

Assessment of Prevalence, Etiology, Risk Factors, and Treatment Goals of Traumatic Dental Injuries: A Review of Literature

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Abstract

In developing countries, traumatic dental injuries (TDIs) are progressively increasing, making it a serious public health concern. The worldwide prevalence has been found with a wide range of 4.1–58.6%. The level of trauma varies greatly depending on the severity, direction, and resilience of the assaulted tissue and it can vary from simple enamel chipping to alveolar fracture. In children, the periodontal ligament is very resilient, so luxation injuries are the most commonly seen in the primary dentition. A number of risk factors need assessment for TDI such as incompetent lips, increased incisal overjet, preschool children, hyperactive children, excessive use of smartphones, not using mouthguards while playing, and presence of physical and mental disabilities. The knowledge and skills of the dentist as well as the emergency aid provided at the place of the injury are major determinants of outcomes. There is a need to educate children, parents including school teachers regarding the prevention and emergency management of TDI. Furthermore, there is treatment negligence and indifference among the people toward dental trauma and its consequences thereafter.

Keywords: Crown fracture, Fall, Traumatic dental injuries.

INTRODUCTION

In addition to dental caries, traumatic dental injuries (TDIs) are becoming a growing public health concern, known as the fifth most prevalent disease in the world. Falls, being struck by an item, bicycle accidents, assaults, and motor vehicle accidents are all common causes of TDI.^[1] Although, no individual is ever at a zero risk, still there are several predisposing factors that can play a role in causing dental trauma.

There is a wide variation seen among TDI in different parts of the world with distinct prevalence, cause, site, location of the injury, and risk factors. The peculiar beliefs and preferences in certain cultures may owe to these differences.

Patient's quality of life may be diminished as a result of TDI, which can affect them physically, mentally, socially, and financially. TDI in a child can be particularly distressing for the parents as well and the treatment presents as a challenge in itself. The consequences of TDI in a child other than pain, swelling, and possible infection, if primary teeth are injured, can cause complicated problems to the underlying permanent

teeth, such as hypoplasia (Turner's tooth), discoloration of teeth, ectopic eruption, delay in eruption time, arrested root formation, and tooth malformation such as dilaceration.^[2]

Since the TDI needs emergency attention, if the consulting dentist is lacking the skill and expertise in managing it, providing a referral to an expert would be a better judgment. The treatment standards have become increasingly conservative over time. To restore the lost teeth, newer advancements are being made each day, in the near future, we may be looking at regenerating the root (bio-root) using stem cells.^[3]

It is very unfortunate that despite being so prevalent, awareness regarding both prevention and treatment is lacking. There

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should be a provision of emergency services in case any such mishap has occurred. To build a more aware and responsible society, drastic steps are required.

The aim of this article was to assess the prevalence, etiology, risk factors, and treatment goals of TDI.

PREVALENCE

The frequency of TDI is high worldwide having significant variations. The presence of cultural, behavioral, and socio-economic diversities and the absence of any standard method of classification to determine TDI owe to these variations.

It was found that in the United States (US), one out of four while in the United Kingdom (UK), one out of five children has experienced TDI.^[4] Glendor concluded that one-third of children having the primary dentition underwent a dental injury, one-fourth of school-going children, and one-third of all adults having permanent dentition had TDI.^[5] A Danish study demonstrated the incidence of TDI in children to be 30%, an Australian study found it to be 20%, while a Swedish study reported the incidence to be 28%.^[6]

In 1967, the first study was published that estimated the prevalence of TDI in India.^[7] Various studies have been conducted in India thereafter, exhibiting the range of prevalence from 1.25% to 20.9% (Table 1). The prevalence among males was found in the range 3.1 to 78.5%, while, in females, the prevalence was found in the range 2.3–36.4% (Table 2).^[2,7-28]

