

A Systematic Approach to Management & Prevention of Dental Trauma in Children

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Abstract

Trauma to teeth and supporting structures is one the most challenging situations dentists face in their day to day practice. World wide studies have shown an increased prevalence of dental trauma and resultant fractured, displaced, or avulsed teeth can have functional, esthetic, and psychological effects on children. For successful management of patients with dental trauma it is therefore very important to know the history, circumstances of the injury, type of trauma, and initial reaction of the child and/or guardian. Dentists should therefore be able to recognize, differentiate, and either treat or refer patients based on the type of dental trauma. To efficiently determine the extent of injury and correctly diagnose injuries to the teeth, periodontium, and associated structures, a systematic approach to diagnosis and treatment is essential. The article gives details of the treatment modalities for dental trauma and recommendations for prevention of Dento-facial injuries.

KEYWORDS: Oral Traumatic Injuries, Dental Trauma, Management, Prevention

Introduction

An injury to the teeth is one of the major challenges that dentists face in the clinic and proper management becomes a priority in order to retain the tooth in the dental arch. Injuries to the teeth can occur at any age and are usually due to falls, sports injuries, school fighting and road traffic accidents.(1,2,3,4) The greatest incidence of trauma to the primary teeth occurs at 2 to 3 years of age, when motor coordination is developing. (5) Maxillary central incisor is most vulnerable, which sustains approximately 80% of dental injuries followed by the maxillary lateral and the mandibular central and lateral incisors. Studies have shown moderate to high prevalence of dental trauma around the world (5). Prevalence rates in the primary dentition peaked at age 10-24 months in a Brazilian study, while the frequency of trauma to the permanent dentition in school age children peaked in the age group 9-15 years (5). The increasing number of children facing trauma related to teeth in their homes and schools has increased the demand for a preventive program dedicated entirely to prevention of dental trauma. Therefore any protocol for management of dental trauma should necessarily contain a section on prevention of trauma to Dento-facial area.

Management of Dental Trauma (6) :

History & Clinical Examination:

- Ascertain **when** the injury has occurred to elicit the time period that has elapsed since the injury occurred to establish the line of treatment.
- Ask **how** the injury occurred to understand the nature of injury and locate specific injuries.
- Enquire about the place **where** the injury occurred for prognosis.
- Establish **whether** any preliminary treatment or replacement of avulsed tooth

has been done as this will also affect the prognosis.

- **Chief Complaint** Record complaints aside from pain and bleeding, that may assist in the diagnosis.
- **Neurological Examination** While the clinician is obtaining the history of the accident and chief complaint, the patient should be observed for neurological or other medical complications.
- **External Examination** Before having the patient open the mouth for an intra-oral examination, the clinician should first look for external signs of injury of the head and neck.
- **Intra-Oral Soft-Tissue Examination** Next the clinician should look for lacerations of the lips, tongue, cheek, palate, and floor of the mouth.

- **Hard-Tissue Examination** One of the best examinations for evidence of traumatic injuries is simply to look carefully. Each tooth and its supporting structures must be examined with an explorer and periodontal probe.
- **Thermal and Electric Tests** A few general statements in regard to pulp tests on traumatized teeth may be helpful to interpret the results.
- **Radiographic Examinations** Radiographs are essential to the thorough examination of traumatized hard tissue. They may reveal root fractures, sub-gingival crown fractures, tooth displacements, bone fractures, or foreign objects. The radiographic examination should an Intra-oral peri-apical x-ray from three different angles, an Occlusal film and a panoramic OPG.

A. TRAUMA TO HARD DENTAL TISSUE: 1. Uncomplicated Crown Fracture

Type	Diagnosis	Treatment	Follow up
Crown Infraction	Crack or craze can be observed on clinical examination Direct illumination, trans-illumination, fiber optic resin curing light can be great value in diagnosis.	Establishing a baseline pulp status with routine sensitivity testing	At 3, 6, and 12 months and annually thereafter.
Uncomplicated Crown Fracture	Enamel fracture includes a superficial, rough edge. sensitivity to air and hot and cold liquids may be a chief complaint. Commonly a lip bruise or laceration is present.	Smooth the sharp edges Placing bonded composite resins may be necessary for esthetics. Enamel and Dentin Fracture: Urgently a hard-setting calcium hydroxide base is placed over exposed dentinal tubules followed by restoration with a bonded resin technique.	At 3, 6, and 12 months and annually thereafter.
Complicated Crown fracture	Involves the enamel, dentin, and pulp	There are two treatment options: Vital pulp therapy , Pulpectomy, RCT or Apexification or Apexogenesis	At 3, 6, and 12 months and annually thereafter.

