



ORIGINAL PAPER

Patterns and characteristics of traumatic dental injuries in children – a retrospective study in a dental hospital in Kolkata, India

Suchetana Goswami 

Dr. R. Ahmed Dental College and Hospital, Kolkata, West Bengal, India

ABSTRACT

Introduction and aim. Traumatic dental injuries (TDIs) in children can have aesthetic, functional, and psychological consequences. This retrospective study aimed to investigate the epidemiology and patterns of TDIs in a hospital-based population.

Material and methods. Patient records from the Department of pediatric and Preventive Dentistry in a dental college and hospital in Kolkata, India, were reviewed. A total of 381 patients, aged 1 to 12 years, who presented one or more traumatized anterior teeth between September 2018 and August 2022, were included. Data on age, sex, mechanism of injury, type of trauma, dentition type, and number of affected teeth were collected. The World Health Organization classification system was used to classify the type of dental trauma.

Results. Among the study population, there were 235 males (61.7%) and 146 females (38.3%), with a mean age of 7.67 ± 3.87 years. Falls were the most common cause of trauma (52.2%). The maxillary central incisors were the most frequently affected teeth in both primary and permanent dentitions.

Conclusion. Falls were the most common cause of trauma and the maxillary central incisors were the most commonly affected teeth in children.

Keywords. anterior teeth, child, dental trauma, epidemiology, primary/permanent teeth

Introduction

Traumatic dental injuries (TDIs) pose a significant public health problem due to their potential to cause aesthetic, functional, and psychological disturbances, particularly in children. These injuries account for approximately 5% of all bodily traumatic injuries and display a wide-ranging prevalence of anterior tooth injuries globally, ranging from 4% to 58%.^{1,2} The variation in prevalence can be attributed to various factors, such as differences in trauma classification, study types, sample sizes, diagnostic criteria, and cultural behaviors.²⁻⁵

While TDIs can affect individuals of any age, they are more commonly observed among children and young adults, with the maxillary central incisors and lateral inci-

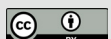
sors being particularly vulnerable due to their position and exposure.⁶⁻¹⁰ Previous studies have indicated a higher incidence of dental trauma in patients with inadequate lip coverage and class II malocclusion.¹⁰⁻¹² Typically, traumatic injuries affect a single tooth, although severe cases may involve multiple teeth. These injuries often lead to discomfort and hinder patients' daily routines. Therefore, there is a need for early intervention and proper management to preserve the affected teeth and reduce potential complications.

The aetiology of dental trauma varies depending on the age group. Falls are the most frequent cause in toddlers and preschool children, while sports-related injuries and interpersonal violence predominate among school-age children and adolescents.^{8,13,14}

Corresponding author: Suchetana Goswami, e-mail: goswamisuchetana97@gmail.com

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Aim

Research suggests that the profiles of dental trauma differ across ethnicities and geographic locations. Unfortunately, limited data are available on dental trauma in the pediatric population in the eastern part of India.

The primary aim of this study is to investigate the characteristics of traumatic dental injuries (TDIs) in children aged one to twelve years, with a focus on demographic factors, injury etiology, and types of dental trauma. Among children who visited a tertiary care hospital in Kolkata, India.

Material and methods

A retrospective analysis of TDI in a pediatric population treated at the Department of Pediatric and Preventive Dentistry, Dr. R. Ahmed Dental College and Hospital, Kolkata, India, between September 2018 and August 2022 was conducted. Approval for the study was obtained from the Institutional Ethics Committee (IEC/DCH/279 dated 28/9/2022). The present study was performed in accordance with the Declaration of Helsinki, and the research adheres to the guidelines outlined in the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) statement.