Table 1: The prevalence of TDI from Indian perspective

S. No.	Author	Year	Overall prevalence
1.	Rai and Munshi	1998	5.29%
2.	Gupta <i>et al.</i>	2002	13.8%
3.	Tangade	2007	4.41%
4.	Gupta <i>et al.</i>	2010	4.15%
5.	Ingle <i>et al.</i>	2010	11.5%
6.	Ravishankar <i>et al.</i>	2010	15.1%
7.	Kumar <i>et al.</i>	2011	14.4%
8.	Murthya	2012	9.7%
9.	Dua and Sharma	2012	14.5%
10.	Patel and Sujana	2012	8.79%
11.	Govindarajan <i>et al.</i>	2012	10.13%
12.	Rambharos <i>et al.</i>	2014	10.5%
13.	Chopra <i>et al.</i>	2014	10.2%
14.	Gojanur <i>et al.</i>	2015	2.7%
15.	Ain <i>et al.</i>	2015	9.3%
16.	Chalissery <i>et al.</i>	2016	10.2%
17.	Maran <i>et al.</i>	2017	20.9%
18.	Juneja <i>et al.</i>	2018	10.2%
19.	Saraswathi and Kumar	2018	16.1%
20.	Dharmani <i>et al.</i>	2019	11.4%
21.	David <i>et al.</i>	2019	6%
22.	Tewari <i>et al.</i>	2020	13%
23.	Goswami and Aggarwal	2021	1.25%

TDI: Traumatic dental injuries

The most commonly affected tooth by TDI has been found to be Maxillary Central Incisor.^[2,12-14] According to some authors, most prevalent type of trauma was Enamel fracture while Gupta *et al.* stated that complicated crown fracture was more common.^[10,11] A study done by Goswami and Aggarwal, in 2021, concluded that non-vital tooth due to trauma was most common.^[28] Falls were the most common reason for trauma as stated in many studies.^[2,11-13] Rai and Munshi stated that Class 1 type 2 and Class 2 div 1 were most commonly affected by TDI.^[8]

PREDISPOSING FACTORS

As compared to children having normal occlusion, those with protruding incisors have twice as much TDI. It was seen that children having an overjet >3.0 mm were likely to have 5.4 times more chances of having dental injury compared to those having an overjet of size equal to or lower than 3.0 mm.^[27] Petti concluded that out of all the global TDI, 21.8% of this fraction is attributable to large overjet.

Some of the studies indicated a three-fold risk for TDIs due to the presence of inadequate lip coverage, while some of them have been shown no significant association.^[28] Glendor found the influence of some other factors such as children having a risk-taking behavior, failure to cope with emotionally stressful conditions, and children who are being bullied or having attention-deficit hyperactivity disorder.

Overweight and obese children have got a higher risk of TDIs as shown by some studies.^[29] Some of the studies have indicated a relationship between seasonal variations and dental injuries. There is a lack of a single opinion on whether the frequency increases during winters or summers and studies have provided conflicting results. One of the major environmental factors that can predispose to TDI is overcrowding. The reason being the more deprived the area is, the lesser is the safe environment which facilitates falls and collisions.^[4]

ETIOLOGY

Unintentional TDI

1. Falls and collisions:

The major common cause for TDI is the falls, home, and neighborhood being the most common place, particularly among children. As the child begins to walk or run since they lack experience and coordination, the chances of falling and being struck by objects such as furniture increase many fold.^[4]

2. Sports activities:

Physical leisure activities are a part of daily routine, particularly the young individuals due to their oral injuries. Federation Dentaire International has organized sport in two categories according to their risk for TDI: High-risk sports that include American football, hockey, ice hockey, lacrosse, martial sports, rugby, and skating; and medium risk sports including basketball, diving, squash, gymnastics, parachuting, and water polo. A total of one-

Table 2: The prevalence of TDI among Indian males and females

S. No.	Authors	Year	Male prevalence (%)	Female prevalence (%)
1.	Rai and Munshi	1998	72.27	27.73
2.	Tangade	2007	4.96	3.33
3.	Ingle <i>et al.</i>	2010	78.5	21.5
4.	Kumar <i>et al.</i>	2011	16.2	12.7
5.	Murthya	2012	12.2	7.1
6.	Dua and Sharma	2012	63.2	36.4
7.	Rambharos <i>et al.</i>	2014	11.61	9.47
8.	Gojanur <i>et al.</i>	2015	3.1	2.3
9.	Chalissery <i>et al.</i>	2016	11.87	8.14
10.	Juneja <i>et al.</i>	2018	68.38	31.62
11.	Saraswathi and Kumar	2018	18.4	13.6
12.	Tewari and Mathur	2020	For <6 years = 15 For >6 years = 13	For <6 years = 16 For >6 years = 8

TDI: Traumatic dental injuries

third of dental injuries are sports-related. A popular sport in some of the countries is horseback riding, which is also a quite significant source of injury. With the use of well-fitted, mouthguards and sturdy helmets surely TDIs can be reduced.

