

Anterior Dental Injuries in 8–12-year-old Schoolchildren of Yamunanagar, Northern India: A Districtwide Oral Health Survey

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ABSTRACT

Background/aim: Due to its frequency, early occurrence, and severe adverse effects, if untreated, traumatic dental injury (TDI) is a public dental health issue. The purpose of this study was to investigate the prevalence of dental injuries caused by trauma in the anterior teeth among schoolchildren of Yamunanagar (Haryana), Northern India.

Materials and methods: A sample of 11,897 schoolchildren in the age-group of 8–12 years from 36 urban/rural schools was examined for TDI using Ellis and Davey classification. Children with TDI were interviewed using a structured questionnaire and presented with validated motivational videos to educate them about dental trauma, the sequelae of unmet treatment, and to motivate them to undergo treatment. The subjects with trauma were reevaluated after 6 months to assess the percentage of subjects who have undergone treatment after motivation.

Result and conclusion: The overall prevalence of children afflicted with TDI was 6.33%. Statistically, a significant difference of $p \leq 0.001$ was noted between the percentage of boys (7.29%) and girls (4.8%) experiencing TDI. Maxillary incisors (94.3%) were the most commonly injured teeth. Falls in the playground (37.70%) were the major cause; on reevaluation, only 9.26% of the study population got their traumatized tooth treated. TDI is an existing dental problem. Motivating children at schools was found to be ineffective. There is a need to educate the parents and teachers to take appropriate preventive measures.

Keywords: Dental health, Education, Prevalence, Tooth fracture, Traumatic dental injury.

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INTRODUCTION

Due to its frequent occurrence, presentation at younger ages, and complicated and often irreversible pathology and treatment, TDI is now considered a public dental health problem. The oral region is frequently injured and makes up about 5% of all injuries warranting treatment in dental clinics and hospitals.¹ Generally, patients experiencing TDIs are in the younger age-groups during which growth and development of the dento-osseous structures take place. It accounts for about 18% of all injuries in preschool children. Treatment for TDI is often complex and expensive and often requires an interdisciplinary approach. Unlike most other traumatic injuries seen in the outpatient setting, a TDI is usually irreversible, which increases the possibility that this might result in a life-long treatment for the patient.¹

Damage to the anterior teeth of the child is often the most psychologically and emotionally impacting experience for a parent or child.² Unesthetic damage to the anterior tooth can have a negative impact on a child's self-esteem and may even affect his progress in school and daily living.³

It is often difficult to prevent injuries to oral structure in a growing child. But fortunately, it is possible to plan preventive measures that may be able to reduce the prevalence of such traumatic episodes by undertaking cross-sectional studies. Cross-sectional surveys are based on data obtained about demographic and personal characteristics, the prevalence of acute and chronic diseases, perceived healthcare needs, and the utilization of healthcare services.

Despite it being a major global public health concern, there is limited data regarding the epidemiology of traumatic dental injuries and of the causes of TDI to prioritize the factors that should be addressed. This study aims to provide a more detailed insight

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into the factors and content related to TDI in India. There is no information on the prevalence of dental trauma in the Yamunanagar district of Haryana.

For this reason, this study was performed with an aim to determine the prevalence of treated and untreated cases of anterior tooth trauma among 8–12-year-old schoolchildren in Yamunanagar district of Haryana, Northern India, and to investigate the presence of any predilection in either of sex along with the impact of motivational interviews (audiovisual and verbal) in encouraging the patient to pursue treatment.

MATERIALS AND METHODS

District Yamunanagar is located in the Haryana state and is the industrial locus of Northern India. Over the past 30 years, it has expanded geographically as well as culturally. This district, because of its economic growth, attracts people from all over India; hence in a way represents “mini-India.” Administratively, it is divided into six developmental blocks, which comprise the urban and rural populations.

A districtwide cross-sectional survey was conducted among 8–12-year-old school-going children from selected schools of all six blocks so as to include schools from all geographical directions. Further, to ensure the participation of children from all socioeconomic groups, the schools from each block were divided into three categories as low, middle, and high, as per their school fees.^{4,5} Two schools in each category were selected randomly from each block. Thus, the study represents a population that includes children attending 36 schools selected from the district Yamunanagar, Haryana.

Prior to the commencement of the survey, ethical approval, and official permission were sought from the Institutional Ethical Committee and District Education Officer Yamunanagar, respectively. An information letter/informed consent regarding the objective of the survey and its importance, oral examination procedure, and date and time of the examination was delivered to the parents/guardians of the children of the selected schools through their class teachers. This form was collected from the respective class teachers on the day of the examination.

