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# TRAUMATIC DENTAL INJURIES

Colgate Dental Education Programs  
Special Topic No. 19

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# TRAUMATIC DENTAL INJURIES

## INFORMATION FOR DENTAL PRACTITIONERS

Dental trauma or traumatic dental injuries (TDIs) are considered as impact injuries to the teeth and/or other soft and hard tissues within and surrounding the oral cavity.<sup>1-6</sup> TDIs are common worldwide affecting both the primary and permanent dentitions with an estimated overall prevalence between 13% – 17.4% in 2016.<sup>5,6</sup>

The global prevalence of TDIs is higher in primary teeth (22.7%) than in permanent teeth (15.2%) while the global incidence rate of TDIs has been estimated to be 2.82 per 100 person per year.<sup>5</sup> Males are more likely to have TDIs than females<sup>4,7</sup>, particularly in the permanent dentition<sup>8</sup>, while a vast majority of TDIs occurs before the age of 40 years.<sup>4,7</sup>

Although national level data for TDIs are lacking in Australia it has been reported that the prevalence of TDIs among 12-15 year old Sydney high school students was 6%<sup>9</sup> and the incidence of TDIs among 0-86 year old Victorian population was 4.1%.<sup>10</sup> The 2009 New Zealand Oral Health Survey<sup>11</sup> revealed that the overall prevalence of TDIs among adults aged 18+ years was 23.4% while a recent analysis of the same data suggested that males, those aged 35-44 years and Maori people were more likely to experience TDIs.<sup>12</sup>

### Burden of TDIs

A recent meta-analysis has disclosed that between 90 and 125 million people globally are affected with TDIs placing it as the fifth most prevalent disease or injury.<sup>5,6</sup> Although the oral region represents about 1% of the human body, TDIs contribute to 5% of all bodily injuries with 85% of patients across all age groups presenting with injuries to the oral region.<sup>5,6,13</sup> Despite most, if not all, TDIs falling short of being life threatening injuries, the cost and time involved in managing TDIs are not only significantly higher, relative to all other bodily injuries but most likely to continue for the remainder of the person's life.<sup>1,3-6,13</sup> Consequently, socially disadvantaged groups such as those from lower socioeconomic backgrounds have given a lesser priority to

seeking treatment for TDIs than other bodily injuries.<sup>6,13</sup> As well as being a source of stress among families of the victims, TDIs have been associated with negative psycho-social and functional status and impaired quality of life, particularly among children and adolescents<sup>4,6,14,15</sup>. Considering all these, TDIs can be collectively deemed as a significant public health issue. Nonetheless, TDIs have neither been recognized by major international public health bodies including the WHO, nor been regarded by the Global Burden of Disease (GBD) study, as one of the most ubiquitous conditions affecting people of all walks of life.<sup>5,6</sup>

### Aetiology of TDIs

TDIs have a complex and multifactorial aetiology. Oral factors, environmental factors and human behaviours are the three main domains under which aetiological factors for TDIs can be included.<sup>1-4,8,16</sup>

#### Oral factors:

- Increased overjet/anterior teeth protrusion
- Anterior open bite
- Lip incompetence/inadequate lip coverage

#### Environmental factors:

- Material deprivation
- Overcrowding
- Unsafe environment

#### Human behaviours

- Hyperactivity/risk-taking behaviours
- Emotional stress
- Obesity/Overweight

While oral factors may separately or collectively enhance the TDI risk, increased overjet is regarded as the strongest oral aetiological factor for TDIs.<sup>2,8</sup> Likewise, environmental factors are interrelated and associated with high TDI prevalence<sup>1,2</sup> while human behaviours including risk-taking and stressful states such as attention-deficit hyperactivity disorder are all associated with increased risk of TDIs.<sup>2,3</sup> Individuals who are less agile, deft and active, obese/overweight may be more susceptible to

falls and consequently to TDIs.<sup>2,3</sup> The most common activities that contribute to TDIs in the primary and permanent dentitions of young people are falls and sporting activities, respectively, with falls also being cited as the main cause for TDIs among older people.<sup>2,3</sup> Incidents which result in impact such as collisions, traffic accidents, fights, assaults including domestic violence and child abuse, and night life and alcohol related behaviours/ binge drinking, are other factors associated with TDIs.<sup>1-3,17</sup>

Presence of illnesses such as epilepsy and cerebral palsy have been associated with high levels of TDIs, while patients with learning difficulties and hearing/visual impairment are more likely to have TDIs than otherwise healthy individuals.<sup>2</sup> Inappropriate use of teeth as a tool to open bottles, fix electronic equipment as well as to cut/hold objects and oral piercing have been linked with TDIs<sup>2-4,18</sup> along with procedures such as intubation and laryngoscopy which have contributed to iatrogenic TDIs.<sup>2,4</sup> Moreover, smart phone use (accidentally dropping devices on to the face) is an emerging aetiological factor for TDIs, particularly among children and adolescents.<sup>19</sup> New episodes of TDI are more likely to occur among those who have previous TDI experiences.<sup>16</sup>

