

## Prevalence of permanent anterior teeth fracture among young children's aged 8-14 years according to Ellis and Davey's classification- An epidemiological study.

Dr. Daliya Kole<sup>1</sup>, Dr Mrinal Kanti Dholey<sup>2\*</sup>, Dr. Sukanta Sen<sup>3</sup>

<sup>1</sup>Associate Professor, Department of Dentistry [Pedodontia & Preventive Dentistry], College of Medicine & J.N.M. Hospital, Silpanchal Station Rd, Block A2, Kalyani, West Bengal 741235

<sup>2</sup>MDS in Department of Periodontics, West Bengal Dental Services, GN-29, GN Block, Sector V, Sector-V, Kolkata, West Bengal 700091

<sup>3</sup>Professor, Department of Pharmacology, ICARE Institute of Medical Sciences & Research, Banbishnupur, P.O. Balughata, Haldia, Dist- Purba Medinipur, West Bengal 721645

Corresponding Author: **Dr Mrinal Kanti Dholey\***

---

### Abstract:

**Background:** Traumatic injuries to the anterior teeth among the young children are tragic but often an ignored problem. Children with injuries to their anterior teeth, and their concerned parents present a challenge for the dentist that is often unparalleled. The objective of the present study was to investigate or assess the prevalence or pattern of fracture of traumatic injuries to permanent anterior teeth in 8-14 years old patients according to Ellis classification.

**Materials & Methods:** Only the patients whose ages were between 8-14 years were considered for this study.

**Results:** A total of 7056 children between the ages 8-14 years were included in this study, out of which 150 patients had injured permanent anterior teeth. Results showed that boys are usually more affected than girls (boys to girls ratio was 1.83: 1 or nearly 2:1) in case of anterior tooth trauma and Upper teeth, particularly, maxillary central incisors are most commonly affected than the rest of the anterior teeth.

**Conclusion:** It can be concluded by saying that further extensive studies with greater number of samples are needed to obtain definitive conclusions when 'prevalence of anterior tooth injury' is concerned. Traumatic dental injuries to anterior teeth are a significant public health problem, not only because their prevalence is relatively high, but also because they have considerable impact on children's daily lives. Traumatic dental injuries (TDIs) cause physical and psychological discomfort, pain and other negative impacts, such as tendency to avoid laughing or smiling, which can affect social relationships. Furthermore, improving the knowledge of dental practitioners through continuing education would also help in minimizing sequelae of traumatic dental injuries.

**Keywords:** Anterior teeth, Traumatic dental injuries, Maxillary central incisors, Ellis and Davey's Classification, Epidemiology.

---

Date of Submission: 18-01-2019

Date of acceptance:02-02-2019

---

### I. Introduction

Now-a-days, children are exposed to the surrounding environment from a very early period of their lives than their ancestors, making them more vulnerable to various risk factors of trauma like falls, accidents, fighting with the peers etc. It is therefore important for the pedodontist who treats children to treat anterior tooth-injury as an emergency treatment. They should be knowledgeable about the techniques used for managing traumatic injuries, and be readily available during and after office hours to provide treatment.<sup>1, 2</sup> Epidemiological studies reveal that one out of two children sustained a dental injury most often between ages 8 and 13. raumatic dental injuries in the primary dentition are related to possible sequelae affecting the permanent succedaneous teeth and malformation has been estimated to occur in 25 to 69% of cases.<sup>3</sup> The objective of the present study was to investigate or assess the prevalence or pattern of fracture of traumatic injuries to permanent anterior teeth in 8-14 years old patients according to Ellis classification.

### I. Materials And Methods

#### Sample Selection

The study was conducted at the post-graduate clinic, Department of Pedodontics and Preventive Dentistry, Dr. R. Ahmed Dental College and Hospital. The dental records of all patients aged 8-14 years, presented for treatment at the Outpatient Department, Department of Pedodontics and Preventive Dentistry from 1st June, 2004 to 28th February, 2006 were examined. Of all patients (7056) 150 patients had suffered

traumatic dental injury to permanent anteriors (upper or lower or both) teeth. Out of 150 affected patients, there were 97 (64.6%) male and 53 (35.3%) female patients.

**Method**

Only the patients whose ages were between 8-14 years were considered for this study. The ages were sub-divided into three groups – i) 8-9 years, (ii) 10-11 years and (iii) 12-14 years. The chronological age of the patient was determined by the history taken from the patient or parents only and was correlated with the dental age.