A single calibrated examiner performed the examination on the school premises in natural daylight using sterilized diagnostic instrument kits. A full mouth oral examination was done for all the children, and oral hygiene instructions were given to them. The traumatic injuries to the teeth were recorded using the (1960) classification.^{6–9} However, Ellis and Davey’s type VI fracture was not included in the survey as there were no provisions for dental radiographs in the in-school field conditions. Children were then interviewed for the history of the injury, and information concerning the etiology of traumatic injury, the number of injured teeth, and the class of the teeth involved were recorded through a trauma assessment form using a structured questionnaire.¹⁰ After the oral examination, children were shown a validated motivational video so as to educate them about dental trauma, sequelae of unmet treatment, emergency first aid measures, all the treatment options available, and to motivate the patients with trauma to get their treatment done. In addition, to evaluate the impact of motivational interviews, all the students with trauma were reevaluated after 6 months so as to ensure that how many patients got the treatment done.

The statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) version 17.0. The Chi-squared test was carried out to compare qualitative data and to determine

statistical significance, which was predetermined at a probability value of 0.05 or less.

RESULTS

Out of 11,897 students examined during the survey, 7,196 (60.48%) were males, and 4,701 (39.52%) were females. The mean prevalence of TDI was noted to be 6.33% (754/11,897). Among the affected study population, 7.29% were males as compared to 4.8% of females (*p*-value ≤ 0.001*) (Table 1).

Prevalence rates were found to be 11.1% at age 8, 12.3% at the age of 9, 17.1% at the age of 10, 19% at age 11, and 40.5% at the age of 12 years; it was noted that the difference was statistically highly significant ($\chi^2 = 141.93$, *p*-value ≤ 0.001**) (Fig. 1).

Treated cases of trauma were only found to be 1.2% (Fig. 2). Maxillary teeth (94.3%) were affected more by dental trauma than mandibular teeth (5.18%), and the right maxillary central incisor (52.50%) was most commonly involved by a dental trauma (Fig. 3). A high prevalence was seen in children with high socioeconomic status (Table 2).

Simple crown fracture (54.3%) was the most commonly occurring type of dental trauma encountered in the study population (Table 3). The most common type of dental trauma was single tooth injury (76.80%). The average number of teeth showing traumatic injury per patient was found to be 1.25 in the study population (Fig. 4).

The school (35.50%) was the commonest site of dental trauma, followed by home (29.70%), unknown (17.20%), roadside (10.1%), street (4.8%), park (2.4%), and party lawn (0.3%) and the difference were statistically significant (Table 4).

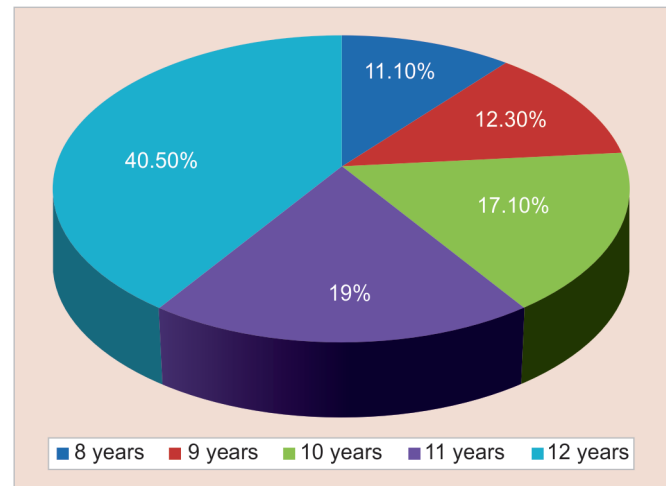


Fig. 1: Distribution of TDI according to age

Table 1: Prevalence and male:female ratio for dental injuries to permanent anterior teeth in schoolchildren (*n* = 11,897) aged 8–12 years (Yamunanagar, 2013)

Gender	Dental injury		Total <i>n</i> (%)	Boys:girls ratio	<i>p</i> -value
	Yes, <i>n</i> (%)	No, <i>n</i> (%)			
Boys	525 (7.29)	6,671 (92.70)	7,196 (60.48)	2.2:1	<0.001**
Girls	229 (4.8)	4,472 (95.12)	4,701 (39.51)		
Total	754 (6.33)	11,143 (93.67)	11,897 (100%)		

*Chi-squared test

Falls in a playground (37.70%) were the main cause of dental trauma, followed by an unknown cause, that is, no obvious reason/missing information (17.40%), bicycling (16.8%), violence (8.1%), fall from stairs (8%), collision (6.7%), traffic accident (4.4%), and fall from terrace without fencing (0.9%) and the difference was statistically significant (Table 5).

