



# Traumatic Dental Injuries to the Permanent Dentition

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## Introduction

Traumatic dental injuries (TDI) is a common cause of tooth damage and loss in the young and adolescent age group. As children start to attend school and engage in various physical activities, trauma to the teeth, especially anterior teeth, becomes common. However it has been shown that the correct knowledge to manage TDI is not adequate among local physical education teachers, who are likely to face such injuries on a daily basis (Chan et al 2001). Other causes of TDI are road traffic accident and violence, including child abuse. Proclined incisors predispose an individual to injuries.

TDI could be prevented by the use of mouth guards (Fig. 1) during physical exercise (Newsome et al 2001). These mouth guards are customary made from soft silicone and are readily available from private dentists and The Prince Philip Dental Hospital. Unfortunately they are mostly ignored except in some contact sports.

## General management

Management of TDI could be divided into primary, secondary and tertiary phases. Primary care provides the urgent treatment required immediately after trauma. This can be divided into acute, sub-acute and delayed priorities. Acute priority deals with problems that time will affect the outcome, usually in the scale of minutes, like haemostasis, replanting avulsed (dislodged) teeth and fixing alveolar fractures. In case of avulsion it is recommended that the tooth be cleaned if soiled, with saline, milk or water, and reimplanted into the socket immediately on site, before seeing a dentist. (<http://www.aae.org/pressroom/releases/newsmilk.htm>).

Sub-acute priority could be executed within hours after injury, like treating various types of teeth luxations (displacement), complicated crown fractures, root fractures and removal of foreign bodies from the wound. Tetanus booster or antibiotic prophylaxis is also provided at this stage. Delayed priority includes the restoration of uncomplicated crown fractures. However, in view of the small size of Hong Kong and the almost immediate accessibility to dental treatment, this classification is more of an academic interest. More importantly rather, it is the willingness of the victim to attend for treatment, correct diagnosis and meticulous execution of treatment that determine the outcome of primary treatment.

The secondary phase of treatment usually starts two weeks after the primary phase. This includes monitoring of pulpal status and healing of soft and hard tissues, root canal treatment, periodontal surgery and orthodontic treatment. The tertiary phase of treatment commences a few months to years after injury, which includes the final restoration of missing teeth, orthodontic treatment and monitoring reimplanted teeth.

## Type of trauma and management

TDI are usually a combination of trauma to the peri-oral soft tissues, teeth and their supporting tissues. These injuries and management are categorized individually for descriptive purpose only.

### Soft tissue

The wound should be cleaned and haemostasis achieved. Any foreign body should be identified, by clinical and radiographic examinations, and removed. Lacerations should be sutured after removal of necrotic tissue.

### Hard tissue

#### Uncomplicated crown fracture

Restoration of the fracture or bonding of the original fragment could be performed. The tooth may not respond to pulp test initially so vitality is checked periodically over a period of one year. Discolouration may occur. This could be due to transient hyperaemia, which is reversible, but it could also be due to pulpal necrosis or sclerosis.

#### Complicated crown fracture

Depend on the size of the exposure, pulp capping or high level pulpotomy could be performed. With the availability of mineral trioxide aggregate (MTA), treatment has become easier and more predictable (Fig. 2).

### Root fractures

Root fracture could occur at the apical, middle or coronal one third of the tooth. The coronal fragment is usually displaced or dislodged. It is mobile and the fracture line could be revealed using multi-angle periapical radiographs (Fig. 3).

The dislodged fragment of a coronal root fracture should be discarded. Orthodontic extrusion of the root is carried out after root canal therapy. Alternatively extraction and dental prosthesis could be considered if age and other factors are favourable.



In case of mid root and apical root fracture, an attempt should be made to splint the teeth with semi-rigid splinting for 4 weeks. Kevlar (Ribbond) composite splint appears to give superior results compared with wire or cap splints (Andreasen et al 2004). In most cases of incompletely formed roots pulpal vitality is maintained, whereas up to 30% of the coronal portion of mature roots undergo pulpal necrosis. Root canal therapy of the coronal portion shall be treated as open apex with a MTA apical plug.

Antibiotic prophylaxis seems to be beneficial to the outcome of periodontal healing. A loading dose of 1g Amoxil followed by 500mg q.i.d. for four days is recommended (Andreasen et al 2004).

### **Tooth displacement**

This ranges from concussion, subluxation, extrusive luxation, lateral luxation to intrusive luxation. In general there is periodontal bleeding and tooth displacement.

The incidence of pulpal necrosis depends on the mode of injury and stage of root formation, and ranges from 100% in intrusive luxation of mature roots to only 5% in concussion of immaturely formed roots. Concomitant root fracture should be excluded using multiple angle periapical radiographs.