**Materials**

Materials and equipments used in this study are:

- Well-equipped dental chair with operating light source, air rotor unit etc.
- Examination set: plane mouth mirror, dental explorer, tweezers, cotton roll, mouth rinse, cheek retractor, kidney trays, and customized history sheet.

**II. Results**

A total of 7056 patients were included in this study out of which 150 patients between ages 8-14 years had traumatized permanent anterior teeth. The most common type of fracture according to Ellis and Davey's classification of fracture<sup>4, 5</sup> was type II i.e. fracture involving enamel and dentin (30%) followed by type I fracture (20%) i.e. fracture of enamel only. The least common type was type V (3.33%) i.e. loss of tooth due to trauma. The maxillary anteriors were involved most frequently (96.6%) than the mandibular anteriors. Central incisors were the most commonly affected teeth and in most of the cases (44%) only one tooth was involved followed by 42% involvement of two teeth in a patient. All the available data was computed in different table and statistical analysis was done by using chi-square test.

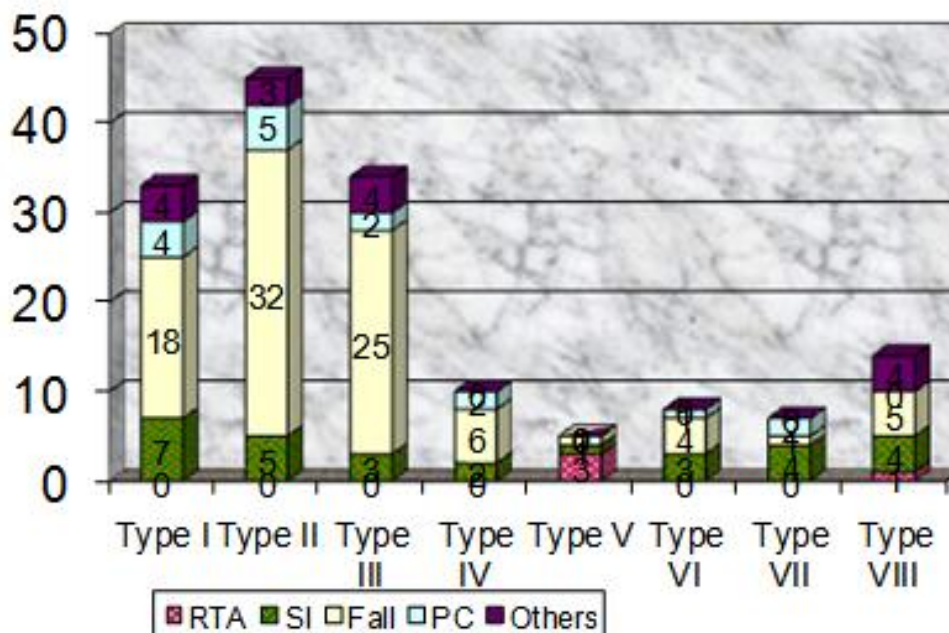
**Table 1:** Distribution of cases according to involvement of upper or lower anterior teeth

Upper (Maxillary)	Lower (Mandibular)	Total Cases
145 (96.67%)	5 (3.33%)	150

[N.B.: Figures within parentheses indicate percentages]

**Table 2:** Distribution of cases according to type of anterior teeth

Type	11-21	12-22	13-23	41-31	42-32	43-33	Total
Number of Tooth	150	34	8	5	4	2	203
Percentage	73.9	16.7	3.9	2.5	2.0	1.0	100