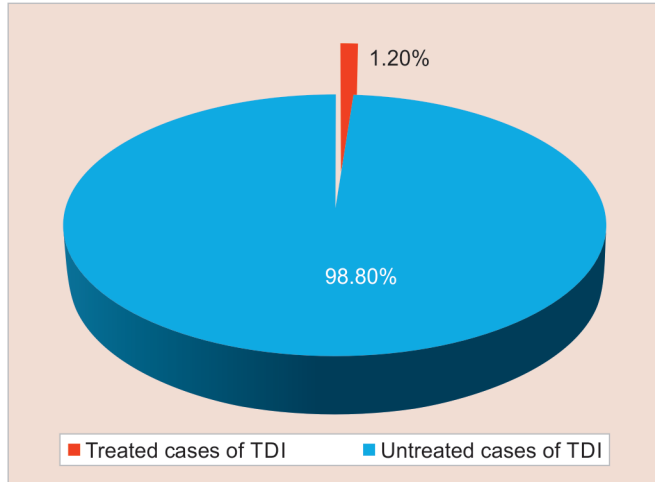


Fig. 2: Treated and untreated cases of dental trauma

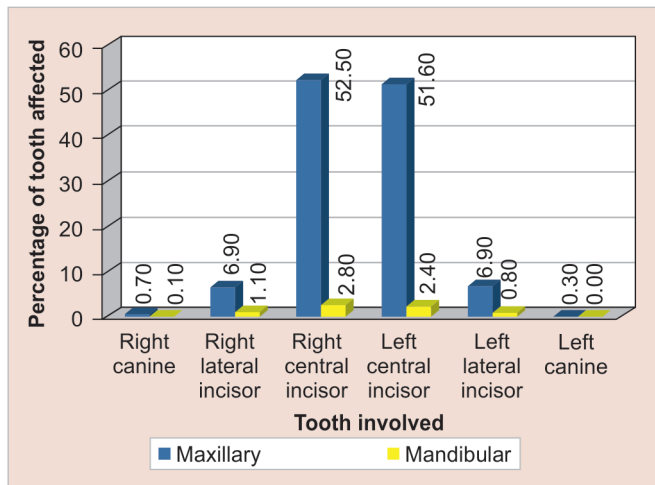


Fig. 3: Distribution of fracture according to type of teeth involved

Lack of awareness (44.29%), followed by lack of any pain or discomfort (24.16%) at the time of dental trauma, was found to be the chief reason for the unmet treatment (Fig. 5).

About 58.92% study population didn't visit any dentist/doctor when they had experienced dental trauma. Rather, a high prevalence of self-medication was observed among the traumatized children (Fig. 6).

Around 66.84% study population felt that their smile was compromised due to a lack of treatment at the time of dental trauma (Fig. 7).

Leave the tooth as such on the ground (34.5%) was the most common reply by the study population when asked what they did to a broken tooth (Fig. 8).

On reevaluation after 6 months regarding the impact of motivational (video + verbal) interviews, it was found that only 69 (9.26%) of the study population got their treatment done for the traumatized tooth after watching motivational videos, whereas 676 (90.74%) still remained untreated (Fig. 9).

DISCUSSION

Existing literature demonstrates that there is significant variation in the prevalence of TDI across various populations. This may be attributed to the variability of criteria which postulates that data comparison is difficult due to varying factors that are used to measure dental trauma. These include age range, cultural diversity, and behavioral variations between domestic and international populations. There is also a variation between urban and rural populations. A significant range is also noted in the classification of trauma, type of dentition, lifestyle and geography, and the availability of healthcare services to evaluate and treat the population.

The prevalence of traumatic dental injuries in the present study was found to be 6.33% (754/11,897) which corroborates the result of a study done by Zerman et al.¹¹ The prevalence was noted as higher as compared to earlier studies done by Esa et al.¹² (2.6%), Nik-Hussein et al.¹³ (4.1%), Gupta et al.¹⁴ (4.15%), Alonge et al.¹⁵ (5%), Rai et al.¹⁶ (5.29%), Zaragoza et al.¹⁷ (5.7%) but lower than Ingle et al.¹⁸ (11.5%), Gupta et al.¹⁹ (13.8%), Tovo et al.²⁰ (17%), and Cavalcanti et al.²¹ (21%).

As found in the present survey, more boys than girls were enrolled in schools. According to a 2011 census,²² Yamunanagar district had a population of 1,214,205, of which 646,718 were males and 567,487 were female. The literacy rates in the district were 83.84% for males and 71.38% for females. The unequal gender

Table 2: Distribution of sample and prevalence of traumatic injuries by geographical area and socioeconomic status

Variable	Number of subjects examined	Number of subjects with trauma	Prevalence (%)	p-value
Geographical area				
Urban	2,781	228	8.1	<0.001**
Suburban	1,272	46	3.7	
Rural	7,844	480	6.1	
Socioeconomic status				
High	6,138	383	6.2	0.123
Middle	3,147	193	6.1	
Low	3,366	178	5.2	
Total	11,897	754	6.33	

*Chi-squared test

Table 3: Nature of injured tooth in children

Nature of trauma	Number of injured teeth		Boys		Girls		p-value
	n	%	n	%	n	%	
Treated	9	0.9	5	0.7	4	1.4	0.04*
Class I	516	54.3	355	53.1	161	57.0	
Class II	305	32.1	213	22.4	92	32.6	
Class III	98	10.3	73	10.9	25	0.3	
Class IV	19	2	19	2.8	0	0	
Class VIII	3	0.3	3	0.4	0	0	
Total	950	100	668	100	282	100	

