely to have dental injuries than girls, Vanka., *et al.* [33], where boys-girl ratio reporting trauma was 1.7:1.0, Rajesh., *et al.* [36], with boys more affected than girls, with a ratio of 1.53:1 and Chen., *et al.* [32], the ratio of injuries among boys:girls was 1.96:1.

The trauma was significantly more among boys (11.3%) in comparison to girls (6.7%) which was similar to the study by Soriano., *et al.* [19] boys presented with more traumatic injuries, David., *et al.* [7], Boys (7.9%) reporting more injuries as compared to girls (3.6%), Navabazam and Farahand [27] boys showed a higher prevalence than girls (33.05% and 22.08% respectively), Hunter., *et al.* [29] reported that Boys (19.4%) showed a higher prevalence of trauma than girls (11%), Thelen and Bardsen [37], boys (12.4%) suffered more traumatic injuries than girls (7.7%) and Faus-Damiá., *et al.* [22] where males (51.2%) were more affected by dental trauma than females (48.8%) and Ravishankar., *et al.* [10] in which, trauma was higher in boys compared to girls.

The explanation to the fact that males are affected more might be. Attributed to behavioural factors, with the boys tending to be more energetic and inclined toward vigorous outdoor activities as compared to girls and indulgence in more violent behavior by boys.

There have been exceptions, in the study by Garcia-Godoy [25], a male: female ratio of 0.9:1.0 was observed. However, studies by Rocha., *et al.* [38] and Hargreaves., *et al.* [39] indicated an increasing trend of dental trauma among girls, because of their increasing participation in sports related activities.

In the present study, children with Overjet more than 5 mm (Odds ratio=1.685) and inadequate lip coverage (Odds ratio = 1.907) were significantly more likely to have trauma. This was similar to the studies by Francisco., *et al.* [24] (Children with an overjet size > 3 mm were 1.78 times and inadequate lip coverage were 2.18 times more likely to experience dental trauma), Schatz., *et al.* [35] Children with an overjet size greater than 6.0 mm were 4.03 times more likely to have a dental injury and Ravishankar., *et al.* [10] the anatomic factors of incisal overjet beyond 5.5 mm and inadequate lip coverage were important risk predictors.

There was a statistically significant difference between traumatic dental injuries among children with overjet more than 5 mm and less than 5 mm in the present study which was similar to the study conducted by Hunter., *et al.* [29] the percentage of subjects suffer-

ing from trauma increased significantly with increasing overjet, but different from the present study in that lip incompetence did not affect the prevalence of accidental damage. The study by Traebert, *et al.* [23] reported contrasting findings with no association between inadequate lip coverage and traumatic dental injuries ($P > 0.05$).

Traumatic injuries to teeth are significantly associated with deviations from normal function and posture of perioral soft tissues [17].

The teeth most commonly involved teeth with trauma were maxillary incisors (96.32%) in the present study which was similar to the study by Francisco, *et al.* [24] (84.8%). Rajesh, *et al.* [36], David, *et al.* [7], Schatz, *et al.* [35], Hunter, *et al.* [29], Chen, *et al.* [32], Vanka, *et al.* [33], Ravishankar, *et al.* [10], Faus-Damiá, *et al.* [22] and Soriano, *et al.* [19] among Brazilian schoolchildren.

Multiple tooth injuries were found among 23 (12.1%) children with 14.4% among boys and 8.3% among girls. The study by Thelen and Bradsen [37] reported fracture of only one affected tooth similar to the present study.

The most commonly affected teeth in the present study was left maxillary central incisor followed by right maxillary central incisor. Navabazam and Farhani [27] reported that the left maxillary central incisor was more commonly involved (51.9%). Vanka, *et al.* [33] however reported different findings that the right maxillary central incisor accounted for 39% of the injuries followed by the left maxillary central incisor (36%).

Enamel fracture was most commonly reported injury (50.0%), followed by Enamel and dentin fracture (38.70%) which was almost similar to the study conducted by Francisco, *et al.* [27] (66% was enamel fracture), Garcia-Godoy [25], enamel fracture (51.1%) was the most common injury followed by concussions (25.6%), Ramos-Jorge, *et al.* [12], Taiwo and Jalo [14] and Ravishankar, *et al.* [10] reported that enamel fractures as the main type of traumatic injuries to teeth. This was in contrast to the studies by Vanka, *et al.* [33] in which, non-vital teeth were unusually high, Rajesh, *et al.*

[36] and Schatz, *et al.* [35] class 2 fracture was the most common.

The etiology of injuries in the present sample was in agreement with earlier reports that falls (60.0%) were the most reported cause of injuries as reported by Soriano, *et al.* [19] in which, falls and collisions were the main causes of dental trauma, Garcia-Godoy [25] falling against an object was main reason for injury (60.0% in boys and 42.0% in girls), Nicolau, *et al.* [6] falls (24.1%) followed by collisions with people or inanimate objects (15%) were the common cause of injury and Taiwo and Jalo [14] reported that falls (64.2%) to be leading cause of injury and Rocha, *et al.* [38].

This was also similar to the study by Vanka, *et al.* [33] in which, the majority of TDIs occurred at home and at school during physical leisure activities such as playing football, running and cycling. These were the main activities resulting in fall and were related to the aetiology of TDIs. These findings are similar to other reported studies by Adekoya-Sofowora, *et al.* [40] among 12-year-old suburban Nigerian schoolchildren and Altun, *et al.* [39].

However, the percentage of TDI because of falls and collisions in the present study was much higher than those suggested by Huang, *et al.* [29]. The discrepancy may be the result of using a refined approach to assess TDI related events.

However, the present study is not without limitations. One of the limitations in the present study was that only untreated dental trauma was assessed and treated dental trauma was not considered.

Conclusion

The frequency and causes of traumatic injuries to anterior teeth is important for identification of risk groups, treatment needs and cost involved in order to allow establishment of effective preventive measures. It also helps in formulation of educational campaigns for parents and care givers to increase their knowledge of the emergency procedures of dental injuries. The lay community should be provided with information about the importance of early management of dental trauma.

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