Selection of patients and data collection

Clinical records of all patients aged 12 years or younger with traumatic injuries to the maxillary and mandibular incisors and canines were reviewed. Both primary and permanent anterior teeth with trauma were considered. Over a four-year period, 388 patients were examined in our department. Incomplete medical records, such as missing data of radiographs, were excluded. Additionally, patients with syndromes, craniofacial anomalies, neuromuscular diseases, physical, or mental retardation were excluded from the study, resulting in the exclusion of seven clinical records. Finally, 381 (235 males and 146 females) patient files were scrutinized and categorized into two age groups: 1-6 years and 7-12 years.

The recorded data included age at the time of injury, gender, mechanism or cause of injury, type of trauma, type of dentition, and the number of affected teeth. Mechanisms of injury were categorized into falls, road traffic accidents, play or sports-related injuries, bicycle accidents, trauma from a tube well handle, interpersonal violence, and animal-related injuries. A tube well is a type of water well that uses a long, narrow pipe (the tube) to draw water from underground sources, mainly in rural areas. A tube well handle is a part of the equipment used to manually operate tube wells. Mishaps, such as slips or improper handling during its operation, can result in the handle colliding with the face, with a particular focus on the mouth region. Such inadvertent contact may induce blunt force trauma, potentially leading to traumatic dental injuries. The type of den-

tal trauma was classified in accordance with the slightly modified World Health Organization (WHO) classification system as proposed by Andreasen et al.⁹

According to this classification, dental trauma included: enamel infraction, enamel fracture, enamel-dentin fracture, complicated crown fracture, uncomplicated crown-root fracture, complicated crown-root fracture, and root fracture and periodontal tissue injuries: concussion, subluxation, intrusion, extrusion, lateral luxation, and avulsion. Teeth affected by trauma were numbered according to the internationally recognized two-digit Federation Dentaire Internationale numbering system. Lip coverage was assessed according to Burden.¹¹ If the upper incisors were covered by the lip while at rest, it was deemed as adequate lip coverage. Conversely, lip coverage was considered inadequate if most of the upper incisors were visible, or if there was noticeable tension in the lip during closure.

Statistical analysis

The collected data were analyzed using Microsoft Excel 2010 (Redmond, WA, USA) and Epi Info 7 (CDC-INFO, Atlanta, GA, USA). Comprehensive descriptive analyses, including frequencies, proportions, and percentages, were conducted. To determine the statistical significance of the findings, the chi-square test was employed, with a significance level set at $p < 0.05$.

Results

The average age of participants in this research was 7.20 ± 3.43 years, with a range of one to 12 years. Among the surveyed individuals, 235 were male (61.7%), and 146 were female (38.3%), resulting in an overall male-to-female ratio of 1.6:1. Specifically, in the 1-6 years age group, the male-to-female ratio was 1.2:1, which increased to 1.8:1 in the 7-12 years age group.

Table 1. Characteristics of patients with traumatic dental injury

Characteristics	n	%		
Number of patients	Male	1-6 years n=84	233	61.2
		7-12 years n=149		
	Female	1-6 years n=67	148	38.8
		7-12 years n=81		
Total	381	100		
Number of Affected teeth	Primary teeth	274	42.7	
	Permanent teeth	367	57.3	
	Total	641	100	
Lip coverage	Adequate	175	45.9	
	Inadequate	206	54.1	
	Total	381	100	

Among the 381 patients, 214 (63.3%) fell within the 7 to 12-year age group, while 167 (36.7%) were in the 1-6-year age group. A total of 641 affected teeth (274

Table 2. Etiology of patients with traumatic dental injury according to gender*

Etiology	Male		Female		Total		Chi-square test (p)	Primary teeth		Permanent teeth		Chi-square test (p)
	n	%	n	%	n	%		n	%	n	%	
Fall	123	52.3	76	52.1	199	52.2	12.95 p=0.04 Df=6	181	66.1	141	38.4	59.59 p<0.001 Df=6
Play	47	20.0	15	10.3	62	16.3		28	10.2	73	19.9	
RTA	24	10.2	24	16.4	48	12.6		40	14.6	65	17.7	
Bicycle	15	6.4	12	8.2	27	7.1		11	4	32	8.7	
Tube well	9	3.8	11	7.5	20	5.2		10	3.7	23	6.3	
IPV	16	6.8	6	4.1	22	5.8		2	0.7	31	8.5	
Animal	1	0.5	2	1.4	3	0.8		2	0.7	2	0.5	
Total	235	100	146	100	381	100		274	100	367	100	

* IPV – interpersonal violence, Chi Square test=12.95, Df=6 p= 0.04

primary teeth and 367 permanent teeth) were observed. Therefore, the number of affected teeth per individual was 1.68. In 206 (54.1%) children with TDI, inadequate lip coverage was observed (Table 1).