*Chi-squared test

Table 4: Distribution and percentage of children with traumatized anterior teeth according to a place of occurrence of trauma

Place	Children with trauma		Boys with injured teeth		Girls with injured teeth		p-value
	n	%	n	%	n	%	
Home	224	29.7	150	28.6	74	32.3	0.027*
Park	18	2.4	9	1.7	9	3.9	
Party lawn	2	0.3	1	0.2	1	0.4	
Roadside	76	10.1	64	12.2	12	5.2	
School	268	35.5	192	36.6	76	33.2	
Street	36	4.8	22	4.2	14	6.1	
Unknown	130	17.20	87	16.6	43	18.8	
Total	754	100	525	100	229	100	

*Chi-squared test

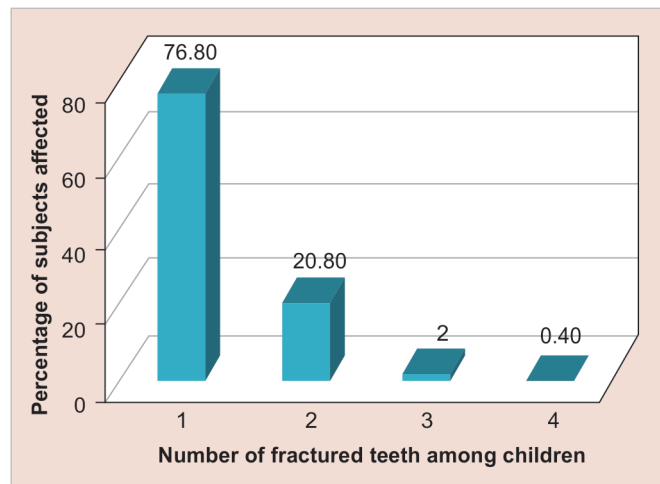


Fig. 4: Distribution according to the number of fractured teeth among children

distribution of boys (60.48%) and girls (39.52%) in our random sample of schoolchildren also reflected this.

Boys:girls ratio (dental trauma) was found to be 2.2:1. A positive association between the male gender and dental trauma had also been reported in previous studies.^{6,9,23,24} The inclination and energy of boys toward outdoor activities tend to be more. The conservative cultural and social conditions in India enforce the restricted behavior of girls.

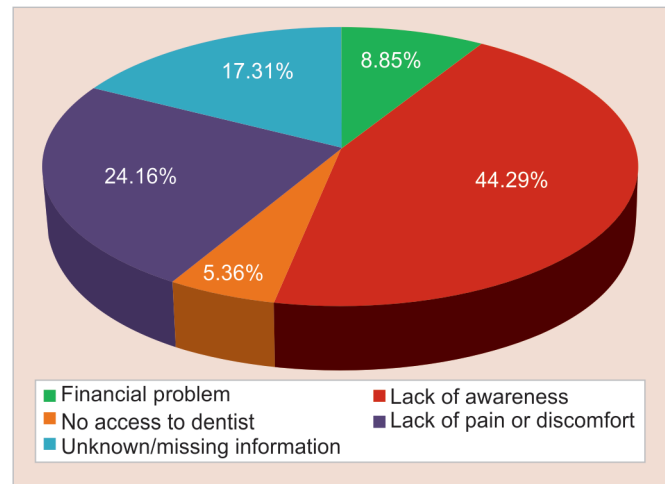


Fig. 5: Reason for unmet treatment

The studies suggested by Zadik D and Garcia Godoy, who did not find significant gender-based is an exception to this epidemiological concord.^{25,26}

The perception that girls sustain fewer injuries than boys could be challenged. As nowadays, there may be more girls getting traumatic injuries as compared to boys because of enhanced participation of girls in sports/activities previously practiced only by boys. Also, a previous Brazilian study had already indicated an increasing trend of dental trauma among girls.²⁷

Table 5: Distribution and percentage of children with traumatized anterior teeth according to etiology of sustaining trauma

Etiology	Children with trauma		Boys with injured teeth		Girls with injured teeth		p-value
	n	%	n	%	n	%	
Bicycling	127	16.8	91	17.3	36	15.7	0.014*
Collision	51	6.7	35	6.6	16	7.0	
Fall in playground	284	37.7	181	34.5	103	45.0	
Fall from stairs	60	8.0	43	8.2	17	7.4	
Fall from terrace without fencing	7	0.9	6	1.1	1	0.4	
Traffic accident	33	4.4	31	5.9	2	0.9	
Unknown	131	17.4	90	17.1	41	17.9	
Violence	61	8.1	48	9.1	13	5.7	
Total	754	100	525	100	229	100	