### Type of teeth and injuries involved in TDIs

Anterior teeth of both the primary and permanent dentition are involved in the majority of dental trauma with the maxillary central and lateral incisors being the most common teeth injured.<sup>2-4</sup> TDIs affecting a single tooth occur more frequently, however, multiple teeth are more likely to be involved in episodes like road traffic accidents, sports and violence.<sup>3,4</sup>

Fractures of teeth and alveolar bone, luxation injuries (displacement/dislocation of teeth) and avulsion of teeth (complete dislodgement of teeth) are the three main types of injuries involved in TDIs (Figure 1), although several subtypes come under each main type.<sup>20-22</sup>

The most common type of TDI reported is uncomplicated crown fracture in the permanent dentition while luxation injuries occur more frequently in the primary dentition.<sup>2,4,20-22</sup>

Due to the resilient nature of the supporting structures, luxation injuries are more common than fractures in the primary dentition.<sup>2</sup> Avulsion of teeth is one of the most serious dental injuries. It is rare compared with the other two types of injuries, although it occurs frequently in subpopulations where fights/assaults are common.<sup>2,21</sup>

### Management of TDIs

International Association of Dental Traumatology (IADT) developed evidence-based guidelines for dental trauma management of TDIs in 2001, which were updated in 2007 and revised in 2012.<sup>20-22</sup> These are the currently available best evidence and practice-based guidelines, developed by a group of experts from relevant field/s for the management of TDIs and endorsed by the American Association of Endodontists. The IADT acknowledge that appraisal of a given clinical scenario, will include patient characteristics and clinician's judgement which play a significant role in the application of these guidelines. The IADT believes that their application can enhance, but not guarantee, the probability of a favourable outcome.

Combined guidelines for the management of different subtypes of TDIs as well as their long-term follow-up for both the primary and permanent dentitions have been described in detail elsewhere and can be [freely accessed](#).<sup>23</sup> Providing such comprehensive and detailed guidelines is beyond the scope of this information sheet. While reiterating that the final decision in regards to patient care remains primarily with the clinician, some general recommendations and considerations for managing TDIs in the permanent and primary dentitions are briefly discussed below.

### Permanent dentition

- For diagnosis, radiographic examination with periapical (both lateral and horizontal angulations) and occlusal views are suggested although the final decision is at the discretion of the clinician.
- For root-fractured, luxated and avulsed teeth, short-term, non-rigid splinting is suggested to maintain repositioned teeth in the correct position with enhanced functional support.
- Little or no evidence supports that use of antibiotics improves the outcomes for root-fractured teeth, luxation injuries and replanted avulsed teeth. Thus the clinician may use them depending on the extent of other associated injuries and medical condition of the patient.
- At the time of injury, dental pulp sensibility tests (cold, heat and/or electric pulp test) usually indicate no response due to a momentary absence of pulpal response. At least two signs and symptoms including

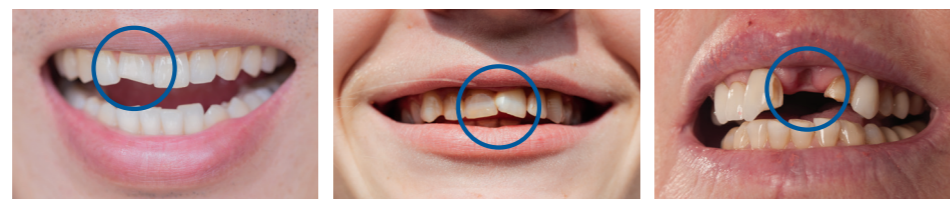
no response to cold, heat or electric pulp testing, tenderness to percussion/palpation or biting and/or radiographic evidence are thus required for confirming the diagnosis of necrotic pulp. There may be no evidence of radiographic changes or presence of these symptoms at the time of injury and therefore it is emphasised that all these tests including radiographic examination are required at regular follow ups to confirm a pulpal diagnosis.

- Given that immature permanent teeth (with open apices) have a substantial capacity to heal after root fractures, luxation injury and pulp exposure, every effort should be made to preserve their pupal vitality by resorting to emergency treatment options such as partial pulpotomy and thereby facilitating root development.
- Partial canal obliteration (PCO), which indicates ongoing pulpal vitality, more commonly happens with severe luxation injuries of teeth with open apices as well as root-fractured teeth and less frequently with crown-fractured teeth.
- For optimal healing and to prevent further injury after TDIs, patient compliance with follow-up visits and home care plays a significant role. Instructions should be provided to both the patients and the carers of young patients regarding post-injury care of teeth (and replanted avulsed teeth) as follows:
  - > Avoid participation in contact sports until completely recovered from TDI
  - > Have soft diet for up to two weeks and then return to normal function as early as possible
  - > Maintain meticulous oral hygiene by brushing teeth after every meal using a soft toothbrush
  - > Use 0.1% chlorhexidine gluconate alcohol free mouthwash for 1-2 weeks
- It is important to provide first aid for avulsed teeth at the place of injury/accident as per the below steps:
  - > Keep the patient calm and determine if the avulsed tooth is a permanent tooth as primary (deciduous) teeth should not be replanted
  - > Pick-up the tooth by the crown without touching the root
  - > If the tooth is dirty, wash the tooth under cold running water briefly for a maximum of 10 seconds.
  - > Encourage the patient/carer to replant the tooth and once it is back in place ask to bite on a handkerchief/cloth to hold it in position
  - > If the above is not possible, place the tooth in a glass of milk or container with patient's saliva (avoid storing in water) and bring the patient to the emergency clinic. The tooth can be transported inside the lip or cheek if the patient is conscious and at an age where they are old enough to not swallow the avulsed tooth

