The Treatment of Dental Traumatic Injuries

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Introduction

When treating dental trauma, the **timeliness** of care is key to saving the tooth in many cases.

It is, therefore, important for all dentists to have an understanding of how to **diagnose** and treat the most common dental injuries.

This is especially critical in the **emergency phase** of treatment.
Proper management of dental trauma is most often a team effort with general dentists, pediatric dentists or oral surgeons on the front line of the emergency service, and endodontic specialists joining the effort to preserve the tooth with respect to the pulp, pulpal space and root.
Prior to any treatment, one must evaluate the injury thoroughly by careful **clinical** and **radiographic** investigation.

It is recommended to follow a checklist to ensure that all necessary information regarding the patient and the injury is gathered, including:

1. Patient’s name, age, sex, address and contact numbers (include weight for young patients)

2. Central nervous system (CNS) symptoms exhibited after the injury
3. Patient’s general health
4. When, where and how the injury occurred
5. Treatment the patient received elsewhere
6. History of previous dental injuries
7. Disturbances in the bite
8. Tooth reactions to thermal changes or sensitivity to sweet
9. If the teeth are sore to (painful) touch or during eating
10. If the patient is experiencing spontaneous pain in the teeth
Once all of this information is gathered, a diagnosis can be made and appropriate treatment rendered.

If the injured individual is not a patient of record, all necessary demographic information should be gathered as soon as the patient arrives and prior to any assessment.
Emergency Care

In the case of **avulsion** and the tooth being out of its socket, one should immediately place the tooth in a physiological solution of specialized media (such as Hank’s Balanced Salt Solution™) or milk, or saline if those are not available.

Only after the tooth is secured in solution should one obtain the patient’s information.
Once the patient is seated in the dental chair, evaluate the central nervous system (CNS) before proceeding with further assessments.

The onset of symptoms can be delayed for minutes to hours.
The most common signs of serious cerebral concussion or hemorrhage are

1- loss of consciousness
2- post-traumatic amnesia.
3- Nausea/vomiting,
4- Fluids from the ear/nose
5- Situational confusion
6- Blurred vision
7- Uneven pupils
8- Difficulty of speech and/or slurred speech may also indicate serious injury.
Once the patient has been cleared of any CNS issues, the dental trauma should be assessed.

The key is to obtain comprehensive information about the injury and:

Thorough extraoral and intraoral clinical exams as well as appropriate radiographic evaluations must be done.
Dental trauma can be roughly divided into two groups: fractures and luxation injuries.

The fractures are then further divided by type: crown, crown-root and root fractures.
Clinical Examination

Dental Injuries

Fracture

Crown

Crown-Root

Luxation

Root
If the pulp is exposed to the oral environment, it is called a *complicated fracture*.

If not exposed, it is called an *uncomplicated fracture*. 
The first thing to do in any crown or crown-root fracture is to look for the broken-off tooth fragment.

It is possible to rebond the fragment to the tooth, which is esthetically the best solution.

Prior to reattaching the tooth fragment, the remaining dental thickness immediately covering the pulp needs to be assessed radiographically and clinically.
If there is at least 0.5 mm of the dentin remaining, there is no need to cover it with a protective liner.

If it is estimated that the remaining dentin is less than 0.5 mm, it is advisable to cover the deepest part, closest to the pulp, with a cavity liner, and then dimple the fragment accordingly.
If the tooth fragment was kept dry, it should be rehydrated in distilled water or saline for 30 minutes prior to reattachment. This process will increase its bonding strength.

In a complicated fracture, the goal is to create a bacteria-tight seal to protect the pulp, after ensuring that the pulpal wound is clean and all inflamed tissue removed.
The two best capping materials available today are calcium hydroxide and mineral trioxide aggregate (MTA), but newer bioceramic materials are showing promise for this application.

It is advisable to create a 1-2 mm reservoir into the pulp with a high-speed diamond bur and copious water cooling, place the capping material, and then either reattach the tooth fragment or restore the crown with a composite resin material.
Fracture margin has to be exposed around the tooth/crown to properly restore the tooth.

This can be accomplished by **gingivectomy** if the fracture line is in the sulcus.

In more extreme cases, the tooth will have to be extruded with orthodontic forces or surgically repositioned.
In the emergency session, if the pulp is exposed, it needs to be protected in the same fashion as complicated crown fractures.

If it is not exposed, all accessible exposed dentin areas should be covered for the patient’s comfort.

Pulpal survival for all these fracture types is generally good; however, endodontic treatment may be indicated later.
Therefore, it is of utmost importance that a recall schedule is followed and that the teeth involved in the trauma are tested every time.

It is not uncommon for there to be no response to vitality tests for up to three months, and a lack of response to vitality tests does not always indicate that root canal treatment is needed – especially in young and immature teeth.
2- Crown-Root Fracture

It is advisable to look for at least one other sign of pulpal necrosis, like vestibule swelling, periapical lesions and/or dramatic color change of the crown.

If no signs exist, continue to monitor the patient at regular appointments every three months, for up to one year.
3- Root Fracture

The pulp is affected in all root fractures. However, if the fragments are approximated soon after the fracture, there is a good chance that no endodontic treatment is necessary, just observation.