*Chi-squared test

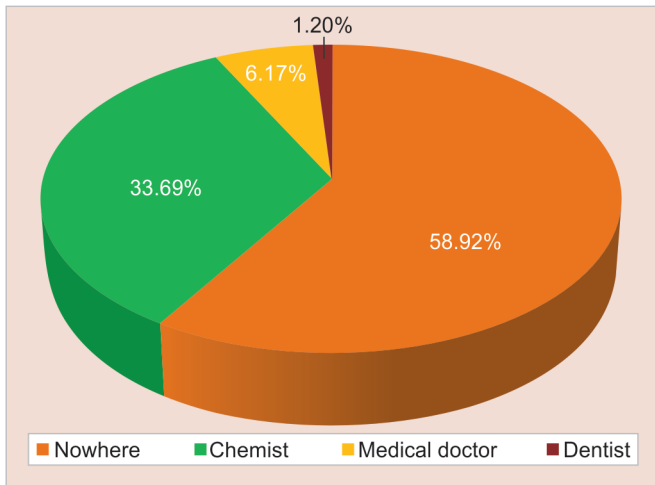


Fig. 6: Response of subject to where did you go when you hurt your teeth

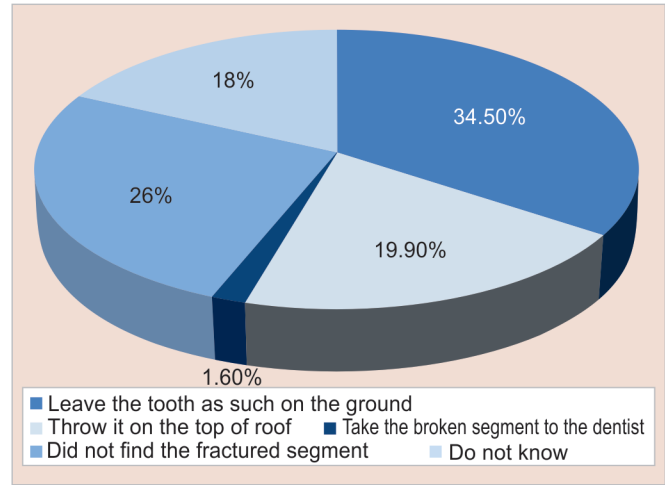


Fig. 8: Response of subjects when asked what they did to a broken tooth

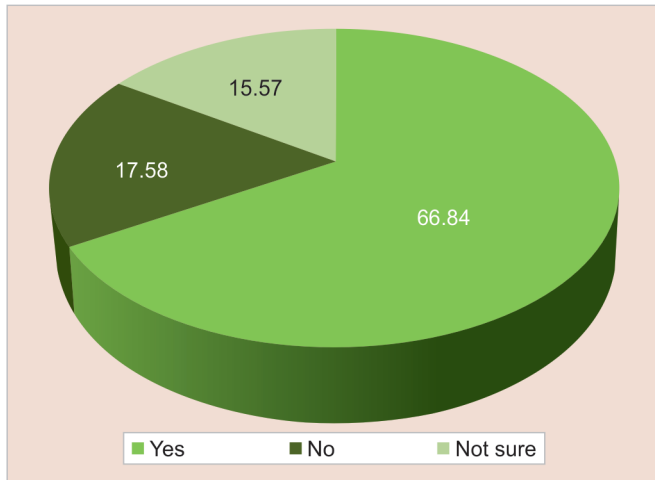


Fig. 7: Response of study population when asked if they thought their smile is compromised due to lack of treatment at the time of the accident

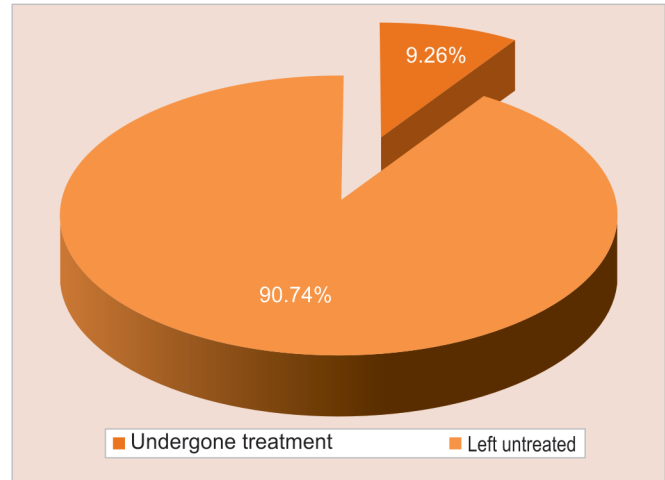


Fig. 9: On reevaluation after 6 months

While analyzing dental trauma cases in relation to age, we found a statistically high notable difference and an increase in the distribution of cases was observed (p -value ≤ 0.001). A number of national and international studies demonstrated this

value.^{7,23,28-31} The highest incidence of injury was shown in the study at 11-12 years of age. The characteristics of traumatic injuries mean that the measurement of this type of dental injury is cumulative, and the factor that the prevalence of dental injury increased with age did not mean that the aged were the most susceptible.