Among a total of 274 traumatized primary teeth, 153 (55.8%) were in males and 121 (44.2%) in females. Similarly, of the 367 permanent teeth with TDI, 246 (67%) occurred in males and 121 (33%) in females. The incidence of affected teeth was significantly higher (p=0.004) in males than females.

The distribution of etiology by gender and dentition type is shown in Table 2. Falls were the most common causes of TDI in primary (66.1%) as well as permanent teeth (38.4%). Overall, falls were responsible for 52.2% of TDI cases. The other causes included play or sports-related injuries (16.3%), road traffic accidents (12.6%), bicycle accidents (7.1%), trauma from a tubewell handle (5.2%), interpersonal violence (5.8%), and animal-related injuries (0.8%).

As shown in Table 3, the maxillary central incisors were the most commonly affected teeth in this survey, accounting for 69% (n=189) of primary teeth and 77.7% (n=285) of permanent teeth. Among the 274 primary teeth with TDI, 232 (84.7%) were maxillary teeth. Similarly, 334 (91%) maxillary teeth were affected with TDI out of 367 permanent teeth. The occurrence of TDI was significantly higher in maxillary teeth compared to mandibular teeth (Chi Square=28.46, df=2, p<0.001).

Table 3. Distribution of traumatic injuries according to primary and permanent tooth type

Tooth type		Primary teeth		Permanent teeth	
		n	%	n	%
Maxillary	Central incisor	189	69	285	77.7
	Lateral incisor	34	12.4	42	11.4
	Canine	9	3.3	7	1.9
Mandibular	Central incisor	22	8	24	6.6
	Lateral incisor	12	4.4	7	1.9
	Canine	8	2.9	2	0.5
Total		274	100	367	100

Occurrence of TDI was significantly higher in maxillary teeth compared to mandibular teeth (Chi Square=28.46, Df=2, p<0.001).

Table 4 presents the distribution of traumatic dental injuries based on etiology and tooth type. Fall and road traffic accidents (RTA) were the two main etiologic factors of primary teeth trauma, whereas fall and play were the two main causes of TDI in permanent teeth.

The distribution of traumatic injury types is shown in Table 5. Periodontal tissue injuries (n=173, 63.1%) were more common in primary teeth compared to hard tissue injuries (101, 36.9%), whereas hard tissue injuries (n=198, 53.9%) predominated over periodontal tissue injuries (n=169, 46.1%). Hard tissue injuries occurred more commonly in permanent teeth, whereas periodontal tissue injuries were more commonly seen in primary teeth (p<0.05).

Table 4. Distribution of traumatic dental injuries according to etiology and tooth type

Etiology	Primary teeth (n=274)						Permanent teeth (n=367)					
	Maxillary			Mandibular			Maxillary			Mandibular		
	Central incisor	Lateral incisor	Canine	Central incisor	Lateral incisor	Canine	Central incisor	Lateral incisor	Canine	Central incisor	Lateral incisor	Canine
Fall	127	22	4	12	9	7	112	10	1	12	5	1
Play	16	3	0	7	2	0	64	8	0	1	0	0
RTA	26	8	3	1	1	1	42	14	6	2	1	0
Bicycle	9	1	1	0	0	0	22	7	0	1	1	1
Tube well	8	0	0	2	0	0	20	1	0	2	0	0
IPV	2	0	0	0	0	0	25	2	0	4	0	0
Animal	1	0	1	0	0	0	0	0	0	2	0	0
Total	189	34	9	22	12	8	285	42	7	24	7	2