3. Roadside accidents:

It includes all types of traffic accidents pedestrian, bicycle, and car-related injuries. They are almost always associated with multiple injuries, injuries to the teeth, supporting bone, and soft-tissue injuries. Cox *et al.* found out that with the use of a seat belt only or a seat belt and an airbag showed a significantly reduced risk of facial injury. Thompson *et al.* concluded that bicycle helmets reduce the risk of facial injuries by 65%, but the users are still at high risk of dental trauma due to lack of protection of the lower face and jaw.^[4]

4. Use of teeth in inappropriate ways:

Some of the professionals such as electricians, carpenters tend to hold nails, and other equipments between their teeth and in turn harm them. Many individuals tend to use their teeth as a tool to cut or hold objects or open bottles of soda or beer, to open hair clips increasing chances of dental trauma. Various researchers have found the prevalence to be different; according to Malikaew *et al.*, it was found to be 18.7%, Nicolau *et al.* –6%, Tapias *et al.* –8.5%, and Traebert *et al.* –3.3%.^[27]

5. Oral piercing:

A fashionable trend in the western world in the use of oral piercing is gaining popularity worldwide commonly lip and tongue piercing. The study from these is shown to cause abrasion, chipping, the fracturing of teeth, as well as restorations, damage to pulp even infections along with pain and swelling.^[4]

6. Iatrogenic injuries:

Direct pressure during intubation and laryngoscopy can produce crown and root fractures, as well as luxations and avulsions. Prolonged intubation is a procedure that is used in the care of prematurely born infants. The

prolonged pressure of intubation tubes in premature infants, against the maxillary alveolar process, may lead to a high frequency of developmental enamel defects in the primary dentition as well as injuries to the tooth germs of the first and second dentition and deformation of the maxillary skeleton.^[4]

7. a. Presence of systemic illness:

Illnesses such as epilepsy and cerebral palsy pose a risk of getting injured frequently. Due to the uncontrolled movements in the patients with cerebral palsy, they have been shown to have 57% more chances of having TDI as corresponding to a healthy population. Concerning epilepsy, the injuries that were seen were repetitive in nature with a prevalence of 52%.^[29]

b. Mental retardation/Learning difficulties:

A relatively high frequency of TDI has been reported in conjunction with specific circumstances such as poor motor coordination, overcrowding in mental institutions, or associated illness such as epilepsy.

c. Hearing or visual impairment:

Visually impaired children have confined movements as compared to deaf children who can play around more freely so significantly more dental trauma was seen in hearing-impaired children.

8. Smartphones:

In today's world, smartphones have become a necessity. Even children these days, imitates their elders and operate on smartphones, but due to lack of dexterity along with heavyweight (129–218 g), large-screen smartphones, present as a severe risk factor if gets coupled with an almost vertical fall.^[30]

Intentional injuries

1. Physical abuse:

Non-accidental injuries or Battered child syndrome is a clinical condition in infants undergone serious *physical abuse* – A devastating cause of oral injuries in small children. Fonseca *et al.* found that head, face, and mouth were the main site of injury in 75% of all abused children.

This type of TDI needs to be reported and dentists along with physicians share a special responsibility for the same.^[4]

2. Assaults and fights:

In the adult age group, injuries from fights, assaults are prominent and have a strong association with alcohol abuse. Rural areas are comparatively less violent. In the individuals aged 16–18 years, nearly 23% of the injuries were caused by violence. It exhibits in a particular injury pattern characterized by luxation and avulsion of teeth along with the fractures of roots and/or supporting bone.^[4]

3. Torture of prisoners:

Trauma to the oral and facial regions of tortured captives is despicable and evidently increasing. Beating, the most common form of torture, results in loosening, or fracture of the tooth, exarticulation of tooth out of its socket, and lacerations of the soft tissue. The use of forceps to pull teeth is also described in the literature along with placing electrodes to the teeth, lips, tongue, and soft-tissue above the temporomandibular joint, leading to a powerful muscle spasm. As a result, teeth were loose and fractured, and muscles and the temporomandibular joint experienced considerable pain.