A high prevalence was seen in children with high socioeconomic status. This is in agreement with the study conducted by Cortes et al.,²⁸ Grimm et al.,³⁰ and Marcenes et al.³² Besides this, socioeconomic status was also added in their analysis, in turn making a better comparison of results difficult.

Further, there have been conflicting results in a few studies that address the relationship between dental trauma and socioeconomic conditions. A study conducted by Hamilton et al.³³ observed that children with higher socioeconomic levels were less prone to traumatic injuries when compared to children with low socioeconomic levels.

Despite the Ellis and Davey classification being an old one, we use it due to its simplicity. We preferred to use simple classification instead of Andreason's as the sample size of the present study was large, and we did not evaluate injuries to the alveolar socket and fractures of the jaws, or laceration of the gingival or oral mucosa. Because of its ease of use, numeric notation, and accuracy in assessing anterior coronal fractures, the classification was preferred.³⁴

The study population showed that Ellis class I; simple fracture of the crown (54.84%) was the most common type of dental trauma encountered. This was in accordance with earlier studies.^{6-9,35}

As dental radiographs are not available for diagnosis in the in-school field conditions root fractures (class VI) were not recorded in the present study.

The majority of patients (76.8%) presented with only one affected tooth although Wright et al.³⁶ found the majority of dental trauma to affect multiple teeth. 1.25 was the number of injured teeth per patient in this study. The variation in previous reports.^{29,35} has been from 1.1 to 1.97.

The right maxillary central incisors (52.5%) were more commonly involved by dental trauma.^{20,37} The maxillary lower incisors are generally less proclined than central incisors and have a tendency to be first to receive a direct blow producing a fracture, that is, the vulnerable position of maxillary central incisors. The maxillary lateral incisors were second post prone to trauma. In the present study and in all the studies conducted so far, 37.70% of the study population had dental trauma by falls on the playground. There was one exception by Forsberg and Tedestam³⁸ where mandibular central incisors were the second most frequently traumatized teeth.

In the current study and in all the studies conducted so far, they asked the participants to specify the cause of the dental injury. The percentage recorded was distributed as; falls in a playground, falls from stairs, and falls from a terrace without fencing. The second most common cause was unidentified, that is, no obvious reason. Since it was a retrospective study in nature and several children did not remember the origin of the dental trauma.

One of the major flaws of retrospective studies is the recall bias due to which there is a high proportion of adolescents that answered the cause.³⁹ It was specifically said to occur in children and adolescents when they have to record the cause of TDI. This might also explain the high proportions of adolescents that answered unknown questions about the cause of TDI. In addition to this, there was one more explanation which could be that the real cause of their TDI might have been violence which they did not want to expose. The higher prevalence of modest injuries (enamel fractures) found in this study can also be explained. Some children may not recollect the traumatic event as the severity of the injury must have been less.

Leave the tooth as such on the ground (34.5%) was the most common reply by the study population when asked what they did to a broken tooth segment. This might be due to a lack of awareness or careless attitude of the study population toward their oral health.

Maximum subjects (58.22%) went nowhere when they had trauma, whereas (33.20%) subjects went to a chemist, then to a medical doctor (6.1%), and the least people went to a dentist (1.10%). This might be due to the lack of access to a dental clinic near the place of residence in rural areas compared to urban areas.

Around 66.84% of untreated subjects responded yes among the study population, that is; they felt that their smile was compromised due to fractured anterior teeth and lack of treatment. This might be due to the reason that children 6–12-year-old develop a sense of self within themselves. Montessori⁴⁰ described this period as the "construction of intelligence." Children and teenagers who had experienced traumatic events may simply find it difficult to cope with interpersonal stress. So, they might feel that their smile was compromised due to fractured anterior teeth.

One of the aims of epidemiological studies should also be to help the children to get educated and motivated for the appropriate treatment. As video-based learning is the medium of learning for today's generation. This is the only study so far that included both visual as well as verbal motivational approaches.

Despite free consultation and treatment backup, the study had shown a shocking revelation that dental awareness was very low, as evident in the number of children (9.26%) who got the treatment done, whereas 90.74% still remained untreated when evaluated after 6 months. There was therefore high unmet treatment need.

The attitude of parents toward the treatment of injured teeth was not great. This is a sign that our society patients and parents do not give importance to traumatic dental injuries and have a tendency of consulting dental hospitals after the time had elapsed or wait until they had acute symptoms of inflammation or esthetic concerns. There was a lack of effort to find opportunities by parents/guardians who had not tried to find therapeutic opportunities if their dependents suffered crown fractures.

CONCLUSION

Awareness about preventive and treatment aspects of traumatic dental injuries and the importance of immediate attendance for dental treatment should be encouraged among children, their parents, and schoolteachers. In order to minimize the effect of traumatic dental injuries, the knowledge of dental practitioners should be improved.

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ETHICAL APPROVAL

Prior to the commencement of the survey, ethical approval and official permission were sought from the Institutional Ethical Committee and District Education Officer Yamunanagar, respectively.