**Fig – 1:** Frequency distribution of samples by type and event of injury

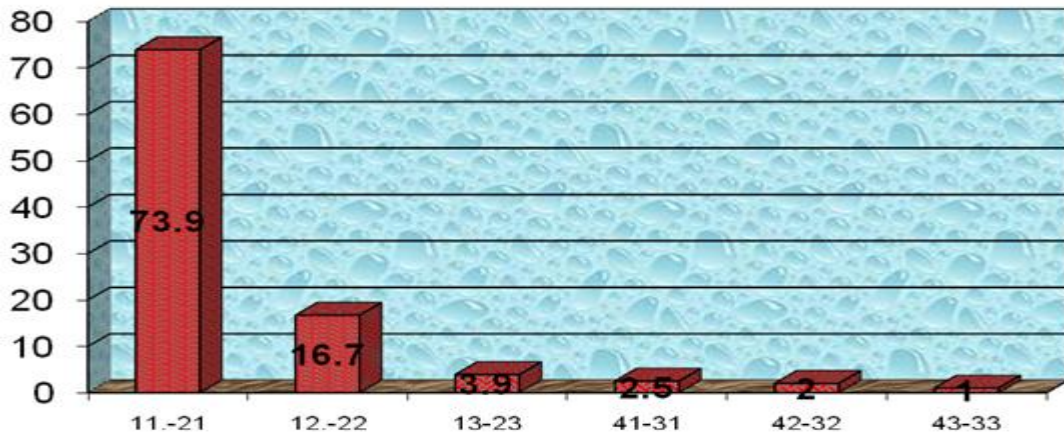


Fig – 2: Frequency distribution of type of anterior tooth injuries according to type of tooth.

Table 3: Distribution of cases by event of injury and type of fracture

Event of Injury	Type of fracture								Total
	Type I	Type II	Type III	Type IV	Type V	Type VI	Type VII	Type VIII	
RTA	0	0	0	0	3	0	0	1	4
SI	7	5	3	2	1	3	4	4	29
Fall	18	32	25	6	1	4	1	5	92
PC	4	5	2	2	0	1	2	0	16
Others	1	3	1	0	0	0	0	4	9
Total	30	45	31	10	5	8	7	14	150

Table 4: Chi-square values of the parameters – event of injury and type of fracture

Event of Injury	Type of fracture								Total
	Type I	Type II	Type III	Type IV	Type V	Type VI	Type VII	Type VIII	
RTA (fo)	0	0	0	0	3	0	0	1	4
Mean (fE)	0.8	1.2	0.82667	0.26667	0.1333	0.21333	0.186667	0.373333	
Chi-Square	0.8	1.2	0.82667	0.26667	61.633	0.21333	0.186667	1.051905	66.178
SI (fo)	7	5	3	2	1	3	4	4	29
Mean	5.8	8.7	5.99333	1.93333	0.9667	1.54667	1.353333	2.706667	
Chi-Square	0.2483	1.5736	1.495	0.0023	0.0011	1.36563	5.175993	0.617997	10.480
Fall (fo)	18	32	25	6	1	4	1	5	92
Mean (fE)	18.4	27.6	19.0133	6.13333	3.0667	4.90667	4.293333	8.586667	
Chi-Square	0.0087	0.7014	1.885	0.0029	1.3928	0.16754	2.526253	1.498157	8.183
PC (fo)	4	5	2	2		1	2		16
Mean (fE)	3.2	4.8	3.30667	1.06667	0.5333	0.85333	0.746667	1.493333	
Chi-Square	0.2	0.0083	0.51634	0.81667	0.5333	0.02521	2.10381	1.493333	5.697
Others (fo)	1	3	1	0	0	0	0	4	9
Mean (fE)	1.8	2.7	1.86	0.6	0.3	0.48	0.42	0.84	
Chi-Square	0.356	0.033	0.398	0.6	0.3	0.4	0.48	11.888	14.455
	30	45	31	10	5	8	7	14	100

$\chi^2 = 104.99$ ; d.f=28;  $p < 0.001$  (highly significant)



Fig. 3: Intraoral photograph of a patient, study cast and IOPA X-ray film (unexposed)



**Fig 4: A photograph showing Elli's and Davey's type III fracture in tooth #11, type I in tooth #21 and type II in tooth #23 in a single patient.**



**Fig 5: A photograph showing Elli's and Davey's type II fracture in tooth #11 and 21**

### **III. Discussion**

Chi-square test based on the two-way table (age and sex) reveals that there is no significant variation in the distribution of cases by sex ( $X^2 = 0.23$ ; d.f.=2;  $p>0.75$ ). But on analyzing the data by ages for both the sexes (males and females) combined, we find highly significant result as shown below.

For males –  $X^2 = 32.23$ ; d.f. = 2;  $p<0.001$ .

For females -  $X^2 = 15.09$ ; d.f. = 2;  $p<0.001$ .

Males and females combined –  $X^2 = 48.16$ ; d.f. = 2;  $p<0.001$

It signifies that the proportion of fracture cases differ from age to age. On further analysis of the data, it is seen that for the first two age groups i.e. 8-9 years and 10-11 years the proportion of cases do not differ significantly for both the sexes. The cases belonging to age group 12 to 14 years are significantly higher than the earlier two age groups ( $P<0.001$  for males, females and combined).