DISCUSSION

The treatment goal is to establish normal form, function, and esthetics for the patient with minimizing the complications

Management of traumatic injuries

According to the recent IADT guidelines, while treating TDI a more conservative approach is recommended, with having more provision for routine follow-ups to avoid future complications. The local anesthetic without a vasoconstrictor is preferable. However, there are some concerns that the healing may get compromised with the use of vasoconstrictor, but the evidence supporting it is lacking. The time period for the initiation of endodontic therapy (symptomatic teeth) has also been advanced from 7 to 10 days to 2 weeks, while the older guidelines recommended conservative procedures such as pulpotomy for immature teeth, newer guidelines give the same opportunities to the mature teeth as well unless the tooth has become symptomatic.

Earlier, the first choice for systemic antibiotics (indicated cases) was *tetracycline*, but newer first-choice drugs are *amoxicillin* and *penicillin*. In case, the patient is allergic to *penicillin* are given *tetracycline* as an alternative, also they have got staining potential so they are avoided until the patient is 12 years or older.^[5,31] In case of TDI to primary dentition, as the earlier guidelines recommended extraction of teeth in case of intrusive injury, in case it has displaced tooth germ, new treatment protocol advocates a wait and watch period of 6 months, for spontaneous repositioning of the tooth. Furthermore, there is a recommendation of referral to the specialist later, if proper treatment has not been during the emergency.^[32,33] To immobilize the teeth, following luxation

or avulsion injuries for an initial period, the use of a splint up to 2 weeks is recommended unless there is alveolar fracture which extends splinting time to 4 weeks.

Recent IADT guidelines advocate the use of passive, semirigid, or flexible splints as compared to the rigid ones. The reason is if splinting is done for long periods, it can cause root resorption or ankylosis. Following avulsion, despite the time duration elapsed, teeth being mature/immature or the medium, in which the tooth was stored, it is still advisable to reimplant the tooth which, however, has a poor prognosis, but keeps our future treatment options viable.^[34-37]

Outcomes

Well-healed pulp and the surrounding tissues are indications of a favorable outcome of TDI which are the healing of the pulp and surrounding tissues. However, the outcome may turn out to be unfavorable and various complications including necrosis of pulp, discoloration of the tooth, formation of sinus tracts, and inflammatory resorption of the root may occur. Furthermore, these outcomes are dependent on the type of injury, the time elapsed before emergency treatment, and the quality of treatment. One of the important things, that has to be considered is that complications of dental trauma can occur several months or even years after the injury so a regular follow-up is a must.^[28]

Awareness

A study done by Divya *et al.* concluded that a significantly low knowledge of emergency management of dental trauma was seen among the school teachers.^[38] Another study found that among the school teachers being surveyed only 6.6% had received prior training in dental trauma.^[39] Serpil *et al.* found a total of seven apps relevant to dental trauma. Among them, *Dental Trauma* is being endorsed by the International Association of Dental Traumatology. Other apps include *AcciDent*, *Chipped Tooth Solution*, *Dental Crown Repair*, *Fixing Cracked Tooth*, *Repairing the Front Tooth*, and *Solution to Broken Tooth*.^[40]

CONCLUSION

Trauma is a sudden, unexpected, and frequently unintentional occurrence that necessitates immediate medical attention. It occurs as a result of a number of inevitable risk factors, rather than a disease. A variety of aspects are explored to understand how and why TDI arises, including human behavior, predisposing factors related to the oral cavity and environmental determinants. Assessment of the specific characteristics and pattern of tooth injury along with its prevalence and risk factors is needed, to enhance the preventive strategies. In addition to that, there is a need to adequately analyze negligence in people regarding the treatment following TDI. Preventive policies should involve creating a safer and appropriate environment at home and in schools. At the school level, screening can be performed to rule out individuals who have a high anatomic and behavioral risk of TDI so that suitable preventative interventions such as preventive orthodontic treatment and the usage of mouthguards may be implemented.

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