Prevalence, Patterns and Pulp Vitality Testing of Traumatic Dental Injuries in Permanent Teeth: A Retrospective Study.

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Abstract

Aim:

The purpose of this retrospective study is to determine the prevalence, patterns, and pulp vitality testing of traumatic dental injuries in primary and permanent teeth.

Material and methods:

From January 1, 2022, to December 31, 2022, the dental records of 102 patients who presented with dento-alveolar trauma to the Postgraduate Dental Clinic at Saveetha Dental College and Hospital were retrospectively reviewed. Data on age, gender, location of trauma [maxillary or mandibular (central, lateral, canine)], type of trauma (Ellis and Davey classification), cause of TDI (falls or collisions), location of the traumatic incident (home, school, road traffic accidents) and type of pulp vitality test performed (heat test, cold test, EPT, any other) were recorded. Descriptive analysis was performed for the frequency distribution and the chi-square test was used for bivariate analysis. The Level of significance was $p<0.05$.

Results: The mean age of the children was 8.70±3.49 years. There were 169 anterior traumatized teeth (central incisor, lateral incisor, and canine). Children suffered trauma more often between the ages of 8 and 9 and between 11 years. Boys had experienced higher trauma than girls. Most TDI that occurred were permanent (91%). The most frequent injury types were luxation injuries in the primary dentition and Ellis class II injuries in the permanent dentition. The most common pulp tests performed are electric pulp tests.

Conclusions: Boys experienced a high level of traumatic dental injuries than girls. Primary teeth were less affected than permanent teeth, while children in the age range of 8, 9, and 11 experienced the most injuries in the studied group.

Introduction:

According to the International Association of Dental Traumatology, dental trauma is defined as the external impact on dental tissues that can result in injury to hard (enamel fracture, fracture involving enamel and dentin with or without pulp exposure, root fracture and alveolar fracture) or supportive tissues (subluxation, concussion, extrusive, intrusive, or lateral dislocation, and avulsion).[1] Traumatic dental injuries (TDI) are considered a serious public dental health issue throughout the world, with an increased incidence of traumatic injuries over the years. Trauma to permanent anterior teeth is the most common finding with a higher incidence of fractures, as the face and teeth are the most undefended parts of the body.[2,3] The incidence of trauma to primary and permanent teeth in children is 1–3%, with a steady prevalence of 20–30%.[4] Maxillary teeth are most frequently traumatized than mandibular teeth, probably due to their vulnerable position. The most noteworthy predisposing factors comprised of protruded upper incisors, increased overjet, incompetent lip coverage, open bite, and individuals with epileptic condition.[2] When trauma is incompetently treated, it results in ill-fated and catastrophic conditions such as malformed teeth, premature tooth loss, and pulpal death with abscess formation.[5] Addressing traumatic dental injuries should be considered a chief problem because it leads altered facial esthetics, hinders speech, and has contrary emotional influence which In turn negatively affects the child's quality of life, apart from pain and potential infection.[6] Grounded on much scientific research, it's been stated that traumatic dental injury for permanent dentition results in fracture of the crown and the root of a tooth, rather than supporting tissue injuries (dislocation of the tooth and dental avulsion).[7]

The primary aim while treating a tooth with crown /root fractures and dislocations is to preserve the pulp vitality of tooth, as traumatic injuries are more frequent in young permanent teeth with incomplete root formation.[8]

The events of healing begin in an attempt to regenerate nerves and vessels and to replace damaged pulpal tissue.[9] To restore the appearance and functionality of affected teeth during this period, it is also essential to determine the pulpal status.[10] The limitations of traditional pulp testing and the transient loss of pulpal sensitivity after trauma make this diagnosis difficult for the physician.[11] It is an need to assess the vital condition of the pulp to reinstate the function and aesthetics of the involved as the healing events (regeneration of the nerve, blood vessels and replacement of pulp tissues) begins immediately after acute trauma.[12] Hence, the present retrospective study is to determine the prevalence, patterns, and pulp vitality testing of traumatic dental injuries in primary and permanent teeth.