2. Crown Root Fractures

Type	Diagnosis	Treatment	Follow up
Uncomplicated Crown root fracture	Indirect light and trans-illumination	These injuries are treated in the same manner as uncomplicated or complicated crown fractures, with additional treatment for any attachment injury. If a crown-root fracture under a bone attachment cannot be extruded above bone level by periodontal or orthodontic therapy or both, the tooth should be extracted.	As required by treatment modality
Complicated Crown root fracture	Clinical findings usually reveal a mobile coronal fragment attached to the gingiva with or without a pulp exposure. Radiographic findings may reveal a radiolucent oblique line. While radiographic demonstration often is difficult, root fractures can only be diagnosed radiographically.	Primary teeth: When the primary tooth cannot or should not be restored, the entire tooth should be removed unless retrieval of apical fragments may result in damage to the succedaneous tooth. Permanent teeth: The emergency treatment objectives to stabilize the coronal fragment. Definitive treatment alternatives are to remove the coronal fragment followed by a supragingival restoration or necessary gingivectomy; osteotomy; or surgical or orthodontic extrusion to prepare for restoration. If the pulp is exposed, pulpal treatment alternatives are pulp capping, pulpotomy, and root canal treatment.	As required by treatment modality

3. Root Fractures

It is a fracture of the cementum and dentin involving the pulp. It occurs in less than 3% of all dental injuries.

Horizontal root Fractures

Classification

1. Apical third fracture
2. Middle third fracture
3. Coronal third fracture

Treatment:

Emergency Treatment involves repositioning the segments and rigid splinting to adjacent teeth for 6-8 weeks depending on the fracture site.

Prognosis & Complications of Luxation Injuries

- Pulp canal obliteration. Root canal therapy is usually not required
- Marginal Bone loss. Usually minor
- Transient Apical breakdown. No treatment required
- Discoloration of the crown. Root canal therapy require if dark grey or brown

Type	Treatment
Apical Root Fracture	Expose radiograph at three different angles before tooth is repositioned to determine extent of fracture Reposition coronal segment and take radiograph to assert re-approximation Splint if required for 6-8 weeks. Root canal therapy may not be required If root canal therapy is required, perform only in coronal segment. Perform vitality test at the time of splint removal unless symptoms indicate pulpal pathosis
Middle Third Fracture	Expose radiograph at here different angles before tooth is repositioned in order to determine extent of fracture Reposition coronal segment if displaced and expose additional radiographs to ensure complete re-approximation Coronal segment will require splinting after repositioning is completed Splint with rigid splint for 6-8 weeks Pathogonomic for a failing union between the two segments is a semi lunar radiolucency on one or either side e of the fracture line If root canal therapy is indicated, it is performed only on the coronal half of the root. Pulp necrosis of the coronal segment results because of its displacement in about 25% cases
Coronal Third Fracture	Most difficult to treat Depending upon location the tooth may be treated conservatively. Expose radiograph before tooth is repositioned Reposition and expose additional radiographs to assure complete re-approximation Prognosis is very poor if coronal fracture site can be probed Splint with rigid splint for 6-8 weeks Warn patient that the coronal half may be lost. If coronal segment is lost apical segment can be extruded into position by orthodontic forced eruption or surgically by crown lengthening.

Summary of the Follow –up procedure for fractured permanent teeth and alveolar fractures.

Time	4 weeks	6-8 weeks	4 months	6 months	1 year	5 years
Uncomplicated crown fracture		C(3)			C(1)	
Complicated crown fracture		C(1)			C(1)	
Crown-root fracture		C(1)			C(1)	
Root fracture	C(2)	S+C(2)	S(*)+C(2)	C(2)	C(2)	C(2)
Alveolar fracture	S+C(3)	C(3)	C(3)	C(3)	C(3)	C(3)