With good approximation, it is likely that the pulp will revascularize across the fracture regardless of the age of the patient.
A recent retrospective study included assessment of splinting type and time of root fracture. The study determined that, if the cervical portion of the tooth is stable once the two pieces have been approximated, no splint or a flexible splint for two weeks produces the best treatment outcome.

Longer splinting time is only recommended when the fracture is close to the cervical area.
Luxation Injuries

All luxation injuries will cause some damage to the periodontal ligament and, in some cases, the pulp as well.

The immediate treatment is to limit further damage to the PDL and allow for the best possible healing.

As with all dental injuries, followup is essential.

Late complications, such as internal or external root resorptions, are relatively frequent and require endodontic treatment, especially in more severe injuries.
Luxation

Luxation Injuries

- Concussion
- Subluxation
- Extrusion
- Lateral Luxation
- Intrusion
- Avulsion
Concussion is: an injury to the tooth-supporting structures without increased mobility or displacement of the tooth, but with pain to percussion.
Concussion

Etiology:
Cause by physical trauma that leads to leading-edema in few areas of the periodontal ligament

In most areas the periodontal ligament is without any damage
Diagnosis:

Visual Signs: Not displaced
Percussion test: TTP (tender to percussion)
Mobility test: No increased mobility
Pulp sensibility test: Usually (not always) a positive result

Radiographic findings:

Radiographs recommended: As a routine, occlusal, periapical exposure and lateral view from mesial or distal aspect of the tooth in question to exclude displacement
Concussion

Treatment: No active treatment, monitor pulpal condition up to one year

Followup: clinical & radiographic control at 4 weeks, 6-8 weeks & 1 year
Subluxation is: an injury to the tooth supporting structures resulting in increased mobility, but without displacement of the tooth. Bleeding from the gingival sulcus confirms the diagnosis.
Etiology:

- Damage may have happened to the neurovascular supply
- In many areas separation of PDL with interstitial bleeding edema
- Some areas have undamaged PDL
- Loosening of the tooth
Diagnosis:

**Visual Signs**: Not displaced

**Percussion test**: TTP (tender to percussion)

**Mobility test**: Increased mobility

**Pulp sensibility test**: Sensibility testing may be negative initially indicating transient pulpal damage. Monitor pulpal response until a definitive pulpal diagnosis can be made.

**Radiographic findings**: Usually no radiographic abnormalities

**Radiographs recommended**: As a routine, occlucal, periapical exposure and lateral view from mesial or distal aspect of the tooth in question to exclude displacement
**Subluxation**

**TREATMENT**
A flexible splint to stabilize the tooth for patient comfort can be used for up to 2 weeks.

**FOLLOW-UP**
Splint removal and radiographic control after 2 weeks. Clinical and radiographic control at 2 weeks, 4 weeks, 6-8 weeks and 1 year.
Extrusion

**Extrusion** is a partial displacement of the tooth out of its socket.

It is an injury to the tooth characterized by partial or total separation of the PDL resulting in loosening and displacement of the tooth.

The alveolar socket bone is intact in an extrusion injury as opposed to a lateral luxation injury.
In addition to axial displacement, the tooth will usually have an element of protrusion or retraction. In severe extrusion injuries the retraction/protrusion element can be very pronounced. In some cases it can be more pronounced than the extrusive element.

Extrusion
Extrusion

Etiology:

- Severance of neurovascular pulp supply
- Separation of PDL
- Exposure of root surface
Extrusion

**Diagnosis:**

- **Visual Signs**: Appears elongated
- **Percussion test**: TTP (tender to percussion)
- **Mobility test**: Excessively mobile
- **Pulp sensibility test**: Usually lack of response except for teeth with minor displacements. The test is important in assessing risk of healing complications. A positive result to the initial test indicates a reduced risk of lateral pulp necrosis.
- **Radiographic findings**: Increased periapical ligament space

**Radiographs recommended**: As a routine, occlusal, periapical exposure and lateral view from mesial or distal aspect of the tooth in question to exclude displacement
Treatment:
The exposed root surface of the displaced tooth is cleansed with saline before repositioning.
Reposition the tooth by gently re-inserting it into the tooth socket with axial digital pressure (local anesthesia is usually not necessary).
Stabilize the tooth for 2 weeks using a flexible splint.
Extrusion

Monitoring the pulpal condition is essential to diagnose associated root resorption.