Materials and methods:

This was a retrospective study of dental records of patients with TDI reported to the Department of Paediatric and Preventive Dentistry, Saveetha Dental College and Hospital, Chennai, Tamilnadu, India. Between January 1, 2022, and December

31, 2022, every dental trauma data record was identified and documented using an electronic record system. Only traumatic injuries assigned to post-graduate students were included in the analysis to ensure thorough follow-up in accordance with the guidelines.

The TDIs of 102 patients were examined by 15 postgraduate students. A thorough clinical and radiographic evaluation was performed using a standardised format according to IADT guidelines. After that, additional details on trauma were recorded for each patient about the following parameters: data regarding age, gender, location of trauma [maxillary or mandibular (central, lateral, canine)], type of trauma (Ellis and Davey's classification), cause of TDI (falls or collisions), location of traumatic incident (home, school, road traffic accidents), and type of pulp vitality test performed (heat test, cold test, EPT, any other). TDI was only reported once per tooth; therefore, multiple traumatic injuries to the same tooth were not documented.

To check the intra-examiner reliability in documenting the data, fifteen randomly chosen records were re-evaluated. The intraobserver Kappa reliability score was 0.97. The data was entered in Microsoft excel 2016. Statistical analysis was performed using SPSS 20.0 version for windows (Chicago, IL, USA). Descriptive analysis was performed for frequency distribution. Means and standard deviations of continuous variables such as age were calculated. chi-square test was used for bivariate analysis. The Level of significance was $p<0.05$.

Results:

The review of the dental records revealed 102 new patients with TDI, involving 169 anterior teeth. The age of the patients ranged from 6 to 12 years old, with a mean age of 8.70±3.49 years. Most of the children were in the mixed dentition stage (78%), followed by the primary (5%) and permanent (17%) dentitions, and 68% of the cases were boys. Children suffered trauma more often at the ages of 8, 9, and 11 years. There was a statistically significant difference in the distribution of TDI for the three different types of dentition, with boys having more TDI compared to girls (Table 1). Most TDI occurred were permanent with 91% followed by primary dentition with 9%. A higher prevalence of TDIs was observed among the central incisors followed by the lateral incisors in both primary and permanent dentitions. Maxillary teeth are more commonly effected than mandibular teeth in both dentitions. Notably, a lower prevalence of TDIs were seen in the primary and permanent canines of both arches.

For permanent dentition, 78% of the TDI were fractures involving enamel , enamel and dentin with or without pulp exposure, and root fracture, 15% were luxation injuries, and other fractures constituted 7%. For the primary dentition, 28% of TDI were fractures, 69% were luxation injuries, and 3% were a combination of both. Combination injuries accounted for a very small percentage in both permanent and primary teeth. (Table 2) Majority of the children reported that, falls was the most common cause of the injury and sports was the least common cause of trauma (Table 3).

Discussion:

The prevalence of trauma in children prevalence of traumatic dental injuries has been found to vary considerably, ranging from 4% to 58% in several epidemiological studies.[13] the differences in the range of the aforementioned percentages are due to

variations in the following factors such as geographic, cultural, socio-economical, environmental factors (unsafe parks and playgrounds), individual factors (increased protrusion and overjet, obesity, attention deficit, hyperactivity disorder, physical limitations), iatrogenic factors (during intubation, oral piercing) and the divergence in dentition periods.[14]

Falls are the most frequent activity which results in trauma and account for the majority of the injuries in primary dentition. Even though falls featured outstandingly as etiological factors in permanent dentition, sports activities are also reported for most injuries, followed by further impact activities/accidents such as assaults, fights, as well as bicycle and motor vehicle accidents.[15,16]

The home, parks and kindergarten were the sites where most traumatic dental incidents were reported among young children, whereas sports activities, violent incidents and traffic accidents outside of the home are the commonly stated subjects for dental trauma in adolescent individuals.[17,18]

Anterior teeth are the most commonly affected teeth due to dental trauma in the primary and permanent dentition, among which the central and lateral incisors were the most commonly injured teeth. In most cases, trauma affected a single tooth, but certain events (sports, violence, and traffic accidents) reported a greater probability of injuring multiple teeth.