S= Splint removal

S) = Splint removal in cervical third fracture*

C= Clinical and radiographic examination

B. Luxation Injuries:

Type	Diagnosis	Treatment	Follow up
Concussion	A relatively minor injury resulting in percussion sensitivity but without mobility	<p>No splinting is required since mobility is within normal limits</p> <p>Palliative treatment only (reduction of occlusal forces on the tooth)</p> <p>Patient should be recalled within 1-2 weeks</p> <p>RCT is not indicated in majority of concussion injuries</p> <p>Within 1-2 weeks the traumatized tooth should be WNL to all clinical tests including percussion ,palpation and vitality tests</p> <p>In absence of radiographic changes root canal therapy is not indicated</p>	Depending upon treatment done
Subluxation Injury	Often sulcular bleeding is present More severe than concussion	<p>Usually splinting is not required though mobility is between +1 to +2 mm and splinting can be done if considered necessary</p> <p>Palliative treatment only (reduction of occlusal forces).</p> <p>Radiographic findings are unremarkable.</p> <p>Patient should be recalled within 2-3 weeks</p> <p>Root canal treatment may be required in 20% of the cases</p> <p>Long term sequel may include necrosis, calcification of pulp chamber and canal system and marginal bone loss</p> <p>External or internal resorption does not usually occur</p>	Depending upon treatment done
Extrusive Luxation Injury	Bleeding Periodontal Ligament and dull Percussion sound. More severe than Subluxation.	<p>Administer local anesthesia and reposition tooth in socket</p> <p>Splint required for 7-14 days</p> <p>Root canal therapy required in majority of cases</p>	Patient should be recalled within 1-2 weeks
Lateral Luxation Injury	More severe than the extrusive since damage to the bone often occurs	<p>Administer local anesthesia and reposition tooth in socket</p> <p>In case of bony fracture splinting for 7-14 days or longer 2-8 weeks</p> <p>Root canal therapy is indicated in majority of cases</p> <p>Long term prognosis include high probability of pulpal necrosis and marginal bone loss ids possible</p> <p>External and /or internal resorption is unlikely</p>	Depending upon treatment done
Intrusive Luxation Injury	Metallic sound on percussion Tooth intruded (totally or partially), Tooth locked in the socket .More severe of all luxation injuries	<p>Patient should be told that prognosis is guarded</p> <p>Three options</p> <p>Allow tooth to erupt on its own</p> <p>Place orthodontic wire and extrude</p> <p>Use forceps to extract tooth into normal position</p> <p>Root canal therapy is indicated in all closed apex cases</p> <p>Open apex case should be monitored extremely closely for external resorption</p> <p>External root resorption is highly probable and may result in loss of tooth.</p>	Depending upon treatment done

Pulp Necrosis:

- 15 –59% In The Permanent Dentition
- Subluxation 26%
- Intrusive Luxation 96%
- Extrusive Luxation 64%
- Incomplete Root Development 17%
- Complete Root Development 68%

Canal Obliteration

- 25% of luxated Teeth
- Pulp necrosis 2ry to Obliteration 7-16

Prevalence of pulp canal obliteration after luxation of permanent teeth

- 6% to 33 %

Loss of Marginal Bone support

- 10% Of Luxated Teeth

Frequency of progressive root resorption after luxation of permanent teeth

- 6 % to 18 %

Follow –up procedure for fractured permanent teeth and alveolar fractures.

Time	Up to 2 weeks	4 weeks	6-8 weeks	6 months	1 year	Yearly for 5 years
Concussion /Subluxation		C(1)	C(1)		C(1)	NA
Extrusive luxation	S+C(2)	C(3)	C(3)	C(3)	C(3)	C(3)
Lateral luxation	C(3)	S	C(3)	C(3)	C(3)	C(3)
Intrusive luxation	C(4)		C(4)	C(4)	C(4)	C(4)

S= Splint removal

C= Clinical and radiographic examination

NA= Not applicable

C. Avulsion Injuries

Definition: Complete exfoliation of the tooth with tooth out of the socket. (exanticate)

Treatment:

a. Emergency Treatment at the site of Trauma

Tooth must be kept hydrated and should not be exposed to an environment that will allow the periodontal ligament cells to necrose. By maintaining the cellular integrity of the root surface, a better prognosis will result.

- Rinse tooth with saline ,milk, or water and replant into socket as soon as possible
- If possible, do not scrape or damage the root
- Have patient bite gently on gauze or cloth or have patient secure tooth in socket with finger pressure
- Patient should see dentist or hospital –based emergency dental clinic immediately
- If patient or individual at the injury site cannot perform replantation, tooth should be placed into liquid medium like milk, saline, or secure in plastic wrap or place in patient's mouth. Do not wash the tooth under running tap water

b. Emergency Treatment in the dental office – Tooth already replanted in socket.

