Prevalence of Traumatic Dental Injuries to Permanent Incisors Among 12-year-old School Children in Davangere, South India

Telgi Lingesh RAVISHANKAR[1], Mohapatra Ashok KUMAR[2], Ramesh NAGARAJAPPA[3], Telgi Ravishankar CHAITRA[4]

Objective: *To assess the prevalence and factors associated with traumatic injuries to permanent incisors of 12-year-old school children in Davangere, India.*
Methods: *In total, 1020 12-year-old school children were selected. Two trained and calibrated clinicians examined the children in the school environment using the World Health Organization Classification of Tooth Fracture (1978). Examination was also done for lip coverage and maxillary overjet using the Community Periodontal Index probe. Children were then interviewed using a structured questionnaire for demographic data and history of the injury.*
Results: *The overall prevalence rate of traumatic dental injuries (TDI) to permanent incisor teeth was 15.1%. The prevalence of TDI was higher in boys compared to girls. The major cause of TDI was falling followed by collision. The maxillary incisors were commonly injured, involving mainly enamel fracture. Children with excessive overjet and inadequate lip coverage were more likely to have injuries.*
Conclusion: *TDI could be a serious dental public health problem among children. Thus, there is an urgent need to collect local data on dental injuries in order to obtain a more comprehensive picture of dental health.*

Key words: *traumatic dental injuries (TDI), overjet, tooth fracture*

There is perhaps no single disturbance that has greater psychological impact on both the parents and children than the loss or fracture of a child's anterior teeth. This is especially so if the injury affects the permanent dentition and involves the loss of extensive tooth structure. Traumatic dental injuries (TDI) involving the anterior teeth may not only lead to restriction in biting, phonetics and aesthetics, but may have an impact on a child's personality and quality of life. The majority of dental injuries involving the anterior teeth result from simple falls, accidents, sports activities or childish pranks, which were not intended to harm[1].

Trauma that affects the hard tissue of the teeth causes pulpal and periodontal lesions, which are of great relevance to current dental practice; the magnitude of this problem is substantiated by statistical data which indicates that 6% to 34% of individuals suffer from TDI during childhood or adolescence[2,3]. Andreason and Andreason have reported that the incidence of these injuries has increased during the last 10 to 20 years and suggest that the incidence of dental trauma will soon exceed that of dental caries and periodontal diseases[4]. These figures are distressing but not surprising considering the intensity and type of traffic and sports activities seen in many countries. Moreover, an increase in

1 Department of Community Dentistry, Kothiwal Dental College & Research Centre, Uttar Pradesh, India.
2 Department of Community Dentistry, K. D. Dental College & Hospital, Mathura, Uttar Pradesh, India.
3 Department of Community Dentistry, S.G.T. Dental College, Gurgaon, Haryana, India.
4 Department of Pedodontics and Preventive Dentistry, Kothiwal Dental College & Research Centre, Uttar Pradesh, India.

Corresponding author: Dr Ravishankar TL, Department of Community Dentistry, Kothiwal Dental College & Research Centre, Kanth Road, Moradabad-244001, Uttar Pradesh, India. Tel: +919219612715; Fax: +9105912452996. E-mail: telgiravi@yahoo.com

recorded violence explains why dental injuries are on the rise and, to a certain extent, out of control[5]. Despite being a worldwide major public health problem, most studies on the epidemiology of traumatic dental injuries do not provide sufficient details of the causes of TDI to prioritise which factors should be addressed. The present study set out to give more detailed insights into the context and factors associated with TDI in India. The objective of this study was to assess the prevalence and factors associated with TDI in teeth of 12-year-old school children in Davangere, South India.

Materials and methods

A cross-sectional study was carried out involving 12-year-old school children attending schools situated within the incorporated limits of Davangere. The estimated sample size of 1012 was based on the TDI prevalence rate of 12% in the pilot study, at a confidence level of 95% and 2% acceptable error. Twenty schools were randomly selected from a list of 80 schools to make up the estimated sample size, considering a minimum of 50 to 60 students in each school. However, 1020 children, whose parents had given the informed consent, were included in the study. The study was approved by the Institutional Ethical Committee.

Two trained and calibrated clinicians examined the children in the school environment under natural daylight for TDI to anterior permanent teeth, using the World Health Organization (WHO) Classification of Tooth Fracture[6,7], including fracture of enamel only/enamel chipping, fracture of crown without pulpal involvement, fracture of crown with pulpal involvement, fracture of root, fracture of crown with root, fracture of tooth, unspecified (treated fractured teeth), luxation, intrusion or extrusion, avulsion and other injuries including laceration of oral soft tissues.

Injuries to the root such as fractures involving the cementum and root fracture were excluded, as radiographs were not taken during the clinical examination. The presence of a restoration, if accompanied by a positive history of TDI, was recorded as fracture of tooth unspecified, i.e. code 6.