In the present study, the most frequently traumatized teeth were maxillary incisors, similar to various other studies.[19] The reason may be ascribed to the fact that the central maxillary incisors are generally more protruded than the mandibular teeth and tend to be the first to receive a direct blow that produces a fracture and are less protected. Inadequate lip coverage has been considered the most critical, independent risk factor for the occurrence of TDI in the anterior teeth. This inadequate lip coverage results in decreased incisor protection, which increases the vulnerability of the incisors to trauma.[20] A blow to the maxillary incisors is also more often damaging than a blow to the mandibular incisors, as the latter's force is dissipated due to the non-rigid connection of the mandible to the cranial base.[21]

Based on the analysis of the presented data, uncomplicated crown fractures (without pulp exposure) were the most prevalent subtype (64.9%, n = 387). Write the percentages of different types.

Uncomplicated crown fractures are the most common type of injury in permanent dentition, whereas subluxation type of injury is common in primary dentition due to the resilience of the supporting structures. Kovacs M et al. reported that Ellis Class II injury, followed by Ellis Class I injury is the most common injury in permanent teeth.[22]

Complications such as loss of pulp vitality and root resorption could develop as a consequence of these injuries leading to long-term irreversible damage or even tooth loss.[23] The risk of pulp necrosis after crown fractures ranges between 0.2% and 6%, increasing with concomitant luxation injuries. The percentage of pulp necrosis as a squeal of luxation injury ranges between 15% and 59% with the highest frequency associated with intrusive luxation, on the other hand, it is less common following subluxation and concussion injuries.[24]

The use of dental pulp sensibility / cleanliness tests is an integral part of the pulp assessment process after dental trauma. Different pulp sensibility and vitality tests are available, however, to date no one test has been shown, based on high-

quality evidence, to be superior in terms of sensitivity and specificity.[25] It has been argued that the use of vitality tests is recommended whereby pulp blood flow is measured, which is more appropriate and accurate in assessing pulp vitality than sensibility, therefore, reducing false negative and false positive results. On contrary, the use of pulp sensibility tests was relatively high among respondents while those of vitality tests were very low. Lauridsen et al. showed the importance of using EPT at initial trauma in identifying teeth at increased risk of pulp necrosis.[26] In general, EPT is more reliable in detecting vital teeth than nonvital teeth. The sensitivity of EPT ranges between 67% and 100% while the specificity ranges between 88% and 100%.[27] The value of sensibility tests is highly dependent on several factors, including the patient's understanding, compliance, and cooperation, and the degree of root development. These factors limit their use in children, patients with learning disabilities and patients with limited communication.

Conclusion:

Boys experienced a higher level of traumatic dental injuries than girls. Primary teeth were less affected than permanent teeth, while children in the age range of 8, 9, and 11 experienced the most injuries in the studied group. Fractures involving the enamel, enamel and dentin were the most common injury among permanent teeth, and luxation injuries are more prevalent in primary teeth, with the maxillary incisors most commonly affected. The electric pulp tester was the most preferred pulp vitality device to identify the status of the pulp.

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Tables:

Gender	Number of children with TDIs	Gender ratio	P-value
Boys	69 (68%)	2.1:1	0.001*
Girls	33 (32%)		
Total	102		

Table 1: gender distribution of traumatic dental injuries in children
*: significant

Status of Trauma	Number of injured teeth	Boys with injured teeth	Girls with injured teeth	P-value
Class 1	27	20	7	0.001*
Class 2	36	21	15	
Class 3	28	17	11	
Class 4	24	16	8	
Class 5	12	9	3	
Class 6	11	7	4	
Class 7	24	14	10	
Class 9	7	4	3	
Total	169	108	61	

Table 2: Frequency distribution of types of traumatic dental injuries in school children.
*: Significant

Etiology	Children with injured teeth	Boys with injured teeth	Girls with injured teeth	P-value
Fall	81	57	24	0.001*
Sports	39	30	9	
Road Traffic Accident	49	21	28	
Total	169	108	61	

Table 3: Distribution and percentage of children with traumatized anterior teeth according to the place of occurrence of trauma.
*: Significant