- Assure the tooth was replanted correctly and is clinically in alignment with the other teeth and adjacent arch.
- Expose a radiograph to verify the avulsed tooth (teeth) is /are in correct alignment ,there are no foreign objects within the socket ,there are no alveolar fractures present
- Splint should remain in place for 7-14 days or longer if avulsed tooth is too mobile for splint to be removed.
- Rigid splinting is required in presence of alveolar fractures for 6-8 weeks.

Closed Apex

- If the tooth has a closed apex, root canal treatment is required and root canal therapy may be initiated at the time of splinting or should be initiated within 2 weeks of the injury for the best prognosis.

Open Apex

- If the tooth has an open apex, consider the potential for revascularization of the pulp in lieu of endodontic therapy.

- The avulsed tooth should be closely monitored on weekly basis for first 8 weeks
- Radiographs for evidence of revascularization and lack of peri-apical pathosis must be confirmed
- Peri-apical radiographs should taken every other week to compare the avulsed tooth apical anatomy with the collateral tooth
- Should any evidence of peri-apical pathosis be noted, root canal therapy must be initiated immediately.
- Follow up is of critical necessity.

- Instrument canals and obturate with calcium hydroxide
- Place patient on 6-8 week recall.

Partially or completely closed apex less than 60 minutes Extra oral dry time.

- Instrument canals within 7 to 14 days
- Place calcium hydroxide in the canal for as long as practical (6 to 12 months)
- Permanently obturate with gutta-percha and sealer

Partially or completely closed apex and more than 60 minutes Extraoral dry time

- Instrument canals intra-orally or extra orally
- Before re-implanting tooth into the alveolar socket, remove tissue tags from root and soak tooth in an accepted dental fluoride solution.

Prognosis of Avulsed tooth:

Prognosis is “guarded” and depends upon extraoral dry time, apex development (age of patient) degree of damage to root surface and appropriate treatment received at the time of injury.

c. ADA Recommendations for Avulsed teeth:

Open apex and less than 60 minutes Extra oral dry time.

- Replant tooth with the intent of achieving revascularization
- Recall patient every 3-4 weeks
- If evidence of peri-apical pathosis is noted, the canals should be instrumented and treated with calcium Hydroxide to achieve apexification.

Open apex and more than 60 minutes Extra-oral dry time.

Splinting Guidelines for tooth /bone fractures and luxated /avulsed teeth.

Type of Injury	Splinting Time depending upon severity of trauma.
Subluxation	Usually not required but for 2-3 weeks if mobility beyond 2 mm.
Extrusive luxation	1- 2 weeks
Avulsion	Required for 1- 2 weeks or longer if tooth is mobile.
Lateral luxation	1- 2 weeks or In case of bony fracture 2- 8 weeks
Root fracture (cervical & middle third)	6-8 weeks if required
Alveolar fracture	4 weeks
Root Fracture (cervical third)	6-8 weeks

Prevention of Dento - facial Injuries.

Most of sports related and other dental trauma can however be prevented and there is urgent need to make prevention of sports and activities related dental injuries a part of the national preventive dental program.

Stakeholders:

- Dental professionals
- Medical Professionals
- School Authorities
- Sports Coaches
- Parents
- Local Authorities

Recommendation:

- Prevention of school based and other sports based injuries should be part of the national oral health prevention Program.
- Emergency treatment kits to be made available in schools.
- Identification of age related and individuals who participate in sports which have potential for injury.
- Mandatory use of protective equipment in contact sports.

- Increase awareness about sports related injuries among parents, coaches and public.
- ADA recommends injury prevention counseling right from 6 months to 12 years of age.

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Role of Dentist:

- **Include** traumatic injuries as part of their dental health education lectures in schools and hospitals.
- **Identify** children more vulnerable to dental trauma. These include children with increases over-jet and inadequate lip cover.
- **Modify** risk factors such as malocclusion and initiate orthodontic treatment in early to middle mixed dentition.
- **Fabricate** custom-fabricated mouth guards and demonstrate their use.
- **Educate** children, parents and teachers about protocol to be followed in case of dental trauma or avulsed tooth.
- **Update** knowledge about dental Traumatology and endodontic procedures.

Conclusion:

Facial trauma that results in fractured, displaced, or lost teeth can have significant negative functional, esthetic, and psychological effects on children. Dentists and physicians should therefore collaborate to educate the public about prevention and treatment of oral traumatic injuries. Dental professionals need to influence and educate all stakeholders about the risk of sports related and other Oro-facial injuries and preventive strategies.

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