Lip coverage was recorded on visual inspection as adequate if lips covered the maxillary incisors in rest position, and as inadequate if two-thirds of the crown height was exposed and visible. Measurement of maxillary overjet was made with the teeth in centric occlusion; the distance from the labio-incisal edge of the most prominent maxillary incisor to the labial surface of the corresponding mandibular incisor was measured using the Community Periodontal Index (CPI) probe, as described in the 1997 WHO basic oral health survey guidelines. The overjet findings were grouped into 2 categories: ≤ 5.5 mm and > 5.5 mm. Approximately 10% of the children were re-examined by each clinician, intra-examiner variability was satisfactory (the kappa score was 0.84).

Children were then interviewed using a structured questionnaire for the demographic data. Subjects with clinical evidence of TDI were interviewed for details of the injury event, such as the cause and place of injury, by the same two trained examiners. The data was analysed as proportions of damaged teeth and stratified by types of tooth damage. The chi-square test was used to assess any difference in the distribution of traumatic dental injuries according to the children's characteristics.

Results

A total of 1020 children (519 [51%] boys and 501 [49%] girls) were examined and interviewed for TDI. In total, 154 (15.1%) children had TDI, 97 (18.7%) were boys and 57 (11.4%) girls. The boys had a significantly higher incidence of TDI than the girls ($P < 0.001$). Children with excessive overjet and inadequate lip coverage were more likely to have TDI ($P < 0.001$, Table 1).

Each child was examined for TDI in the maxillary and mandibular anterior permanent teeth. Out of 12,240 teeth examined, there was evidence of TDI to 178 teeth (1.4%), 172 teeth in the maxillary arch and six teeth in mandibular arch. Maxillary central incisors were the most common teeth with TDI. Enamel fracture (74.1%) was the most common type of TDI in both arches, followed by 17.5% of fractures involving both enamel and dentin, and only 5% involving pulp (Table 2).

In total, 35.7% of the TDI were due to a fall. The second most frequent cause was collision and accounted for 24.6% of the TDI, followed by traffic accidents, sports incidents and violence, which altogether accounted for 20.2%. The causes of a remaining 17% were not able to be identified (Table 3).

The majority of TDI occurred at home (52%), followed by 17% outside (i.e. street/road, shops, markets, public play ground and other public places). In total, 17% of the children were not able to recollect the history (Table 4).

Discussion

The present study showed that the prevalence of TDI to anterior permanent teeth was 15.1% in 12-year-old school children in South India. This proportion of damage to teeth in the population was slightly greater than

Table 1 The prevalence of traumatic dental injuries, by gender, overjet and lip coverage.

Children's characteristics		Number	Traumatic dental injuries (%)		χ^2 value
			No injuries	With injuries	P Value
Gender	boys	519	422 (81.3)	97 (18.7)	$\chi^2 = 10.06$
	girls	501	444 (88.6)	57 (11.4)	$P < 0.001$
Overjet	>5.5 mm	269	196 (72.9)	73 (27.1)	$\chi^2 = 41.30$
	≤5.5 mm	751	670 (89.2)	81 (10.8)	$P < 0.001$
Lip coverage	adequate	934	807 (86.4)	127 (13.6)	$\chi^2 = 19.50$
	inadequate	86	59 (68.6)	27 (31.4)	$P < 0.001$
Total		1020	866 (84.9)	154 (15.1)	

Table 2 Distribution of traumatic dental injuries according to the type of fracture and tooth.

Types	Maxillary central incisors (11, 21)	Maxillary lateral incisors (12, 22)	Others (32, 31, 41, 42, 13, 23, 33, 43)	Number (%)
Enamel	124	02	06	132 (74.1)
Enamel/dentin	28	03	00	31 (17.5)
Pulpal involvement	09	00	00	09 (5.0)
Fracture unspecified	06	00	00	06 (3.4)
Total	167	05	06	178 (100)

Table 3 Traumatic dental injuries classified according to the causes of injury.

Cause of injury	Number (%)
Fall	55 (35.7)
Collision	38 (24.6)
Traffic	5 (3.3)
Sports	20 (13)
Violence	6 (3.9)
Missing information	26 (16.9)
Biting on hard objects*	4 (2.6)

*Opening bottle cap, biting metal wire/rope/pen/pencil/toys/key/necklace, etc.

Table 4 Traumatic dental injuries classified according to the place of injury.

Location/place	Number (%)
Home	80 (52)
School	22 (14)
Outside	26 (17)
Missing information	26 (17)

the 13.8% reported in the study by Gupta et al[8], but was similar to the 14.9% reported in a study conducted on NCC cadets in South India[9]. TDI in various epidemiological studies differs considerably, ranging from 6% to 34% depending upon the trauma classification, the dentition, and the geographical and behavioural differences between study locations and countries[7]. The prevalence of TDI was higher in boys compared to girls. This could be attributed to the reason that boys are more inclined towards vigorous activities[10]. The restricted behaviour of girls enforced by conservative parents due to cultural and social conditions in India can be added to the possible factors.