- > It is preferable to use special storage media/transport media such as Hank's balanced salt solution (HBSS) or saline, tissue culture/transport medium if such media are available
- > Seek emergency dental treatment immediately
- In regards to avulsed permanent teeth, treatment choice depends on the maturity of the root (closed versus open apex) and the status of the periodontal ligament (PDL) cells. In particular, extra-oral dry time (time out of the mouth) of the tooth affects the survival of PDL cells. Thus prior to treatment the clinician should assess the status of the PDL cells as follows. The PDL cells are:
  - > most likely viable if the tooth is replanted immediately or after a very short time at the place of the accident
  - > viable but compromised if the tooth has been kept in a storage medium mentioned above and the total extra-oral dry time is <60 minutes
  - > non-viable if the total extra-oral dry time is >60 minutes regardless of using a physiologic storage medium or if non-physiologic medium was used

### Primary dentition

- Special consideration should be given to managing TDIs in the primary dentition because they present with specific issues (some of which are listed below) and their management is different from TDIs in the permanent dentition.
- Fear and lack of cooperation render examining and treating difficult with young children with TDIs, which are distressing for both the children and carers.
  - Be mindful of the close relationship between the underlying permanent tooth germ and the root apex of the injured primary tooth.
  - Severe TDIs in the primary teeth can cause malformation, impaction and eruption disturbances in the developing permanent dentition.
  - Crown discoloration and incisor hypoplasia of permanent teeth are the most common sequelae of primary teeth intrusion and avulsion in young children.
  - Such aftereffects/sequelae of TDIs emphasizes the importance of making relevant treatment decisions to minimise further damage to permanent successors - the main reason behind not replanting avulsed primary teeth.
  - Exfoliation time of the injured tooth, occlusion and the child's maturity and ability to deal with the emergency situation influence treatment options.
  - Partial pulpotomy and pulpectomy are suggested for traumatic pulp exposures although extraction is the alternative if the child is not fully cooperative. However, most luxation injuries heal spontaneously avoiding the need for extraction.



A: Fractured tooth  
B: Luxated tooth  
C: Avulsion  
Figure 1. Main types of TDI (circled)

The IADT expert group has suggested further research on management of TDIs, particularly involving avulsed permanent teeth. Given the overall low quality of existing evidence a recent systematic review has also recommended further studies to ascertain the effectiveness of interventions for managing avulsed permanent teeth.<sup>24</sup>

## Prevention of TDIs

The importance of preventing TDIs is underpinned by their ubiquitous occurrence, psycho-social consequences and impact on quality of life, as well as the time consuming and expensive nature of their treatment options. Below are some preventive strategies that can be followed.<sup>2,25,26</sup>

- Timely intervention of oral factors such as excessive overjet/protrusion of maxillary anterior teeth that contribute to TDIs
- Avoid/minimise exposure to environmental factors such as unsafe playgrounds and human factors including risk-taking behaviours
- A wide range of policies and programmes, not limited to but including below, can be

introduced at school and community level to prevent TDIs:

- > Anti-bullying and violence policies with improved supervision in school yards
- > Sports policies to influence attitudes towards and promote use of intra-oral mouth guard protection as well as wearing other protective equipment and to provide such equipment, particularly in contact sports.
- > Sports policies should also ensure that design, development and maintenance of sport and recreational facilities and equipment meet safety standards while enforcing that playing rules pertaining to skills and fitness are adhered to by the participants
- > School health policies involving life skills, healthy setting for living, learning and working
- > Mutual support among community groups enabling them to improve their physical and social living environment
- Wearing seat belts as well as using appropriate child restraints in motor vehicles and wearing proper bicycle helmets help minimize TDIs during traffic accidents.

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## Summary

- Over one billion people are affected with TDIs placing it as the fifth most prevalent condition worldwide.
- TDIs can be regarded as an important public health issue given their ubiquitous occurrence, impact on quality of life, expensive and time intensive treatment choices.
- A range of oral, environmental and human factors can cause TDIs while falls and sporting activities contribute most to the TDIs in the primary and permanent dentitions.
- Anterior teeth, in particular maxillary incisors, are the most common teeth affected by TDIs. Fractures involving teeth and alveolar bone, luxation and avulsion of teeth are the three main types of injuries involved.
- IADT has developed comprehensive evidence based practice guidelines that assist dental practitioners, patients and carers to manage TDIs.
- Timely intervention of oral factors, minimising exposure to human as well as environmental factors and implementing a wide range of school and community based policies can help prevent TDIs.
- TDIs warrant further studies, particularly in Australia since TDI-related information is currently not available at a national level, to ascertain the effectiveness of TDI management strategies.

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CRICOS 00123M

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