Followup:
Clinical and radiographic control and splint removal after 2 weeks. Clinical and radiographic control at 4 weeks, 6-8 weeks, 6 months, 1 year and yearly for 5 years.
Lateral luxation is:
displacement of the tooth other than axially.
Displacement is accompanied by comminution or fracture of either the labial or palatal/lingual alveolar bone.
- Total separation of PDL
- However, lateral luxations are complicated by fracture of either the labial or the palatal/lingual alveolar bone and a compression zone in the cervical and sometimes the apical area. If both sides of the alveolar socket have been fractured, the injury should be classified as an alveolar fracture (alveolar fractures rarely affect only a single tooth). In most cases of lateral luxation the apex of the tooth has been forced into the bone by the displacement, and the tooth is frequently non-mobile.
Etiology:

- Severance of neurovascular pulp supply
- Entrapment of apex
- Fracture of labial bone plate
- Severance of PDL
- Compression of PDL
Lateral Luxation

**Diagnosis:**

**Visual Signs**
- Displaced in palatal/lingual or labial direction

**Percussion test**
- Usually gives a high metallic (ankylosis) sound

**Mobility test**
- Usually immobile

**Pulp sensibility test**
- It will likely give a lack of response except for teeth with minor displacements.

**Radiographic findings**
- Widened periapical ligament space best seen on occlusal exposure.

**Radiographs recommended**
- As a routine, occlusal, periapical exposure and lateral view from mesial or distal aspect of the tooth in question to exclude displacement.
**Treatment:**

Rinse the exposed part of the root surface with saline before repositioning.

Apply a local anesthesia

Reposition the tooth with forceps or with digital pressure to disengage it from its bony lock and gently reposition it into its original location.

Stabilize the tooth for 4 weeks using a flexible splint.

4 weeks is indicated due to the associated bone fracture.
Intrusion is: a displacement of the tooth into the alveolar bone.

This injury is accompanied by comminution or fracture of the alveolar socket.
**Intrusion**

**Etiology:**
- Disruption of neurovascular supply
- Laceration of PDL
- Contusion of PDL
- Contusion of alveolar bone
- Disruption of marginal gingival seal
Intrusion

**Diagnosis:**

**Visual Signs**
- The tooth is displaced axially into the alveolar bone

**Percussion test**
- Usually gives a high metallic (ankylosis) sound

**Mobility test**
- The tooth is immobile

**Pulp sensibility test**
- Sensibility test will likely give negative response
  - In immature teeth pulpal revascularization may occur

**Radiographic findings**
- The PDL space may be absent from all parts of the root, the CEJ is located more apically in the intruded tooth than in the adjacent non-injured teeth, at times even apical to the marginal bone level

**Radiographs recommended**
- As a routine, occlusal, periapical exposure and lateral view from mesial or distal aspect of the tooth in question to exclude displacement
Intrusion

Treatment:

Treatment options:

1- spontaneous repositioning
2- orthodontic repositioning
3- surgical repositioning

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<tr>
<th>Apex</th>
<th>Intrusion severity</th>
<th>Repositioning</th>
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<tbody>
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<td></td>
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<td>Spontaneous</td>
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Avulsion is: the tooth is completely displaced out of its socket.

Clinically the socket is found empty or filled with a coagulum.
Avulsion

Etiology:
- Severance of neurovascular pulp supply
- Separation of PDL and exposure of root surface
**Diagnosis:**

- **Visual Signs**: The tooth is removed from its socket
- **Percussion test**: Not indicated
- **Mobility test**: Not indicated
- **Pulp sensibility test**: Not indicated
- **Radiographic findings**: If the visual appearance of the injury raises suspicion of a possible intrusion, root fracture, alveolar fracture or jaw fracture an occlusal radiograph should be taken to confirm the diagnosis

**Radiographs recommended**: As a routine, occlusal, periapical exposure and lateral view from mesial or distal aspect of the tooth in question
Avulsion

Treatment

1st thing is to make sure that the avulsed tooth is a permanent since deciduous tooth should not be replanted.

The time outside of the socket for an avulsed tooth is the most critical factor for its survival.

If the tooth is replanted within 30 minutes, or alternatively kept in a physiological solution of specialized media or milk for a few hours, it has a fairly good prognosis.
The tooth can also be transported in the mouth, keeping it between the molars and the inside of the cheek.

If the patient is very young, he/she could swallow the tooth- therefore it is advisable to get the patient to spit in a container and place the tooth in it.
If the tooth has been dry for more than one hour, the periodontal ligament cannot be expected to survive and the tooth will likely become ankylosed.

Once reimplanted, most teeth need to be stabilized with a physiological splint for two weeks.
If the avulsed tooth has an open apex and was reimplanted within the hour, there is a possibility that the pulp will revascularize.

In this case, delaying endodontic treatment at the emergency stage is recommended.

Endodontic treatment should only be performed later if signs of pulpal necrosis, root resorption and/or arrested root development are confirmed.
In the case of a closed apex, revascularization is not expected.

Therefore, endodontic treatment must be initiated two weeks after the tooth is reimplanted, and prior to removal of the splint.

Treatment should not be initiated earlier as any further manipulation of the tooth prior to or immediately after reimplantation can cause further damage to the PDL.
In addition, it has been shown that placing calcium hydroxide as an intracanal medicament immediately after reimplantation will promote inflammation that can lead to PDL damage.

If the tooth had been kept dry longer than 60 minutes, performing root canal treatment prior to reimplantation is indicated.
After the emergency situation has been managed and the tooth/teeth stabilized, the second phase begins, in which the pulpal condition and likelihood of root resorption have to be carefully evaluated and the patient followed over a period of months, if not years.

A follow-up timeline is essential to allow for intervention if signs of complications appear.
Thank You