REFERENCES

1. Glendor U. Epidemiology of traumatic dental injuries—a 12 year review of the literature. *Dent Traumatol* 2008;24(6):603–611. DOI: 10.1111/j.1600-9657.2008.00696.x
2. Stockwell AJ. Incidence of dental trauma in the Western Australian School Dental Service. *Community Dent Oral*

- Epidemiol 1988;16(5):294–298. DOI: 10.1111/j.1600-0528.1988.tb01779.x
3. Cortes MI, Marcenes W, Sheiham A. Impact of traumatic injuries to the permanent teeth on the oral health-related quality of life in 12–14-year-old children. *Community Dent Oral Epidemiol* 2002;30(3):193–198. DOI: 10.1034/j.1600-0528.2002.300305.x
 4. Thelen DS, Bårdsen A. Traumatic dental injuries in an urban adolescent population in Tirana, Albania. *Dental Traumatol* 2010;26(5):376–382. DOI: 10.1111/j.1600-9657.2010.00918.x
 5. Goyal A, Gauba K, Chawla HS, et al. Epidemiology of dental caries in Chandigarh school children and trends over the last 25 years. *J Indian Soc Pedod Prevent Dent* 2007;25(3):115–118. DOI: 10.4103/0970-4388.36559
 6. Traebert J, Peres MA, Blank V, et al. Prevalence of traumatic dental injury and associated factors among 12-year-old school children in Florianopolis, Brazil. *Dent Traumatol* 2003;19(1):15–18. DOI: 10.1034/j.1600-9657.2003.00138.x
 7. Zuhail K, Semra OEM, Huseyin K. Traumatic injuries of the permanent incisors in children in southern Turkey: a retrospective study. *Dent Traumatol* 2005;21(1):20–25. DOI: 10.1111/j.1600-9657.2004.00265.x
 8. Granville-Garcia AF, de Menezes VA, de Lira PI. Dental trauma and associated factors in Brazilian preschoolers. *Dent Traumatol* 2006;22(6):318–322. DOI: 10.1111/j.1600-9657.2005.00390.x
 9. Navabazam A, Farahani SS. Prevalence of traumatic injuries to maxillary permanent teeth in 9–14 year old school children in Yazd, Iran. *Dent Traumatol* 2009;26(2):154–157. DOI: 10.1111/j.1600-9657.2009.00861.x
 10. World Health Organization. Oral health surveys: basic methods. 4th edition. WHO: Geneva; 1997.
 11. Zerman N, Cavalleri G. Traumatic injuries to permanent incisors. *Endod Dent Traumatol* 1993;9(2):61–64. DOI: 10.1111/j.1600-9657.1993.tb00661.x
 12. Esa R, Razak IA. Traumatized anterior teeth in a sample of 12–13-year-old Malaysia school children. *Annals Dent Univ Malaya* 1996;3(1):5–9. DOI: 10.22452/adum.vol3no1.2
 13. Nik-Hussein NN. Traumatic injuries to anterior teeth among school children in Malaysia. *Dental Traumatol* 2001;17(4):149–152. DOI: 10.1034/j.1600-9657.2001.170402.x
 14. Gupta S, Jindal SK, Bansal M, et al. Prevalence of traumatic dental injuries and role of incisal overjet and inadequate lip coverage as risk factors among 4–15 years old government school children in Baddi-Barotiwala area, Himachal Pradesh, India. *Med Oral Patol Oral Cir Bucal* 2011;16(7):e960–e965. DOI: 10.4317/medoral.17265
 15. Alonge OK, Narendaran S, Willaamson DP. Prevalence of fractured incisal teeth among children in Harris County, Texas. *Dent Traumatol* 2001;17(5):218–221. DOI: 10.1034/j.1600-9657.2001.170506.x
 16. Rai S, Munshi AK. Traumatic injuries to the anterior teeth among South Kanara school children—a prevalence study. *J Indian Soc Pedod Prev Dent* 1998;16(2):44–51. PMID: 11813754
 17. Zaragoza AA, Catala M, Colmena ML, et al. Dental trauma in schoolchildren six to twelve years of age. *J Dent Child* 1998;65(6):492–494. PMID: 9883326
 18. Ingle NA, Baratam N, Charania Z. Prevalence and factors associated with traumatic dental injuries (TDI) to anterior teeth of 11–13 year old school going children of Maduravoyal, Chennai. *J Oral Health Community Dent* 2010;4(3):55–60. DOI: 10.5005/johcd-4-3-55
 19. Gupta K, Tandon S, Prabhu D. Traumatic injuries to the incisors in children of south Kanara District, a prevalence study. *J Indian Soc Pedod Prev Dent* 2002;20(3):107–113. PMID: 12435009
 20. Tovo MF, Dos Santos PR, Kramer PF, et al. Prevalence of crown fractures in 8–10 years old schoolchildren in Canoas, Brazil. *Dent Traumatol* 2004;20(5):251–254. DOI: 10.1111/j.1600-9657.2004.00253.x