Reduction of the tooth should be done with digital pressure or extraction forceps with gentle force under local anaesthetic. It is better to tolerate inadequate reduction than to force the tooth into position, risking further damage to the periodontal attachment. The occlusion is adjusted and the patient and parents informed. In mature roots suffering intrusive luxation, or when the tooth is locked too tightly, orthodontic extrusion is the treatment of choice. (<http://www.aae.org/pressroom/releases/newsluxation.htm>). A non-rigid splint should be used for 2-4 weeks depending on the extent of the displacement.

The pulpal and periodontal status should be checked periodically up to one year. Root canal treatment should be instituted for intrusive luxation cases, as pulpal necrosis is almost certain. Severe root resorption is usually not a major problem if root canal treatment is instituted timely.

### **Tooth Avulsion**

Although not life threatening, tooth avulsion demands the most urgent management to prevent replacement resorption. With other factors being equal, successful replantation of an avulsed tooth depends solely on extra-oral drying time and the storage medium of the avulsed tooth.

Replantation - preservation of viable periodontal ligament cells on root

Any soiled material on the tooth surface should be rinsed off with HANKS's Balanced Salt Solution (HBSS) (Pohl 2005) or if not available, with saline, milk or water. The root surface should not be manipulated. The cleansed tooth is replanted back into the socket immediately. If this is not possible due to socket deformity or soft tissue injury, the tooth should be dispatched in the above mentioned

media (Trope 1992) to the dentist with the patient immediately. Water is not a good storage medium and carrying the tooth in the buccal cheek should be considered as a substitute.

Replantation in the dental office should be done under local anaesthesia. After the socket is flushed with normal saline to clean out large blood clots and foreign bodies, the tooth is inserted without undue force. The tooth should be splinted semi-rigidly for 2-4 weeks. There is a chance of pulpal revascularisation during the earlier stage of root formation. Root canal treatment will be required for mature root and this can be performed at the same time when the splint is removed. Calcium hydroxide inter-appointment dressing for one month is recommended. Failing that the necrotic pulp could lead to severe external inflammatory resorption (Fig. 4).

Implantation - removal of periodontal ligament cells on root

If the root has been dried for more than twenty minutes, survival of the periodontal cells is not likely and replantation is not indicated. An implantation procedure, aiming to strength the root against replacement resorption after ankylosis, should be carried out. The root is cleaned of any attached soft tissue and immersed in 2% sodium fluoride for twenty minutes. It is then root filled extra-orally and replaced into the socket. This is followed by rigid splinting for six weeks.

### **Alveolar fracture**

The alveolar segment together with teeth may appear mobile and shows displacement. The teeth may or may not be displaced in their sockets. The segment should be reduced under nerve block anaesthesia and splinted with a rigid splint for 4 weeks. The pulpal and periodontal status should be followed up to one year as more than 75% of one or more teeth could become non-vital.

If the dentist suspects more serious injuries are sustained, the patient should be transfer to an appropriate specialist after primary wound stabilization is performed.

## **Conclusion**

A substantial amount of TDI could be prevented by the use of mouth guards. There is in general a lack of knowledge in the management of TDI among the lay population. This awareness could be raised by promotional campaigns (<http://www.hkda.org/Traumatic.htm>). The outcome of treatment depends on the extent of injury, the stage of root formation and correct execution of treatment (Andreasen 1995).

Dental treatment should be performed only after potential life threatening injuries such as neurological damage, bleeding or aspiration of foreign bodies/teeth, are treated or excluded. The only injury that requires immediate treatment is tooth avulsion. Readily available transporting media\* could make a big difference in the outcome of replantation (Trope & Friedman 1992). Prophylactic antibiotic cover is useful in the following situations: Uncertain tetanus status, root fracture, replantation and excessive soft tissue contamination or laceration.



Fig 1. Silicone mouth guards (Courtesy of Dr. P.R.N. Newsome)



Fig 2 a

Fig 2 b



Fig 2 c

Fig 2

a. Horizontal complicated crown fracture treated by high-level pulpotomy using MTA. The fragment is re-bonded with pin retention.  
 b. Healing successful with completed root formation and normal periapical status. Tooth not responsive to pulp test.  
 c. Orthodontic treatment to correct proclined incisors.



Fig 3 a

Fig 3 c



Fig 3 b

Fig 3

a. Horizontal mid root fracture 21.  
 b. Non-rigid splinting  
 c. No complication following non-rigid splinting. Tooth remains responsive to pulp test.



Fig 4 a

Fig 4 b

Fig 4.

a. Pulpal necrosis and external root resorption is evident in 11 two months following replantation without root canal treatment.  
 b. Root canal treatment of 11, with orthodontic extrusion of 12 to expose fracture margin.

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\*Tooth rescue box (Dentosafe®; Dentosafe GmbH, Iserlohn, Germany; EMT Tooth Saver, SmartPractice.com, Phoenix, AZ, USA.