Table 5. Distribution of types of traumatic injuries according to primary and permanent tooth

Type of TDI	Primary teeth		Permanent teeth		Total	
	n	%	n	%	n	%
Hard tissue injuries						
Enamel infraction/Enamel fracture	17	6.2	53	14.4	70	10.9
Enamel-dentin fracture	12	4.4	71	19.3	83	12.9
Complicated crown fracture	42	15.3	46	12.5	88	13.7
Uncomplicated crown-root fracture	3	1.1	17	4.6	20	3.1
Complicated crown-root fracture	23	8.4	8	2.2	31	4.8
Root fracture	4	1.5	3	0.8	7	1.1
Periodontal tissue injuries						
Concussion	3	1.1	0	0	3	0.5
Subluxation	60	21.9	59	16.1	119	18.6
Intrusion	25	9.1	17	4.6	42	6.6
Extrusion	19	6.9	23	6.3	42	6.6
Lateral luxation	18	6.6	30	8.2	48	7.5
Avulsion	48	17.5	40	10.9	88	13.7
Total	274	42.7	367	57.3	641	100

Table 6 shows the distribution of patients according to the number of teeth affected with TDI. In 47% (N=78) of children, only one primary tooth was affected. Similarly, 46.5% (N=100) of children had only one affected permanent tooth.

Table 6. Distribution of patients according to number of injured teeth*

Type of teeth	Single tooth fracture		Two teeth fracture		Three Teeth fracture		Four Teeth fracture		Five Teeth fracture		Total Teeth fracture	
	n	%	n	%	n	%	n	%	n	%	n	%
Primary	78	47	73	44	10	6	5	3	0	0	166	100
Permanent	100	46.5	84	39	27	12.5	2	1	2	1	215	100

* n – number of children with dental trauma

Discussion

Dental traumas are more common in children and adolescents, primarily due to factors such as their active lifestyles, risk-taking behaviors and participation in sports. Engaging in sports and recreational activities exposes them to a heightened risk of accidents, including those impacting their teeth. Furthermore, since children are still refining their motor skills and coordination, they may be more susceptible to accidents such as falls and collisions.

This study findings reveal a higher incidence of TDIs in males compared to females, regardless of the dentition involved. This is in agreement with results of previous studies indicating a higher incidence of TDIs in males.¹⁴⁻¹⁶ The male to female ratio of 1.6:1 suggests that males may be more vulnerable to dental trauma due to differences in behavior, physical activity levels, and risk-taking tendencies. Additionally, the gender ratio in favor of males increased progressively with age in this survey. Accord-

ing to Collao-González et al. the less marked gender difference in preschool children might be due to age-related childhood activities.¹⁷ On the other hand, greater male predominance in TDI in older children and adolescents may be due to their increased engagement in outdoor activities, sports, and incidents involving violence

Consistent with previous studies, falls were identified as the leading cause of dental trauma, in this survey although the percentage of falls as a cause of dental trauma tends to decrease from younger to older children.^{17,18} Younger children, especially preschoolers, are still developing their motor skills and coordination. They are more prone to tripping, stumbling, or falling due to their limited balance and coordination compared to older children. The finding that falls were the primary cause of dental trauma underscores the importance of creating safe environments and promoting injury prevention measures, particularly in settings where children are prone to falls, such as playgrounds and sports facilities. Educating parents, caregivers, and teachers about potential risks and implementing safety measures can help reduce the occurrence of falls and subsequently lower the incidence of TDIs.

The maxillary central incisors were identified as the most frequently affected teeth in both primary and permanent dentitions, consistent with previous research, highlighting their vulnerability to trauma.¹⁹ The anterior teeth, especially the maxillary central incisors, are more exposed and prominent, making them more susceptible to direct trauma. In contrast, primary teeth are often more protected by surrounding soft tissues and the position of the lips, offering some level of safeguard against external forces. The longer lifespan of permanent teeth exposes them to a greater cumulative risk of trauma over time. As individuals age, the likelihood of exposure to traumatic events increases, contributing to a higher incidence of permanent tooth fractures.