 21. Cavalcanti AL, Bezerra PK, de Alencar CR, et al. Traumatic anterior dental injuries in 7- to 12-year-old Brazilian children. *Dental Traumatology* 2009;25(2):198–202. DOI: 10.1111/j.1600-9657.2008.00746.x
 22. Directorate of Census. Operations and census officials in Yamunanagar District of Haryana. <http://yamunanagar.nic.in/ynr/default.asp>. Last assessed on November 30th, 2013.
 23. Marcenes W, Alessi ON, Traebert J. Causes and prevalence of traumatic injuries to the permanent incisors of schoolchildren aged 12 years in Jaraguá do Sul, Brazil. *Int Dent J* 2000;50(2):87–92. DOI: 10.1002/j.1875-595x.2000.tb00804.x
 24. Rajab LD. Traumatic dental injuries in children presenting for treatment at the Department of Pediatric Dentistry, University of Jordan, 1997–2000. *Dent Traumatol* 2003;19(1):6–11. DOI: 10.1034/j.1600-9657.2003.00131.x
 25. Zadik D. A survey of traumatized primary anterior teeth in Jerusalem preschool children. *Community Dent Oral Epidemiol* 1976;4(4):149–151. DOI: 10.1111/j.1600-0528.1976.tb00973.x
 26. Garcia-Godoy FM. Prevalence and distribution of traumatic injuries to the permanent teeth of Dominican children from private schools. *Community Dent Oral Epidemiol* 1984;12(2):136–139. DOI: 10.1111/j.1600-0528.1984.tb01426.x
 27. Rocha MJC, Cardoso MJC. Traumatized permanent teeth in Brazilian children assisted at the Federal University of Santa Catarina, Brazil. *Dent Traumatol* 2001;17(6):245–249. DOI: 10.1034/j.1600-9657.2001.170601.x
 28. Cortes MI, Marcenes W, Sheiham A. Prevalence and correlates of traumatic injuries to the permanent teeth of schoolchildren aged 9–14 years in Belo Horizonte, Brazil. *Dent Traumatol* 2001;17(1):22–26. DOI: 10.1034/j.1600-9657.2001.170105.x
 29. Saroglu I, Sonmez H. The prevalence of traumatic injuries treated in the pedodontic clinic of Ankara University, Turkey, during 18 months. *Dent Traumatol* 2002;18(6):299–303. DOI: 10.1034/j.1600-9657.2002.00093.x
 30. Grimm S, Frazao P, Antunes JLF, et al. Dental injury among Brazilian schoolchildren in the state of Sao Paulo. *Dent Traumatol* 2004;20(3):134–138. DOI: 10.1111/j.1600-4469.2004.00238.x
 31. Soriano EP, Caldas Jr AF, Goes PSA. Risk factors related to traumatic dental injuries in Brazilian schoolchildren. *Dent Traumatol* 2004;20(5):246–250. DOI: 10.1111/j.1600-9657.2004.00246.x
 32. Marcenes W, Zabot NE, Traebert J. Socio-economic correlates of traumatic injuries to the permanent incisors in schoolchildren aged 12 years in Blumenau, Brazil. *Dent Traumatol* 2001;17(5):222–226. DOI: 10.1034/j.1600-9657.2001.170507.x
 33. Hamilton FA, Hill FJ, Holloway PJ. An investigation of dento-alveolar trauma and its treatment in an adolescent population. Part 1: the prevalence and incidence of injuries and the extent and adequacy of treatment received. *Br Dent J* 1997;182(3):91–95. DOI: 10.1038/sj.bdj.4809313
 34. Ellis RG. The classification and treatment of injuries to the teeth of children, 5th edition Chicago: Year Book Medical Publishers 1970;56:199.
 35. Kargul B, Caglar E, Tanboga I. Dental trauma in Turkish children, Istanbul. *Dent Traumatol* 2003;19(2):72–75. DOI: 10.1034/j.1600-9657.2003.00091.x
 36. Wright G, Bell A, McGlashan G, et al. Dentoalveolar trauma in Glasgow: an audit mechanism and injury. *Dent Traumatol* 2007;23(4):226–231. DOI: 10.1111/j.1600-9657.2006.00430.x
 37. Ozen B, Cakmak T, Altun C, et al. Prevalence and etiology of dental trauma in children aged 2–15 in the Eastern Black Sea region of Turkey. *J Int Dent Med Res* 2010;3(3):126–132.
 38. Forsberg CM, Tedestam G. Traumatic injuries to teeth in Swedish children living in an urban area. *Swed Dent J* 1990;14(3):115–122.
 39. Bastone EB, Freer TJ, McNamara JR. Epidemiology of dental trauma: a review of the literature. *Australian Dent J* 2000;45(1):2–9. DOI: 10.1111/j.1834-7819.2000.tb00234.x
 40. Diane E Papalia. Textbook of Human Development. Mcgraw Hill Publication, 9th Edition, 2003; Ch-1.