It was observed that most of the TDI occurred at home, followed by outside, i.e. on streets, markets, public play grounds, etc. This may be related to the chil-

dren spending approximately 60% of their time at home rather than in school or at the playground[8]. The lower incidence in school may be because of the supervision of school authorities[11]. The two most common causes of TDI were falls and collisions in the present study. These results were similar to previous studies[11,12,13]. However, the cause of TDI could not be identified in 17% of the TDI children. This high percentage of unknown causes may be related to unreported violence, particularly domestic[12]. It was also likely that the children were simply not able to recall the history of the injury, and this was particularly true when the fractures were small and involved only enamel.

In the present study, it was also shown that the maxillary central incisors were the most common teeth with TDI and the enamel fracture was the most common type of fracture, similar to the results of previous studies[7,8,14,15]. The type of fractures in this study showed some differences with other studies. This may be due to the different criteria used and also the location where the study was conducted, i.e. in the hospital or in the field[16]. The anatomic factors of incisal overjet beyond 5.5 mm and inadequate lip coverage were important risk predictors, similar to earlier observations[17]. However, it was different from Burden[18] and Baldava and Anup[9], who found lip coverage to be the greatest single predictor of TDI. Early orthodontic treatment in predisposed children may be an effective preventive strategy. Protective devices such as mouth guards also may help reduce the incidence and severity of dental injuries during contact sports[19]. Improvements in the physical environment, closer supervision of children and adoption of health safety policies are likely to have a positive impact on the prevention of traumatic dental injuries.

References

1. Forsberg CM, Tedestam G. Etiological and predisposing factors related to traumatic injuries to permanent teeth. Swed Dent J 1993;17:183-190.
2. Hamilton FA, Hill FJ, Holloway PJ. An investigation of dentoalveolar trauma and its treatment in an adolescent population. Part I: the prevalence and incidence of injuries and the extent and adequacy of treatment received. Br Dent J 1997;182:91-95.
3. Burton J, Pryke L, Rob M, Lawson JS. Traumatized anterior teeth amongst high school students in Northern Sydney. Aust Dent J 1985;30:346-348.
4. Andreason JO, Andreason FM. Textbook and color atlas of traumatic injuries to the teeth, ed 3. Copenhagen: Munksgaard Publishers, 1994.
5. Davis GT, Knott SC. Dental trauma in Australia. Aust Dent J 1984;29:217-221.
6. World Health Organization. Application of International Classification of Diseases to dentistry and stomatology (ICD-DA). Geneva: World Health Organization, 1978: 88-89.
7. Bastone EB, Frer TJ, McNamara JR. Epidemiology of dental trauma. A review of the literature. Aust Dent J 2000;45:2-9.
8. 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; 20:107-113.
9. Baldava P, Anup N. Risk factors for traumatic dental injuries in an adolescent male population in India. J Contemp Dent Pract 2007;8:35-42.
10. Hunter ML, Hunter B, Kingdon A, Addy M, Dummer PM, Shaw WC. Traumatic injury to maxillary incisor teeth in a group of South Wales school children. Endod Dent Traumatol 1990;6:260-264.
11. Malikaew P, Watt RG, Sheiham A. Prevalence and factors associated with traumatic dental injuries (TDI) to anterior teeth of 11-13 year old Thai children. Community Dent Health 2006;23:222-227.
12. Marcenes W, Murray S. Social deprivation and traumatic dental injuries among 14-year-old schoolchildren in Newham, London. Dent Traumatol 2001;17:17-21.
13. Nicolau B, Marcenes W, Sheiham A. Prevalence, causes and correlates of traumatic dental injuries among 13-year-olds in Brazil. Dent Traumatol 2000;17:213-217.
14. Nik-Hussein NN. Traumatic injuries to anterior teeth among school children in Malaysia. Dent Traumatol 2001;17:149-152.
15. Petti S, Taristani G. Traumatic injuries to anterior teeth in Italian school children: prevalence and risk factors. Endod Dent Traumatol 1996;12:294-297.
16. Zerman N, Cavalleri G. Traumatic injuries to permanent incisors. Endod Dent Traumatol 1993;9:61-64.
17. Sgan-Cohen HD, Megnagi G, Jacobi Y. Dental trauma and its association with anatomic, behavioral and social variables among fifth and sixth grade school children in Jerusalem. Community Dent Oral Epidemiol 2005;33:174-180.
18. Burden DJ. An investigation of the association between overjet size, lip coverage, and traumatic injury to maxillary incisors. Eur J Orthod 1995;17:513-517.
19. Nowjack-Raymer RE, Gift HC. Use of mouthguards and headgear in organized sports by school-aged children. Public Health Rep 1996;111:82-86.