The study also investigated the types of dental injuries observed. Luxation injuries were the most common type in the primary dentition. This is consistent with previous studies highlighting the increased mobility of primary teeth, making them more prone to displacement without fracture.¹⁹⁻²² Complicated crown fractures were the most common type of injury in the permanent dentition. Complicated crown fractures consist of both crown fracture and pulp involvement, indicating a more severe form of dental trauma. The higher prevalence of complicated crown fractures in the permanent dentition can be attributed to the increased strength and rigidity of permanent teeth.

Additionally, this study found a lower prevalence of adequate lip coverage compared to studies conducted in Iraq.²³ Adequate lip coverage was observed in 45.9% of children in the study. This finding shows the need for awareness and education regarding the prevention

of TDIs. Adequate lip coverage can act as a protective cushion during falls or accidents, reducing the impact on the anterior teeth. Promoting lip protection during physical activities, sports, and play can help minimize the risk of dental injuries.¹⁷⁻²⁵

Approximately 53% of the participants in this study experienced dental trauma involving two or more affected teeth, aligning closely with the findings of Choi et al.²⁶ This outcome highlights detrimental impact of dental trauma on multiple adjacent teeth.

This study has some limitations. Firstly, the survey was conducted in a single dental hospital in Kolkata, India, which may limit the generalizability of the findings to a broader population. Additionally, potential biases in retrospective data, age group specificity, exclusion of patients with syndromes, craniofacial anomalies, neuromuscular diseases, physical, or mental retardation may also affect the representation of certain demographic groups. Finally, the use of a hospital-based sample may introduce a bias towards more severe cases, potentially underrepresenting milder or less severe dental injuries in the community. These limitations should be considered when interpreting the results and may guide future research for a more comprehensive understanding of traumatic dental injuries in diverse populations.

Conclusion

Based on the study's objective and the results obtained, several key conclusions can be drawn:

Male predominance in dental trauma: The study revealed a higher incidence of traumatic dental injuries (TDIs) in males, with a male-to-female ratio of 1.6:1.

Falls as a primary cause: Falls were identified as the leading cause of dental trauma, contributing to more than half of the cases (52.2%).

Vulnerability of anterior teeth: The maxillary central incisors were found to be the most frequently affected teeth, both in primary (69%) and permanent dentitions (77.7%).

Types of dental injuries: The study categorized the types of dental injuries observed, with luxation injuries being the most common in primary dentition (63.1%) and complicated crown fractures predominating in permanent dentition (53.9%). These findings underscore the differences in the nature of dental injuries between primary and permanent teeth, with primary teeth being more prone to displacement without fracture and permanent teeth experiencing more severe forms of dental trauma.

Declarations

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author used OpenAI/ ChatGPT in order to check grammar and spelling. After using this tool/service, the authors re-

viewed and edited the content as needed and take full responsibility for the content of the publication.

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Author contributions

Conceptualization, S.G.; Methodology, S.G.; Software, S.G.; Validation, S.G.; Formal Analysis, S.G., Investigation, S.G.; Resources, S.G.; Data Curation, S.G.; Writing – Original Draft Preparation, S.G.; Writing – Review & Editing, S.G.; Visualization, S.G.; Supervision, S.G.; Project Administration, S.G.;

Conflicts of interest

The author declares no competing interests.

Data availability

Data analyzed during the present study and/or are available from the corresponding author upon request.

Ethics approval

The Ethics Committee of Dr. R. Ahmed Dental College and Hospital (No. IEC/DCH/279 dated 28/9/2022) has granted approval for the study. Given that it was a retrospective study, obtaining informed consent from the subjects was not necessary. Furthermore, the identities of all subjects included in this work were anonymized.

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