The distribution by type of fracture (table 3, 4) also differ significantly ( $\chi^2 = 80.4$ ; d.f.=7;  $p<0.001$ ). If, however, we concentrate our attention to type IV to type VIII (excluding first three types, viz., type I, type II and type III which are of higher frequencies), the chi-square value came out to be non-significant ( $\chi^2 = 5.32$ ; d.f.=4;  $p>0.25$ ). Similarly, the first three types, viz. type I, type II and type III cases do not differ among themselves ( $\chi^2 = 0.72$ ; d.f.=2;  $p>0.50$ ).

Table 1 shows that about 97% (96.67%) of cases involve the upper teeth and only 3% cases involve lower ones. The difference is highly significant ( $Z = 23.68$ ,  $p<0.001$ ).

As seen in the table 2, the maximum involvement of tooth is in 11-21 (73.9%), followed by 16.7% of cases in 12-22. The other locations are of very small magnitude (4% to 1%). Among different types of tooth injuries (Ellis and Davey's classification, 1960) type II fracture (i.e. fracture of enamel and dentin without the involvement of the pulp) is maximum in number (30%). Type II fracture is predominant in falls, sports injury and physical collisions except in RTA. Next to type II, the most frequent type of fracture is type I (20%) i.e., fracture of enamel only.

Zerfowski M. et al (1998)<sup>6</sup> found that crown fractures account for the majority of dental trauma in the permanent dentition (26%-76% of dental injuries), while crown root fractures represent only (0.3%– 5%). Law (1961)<sup>7</sup> observed that the Eastman Dental Clinic in Stockholm noted 75 percent of fractured teeth occurred between the ages of 7-11 years and that 40% were cases of enamel fracture (i.e. type I fracture) only. Almost 60% involved dentin, since root fractures occurred in only a small percentage.

Regarding the type of trauma according to the Ellis and Davey's classification, it was observed that the class IX fracture was the most frequent type of fracture followed by classes I and II fractures.<sup>8</sup> The most common type of injury in permanent teeth was enamel fracture followed by enamel and dentin fracture. This was similar to the study conducted by Hunter et al in 1990, Delattre et al in 1994 and Marcenes et al in 1999.<sup>9, 10, 11</sup>

The number of type IV injury cases is less than that of type I, II and type III [Fig 4, 5]. In type V tooth injury (i.e. loss of tooth due to trauma) the RTA cases count the highest because of the greater impact of the force involved in RTA which dislodges tooth / teeth along with associated injuries of the soft tissue and hard tissue structures of the face.<sup>12</sup>

The number of type VI tooth injury (i.e. root fracture) cases is less (1%). Type VII tooth injury (i.e. displacement of tooth with or without crown or root fracture) is more in sports injury. Type VIII fracture i.e. fractures of crown en masse is a common event in fall injury. Rajab, L.D. (2000)<sup>13</sup> analyzed that the peak incidence of injury was in 10-12 years age group. Boys were more affected (18.3%) than girls (10.1%). Falls were the leading cause of injuries (49.9%) and maxillary central incisors were the most affected teeth (90.4%). The study also showed the prevalence of traumatic dental injuries was 14.2% from 2751 subjects. The peak incidence of injury was 10–12 year age group. Boys were more affected (18.3%) than girls (10.1%). Most injuries occurred at home (63.2%), and falls were the leading cause of injuries (49.9%). Most injuries involved one tooth (69.3%) and maxillary central incisors were the most affected teeth (90.4%). The commonest injury was uncomplicated crown fracture (62.5%), then complicated crown fracture (28.7%). Only 17.1% of children sought treatment the same day or the day after the injury.<sup>13</sup>

Study by Gojanur S et al (2015)<sup>14</sup> showed the prevalence of traumatic injuries to the anterior teeth in 5 to 8 years old age group was found to be 2.7%. The 5 years old children (3.6%) presented with the largest number of injuries followed by 6, 8 and 7 years old (3.4, 2.4 and 1.4%, respectively). Regarding the type of trauma according to the Ellis and Davey's classification, it was observed that the class IX fracture was the most frequent type in which 35 teeth were affected, followed by classes I and II fractures. They also observed the teeth most commonly affected by dental trauma were the maxillary central incisors followed by maxillary lateral incisors. The most common cause of dental trauma in this study was due to falls (71.1%) followed by bicycle accidents (11.1%), collisions (8.9%), violence (6.7%) and bike accidents (2.2%).<sup>14</sup>

#### **IV. Conclusion**

The following conclusions were drawn from the study:

- 1) Boys are usually more affected than girls (boys to girls ratio was 1.83: 1 or nearly 2:1) in case of anterior tooth trauma.
- 2) The most common event of injury is 'fall'.
- 3) Upper teeth, particularly, maxillary central incisors are most commonly affected than the rest of the anterior teeth.
- 4) Single tooth trauma is the commonest of all types of injuries followed by injury involving two teeth.
- 5) Type I and type II fractures (Ellis and Davey's classification, 1960) are predominant of all types of tooth injuries.

The above mentioned points are the conclusions which are obtained from the present study. But further extensive studies with greater number of samples are needed to obtain definitive conclusions when 'prevalence of anterior tooth injury' is concerned.

#### **References**

- [1]. Andreasen FM; Andreasen JO, Bayer T. Prognosis of root fractured permanent incisors: prediction of healing modalities. *Endod Dent Traumatol* 1989; 5: 11.
- [2]. Andreasen JO. Etiology and pathogenesis of traumatic dental injuries. A clinical study of 1298 cases. *Scand J Dent Res* 1970; 78: 339-42.

*Prevalence of permanent anterior teeth fracture among young children's aged 8-14 years according*

- [3]. Von Arx T. Developmental disturbances of permanent teeth following trauma to the primary dentition. *Aus Dent J.* 1993;38(1):1–10.
- [4]. Andreasen JO and Andreasen FM. *Essentials of traumatic injuries of the teeth*; 2nd Edn. Copenhagen : Munksgaard; 2000.
- [5]. Andreasen JO, Andreasen FM. *Textbook and Color Atlas of Traumatic Injuries to the teeth*, ed 3, Copenhagen, Munksgaard, 1994.
- [6]. Zerfowski M and Bremerich A. Facial trauma in children and adolescents. *Clin Oral Invest*, 1998; 2: 120-4.
- [7]. LAW DB. Prevention and treatment of traumatized permanent anterior teeth. *Dent Clin NAm* 1973; 66:431-50.
- [8]. Ellis Roy G, Davey Keith W. *The classification and treatment of injuries to the teeth of children*. 5th ed. Chicago: Mosby; 1970. p. 231.
- [9]. Hunter ML, Hunter B, Kingdon A, Addy M, Dummer PMH, Shaw MC. Traumatic injury to maxillary incisor teeth in a group of South Wales school children. *Endo Dent Traumatol.* 1990;6(6):260–264.
- [10]. Delattre JP, Resmond-Richard F, Allanche C, Perrin M, Michel JF, Le Berre A. Dental injuries among schoolchildren aged from 6 to 15, in Rennes (France). *Endod Dent Traumatol.* 1995;11(4):186–188.
- [11]. Marcenés W, al Beiruti N, Tayfour D, Issa S. Epidemiology of traumatic injuries to the permanent incisors of 9 to 12-year-old school children in Damascus, Syria. *Endod Dent Traumatol.* 1999;15(3):117–123.
- [12]. Andreasen JO, Rovn JJ. Epidemiology of traumatic dental injuries to primary and permanent teeth in a Danish population sample. *Int J Oral Surg*, April, 1972; 1: 235-239.
- [13]. Rajab LD. Traumatic dental injuries in children presenting for treatment at the Department of Pediatric Dentistry, Faculty of Dentistry, University of Jordan, 1997–2000. *Dental Traumatology* February 2003; 16(1):6-11.
- [14]. Gojanur S, Yeluri R, Munshi AK. Prevalence and Etiology of Traumatic Injuries to the Anterior Teeth among 5 to 8 Years Old School Children in Mathura City, India: An Epidemiological Study. *International Journal of Clinical Pediatric Dentistry.* 2015;8(3):172-175.

~~Dr P.Pradeep. "Effect of preoperative use of nepafenac and flurbiprofen eye drops in maintaining mydriasis during small incision cataract surgery." IOSR Journal of Dental and Medical Sciences (IOSR JDMS), vol. 18, no. 1, 2019, pp 24-29.~~