
UNIT 36 DIAGNOSIS AND MANAGEMENT

Structure

- 36.0 Objectives
- 36.1 Introduction
- 36.2 Classification and Examination
 - 36.2.1 History Taking
 - 36.2.2 Clinical Examination
 - 36.2.3 Diagnostic Tests
 - 36.2.4 Injuries to the Gingiva/Alveolus
- 36.3 Traumatic Injuries and their Management
 - 36.3.1 Crown Fracture
 - 36.3.2 Crown Root Fracture
 - 36.3.3 Root Fracture
 - 36.3.4 Luxation Injuries
 - 36.3.4 Avulsion
- 36.4 Tooth Response to Traumatic Injuries
- 36.5 Follow up Schedule
- 36.6 Let Us Sum Up
- 36.7 Answers to Check Your Progress
- 36.8 Further Readings

36.0 OBJECTIVES

After reading this unit, you should be able to:

- describe the ramifications of the dentoalveolar complex in order to appreciate the nature of injuries which can occur.
- formulate strategies for systematic examination of these injuries, and accurately diagnose the nature and type of injury.
- develop emergency treatment protocols for traumatized teeth and supporting structures.
- prioritise and plan treatment strategies, which will facilitate functional healing.
- develop clinical strategies for preservation of tooth vitality.
- evaluate and treat pulpally compromised teeth to ensure successful healing and minimise risk of resorption.
- accurately determine possible prognosis based on sound treatment planning.
- to deal with the esthetic needs of the patient and address the same.

36.1 INTRODUCTION

In the previous unit, we have dealt with the classification and diagnosis of traumatic dental injuries. Now we will discuss about the management of these clinical situations.

Traumatic injuries to the dentoalveolar apparatus cause numerous injuries in a variety of directions and a variety of magnitudes. The outcome of traumatic events involving teeth depends on three factors: the extent of injury, the quality and timeliness of initial care, and the follow-up evaluation and care. Frequently these injuries require immediate attention and emergency treatment protocols can substantially influence final prognosis.

As a clinician it is imperative to diagnose and treat the injuries on a priority basis not only to improve the health of the dentoalveolar complex but also to satisfy the patients esthetic needs. A large majority of these injuries can be treated efficiently and expeditiously with accurate diagnostic and treatment strategies. In many cases the initial treatment protocol could lead to preservation of tooth vitality and better prognosis. The goal of this unit is to provide the input required for effective clinical management of these injuries. You will learn how to preserve the vitality of the teeth if possible, as well as management of pulpally compromised teeth to ensure optimal healing.

36.2 CLASSIFICATION AND EXAMINATION

You have already gone through the WHO classification in previous unit. We will just mention it to keep the continuity on.

The purpose of classifying dental injuries is to provide a description of specific conditions, allowing dentists to recognise and treat using recommended treatment remedies.

Different classification have been discussed in details in the previous unit. The currently recommended classification is one based on the World Health Organization classification (1978) of diseases and modified by Andreasen and Andreasen (1994). It is also the classification that will be followed in this unit.

Dentofacial Injuries can be categorised into the following categories:

- Soft tissues Lacerations
- Contusions
- Abrasions
- Tooth fractures
- Enamel fractures
- Crown fractures—uncomplicated (no pulp exposure)
- Crown fractures—complicated (with pulp exposure)
- Crown-root fractures
- Root fractures
- Luxation injuries
- Tooth concussion
- Subluxation
- Extrusive luxation
- Lateral luxation
- Intrusive luxation

Traumatic Injuries

- Avulsion
- Facial skeletal injuries
- Alveolar process—maxilla/mandible
- Body of maxillary/mandibular bone
- Temporomandibular joint

In this unit we would concentrate primarily on diagnosis and management of injuries related to the teeth.

36.2.1 History Taking

History taking involves obtaining information about the accident in chronologic order to determine what effect it has had on the patient. It is important to know if there has been any treatment before this examination. The patient needs to be questioned about previous injuries involving the same area.

The following questions need to be asked:

- 1) **History:** While taking history you must take care of the following points:
 - a) When did the accident happen? — Record the time and date as closely as the patient can recall. The time elapsed since injury can seriously affect the prognosis as in case of avulsion
 - b) How did it happen? — This question provides information on the nature of injury for e.g, blunt or sharp object, direct or indirect blow, all of which will have a bearing on the injury. They also help predict if there could be any concomitant injuries.
 - c) Where did it happen? — Note the location, for example, car accident, cricket pitch, basketball court etc.
 - d) Previous injury or treatment. — Prior treatment affects both the treatment plan and the prognosis. If the tooth was avulsed, was it replanted immediately or how soon after the accident? These questions can provide clues about the standard and quality of emergency care.
 - e) Have you had similar injuries before? — Repeated injuries to teeth affect the pulps and their ability to recover from trauma, which could alter the treatment plan.

- 2) **General Conditions**

Medical history should be enquired about. This is required to detect medical conditions as well as medications given to the patient. It may also be required to provide prophylactic antibiotic therapy for patients at risk. Was the patient conscious? Is there a history of amnesia? - Signs and symptoms to watch for are dizziness; vomiting; severe headaches; seizures or convulsions; blurred vision; unconsciousness; loss of smell, taste, hearing, sight or balance; or bleeding from the nose or ears. Affirmative response to any of the above indicates the need for emergency medical evaluation.

3) **Chief Complaint**

When diagnosing the origins of pain, most of the diagnosis should be done by what we hear and not what we see. In fact, visual clues might throw us off track resulting in incorrect diagnosis. Once a comprehensive history has been taken the practitioner should in most cases know the diagnosis of the problem. The clinical examination and diagnostic tests should then be done to ascertain which tooth fits this diagnostic category. The primary goal of the diagnostic procedure is to evaluate whether the disease process is reversible or irreversible, which in turn has a bearing on treatment planning.

Listening carefully to the patient's description of his/her symptoms can provide invaluable information. It is quicker and more efficient to ask patients specific, but not leading, questions about their pain.

The following questions are absolutely critical

- 1) How long have you had the pain?
- 2) Do you know which tooth it is?
- 3) Does anything initiate the pain or is it spontaneous?
- 4) How would you describe the pain?
 - Sharp or dull
 - Throbbing
 - Mild or severe
 - Localised or radiating
- 5) How long does the pain last?
- 6) Does it hurt most during the day or night?
- 7) Does anything relieve the pain?
- 8) Does a change in posture modify the intensity of the pain?
- 9) Does the pain respond to pain medication?

It is usually possible to decide, as a result of questioning the patient, whether the pain is of pulpal, periapical or periodontal origin, or if it is non-dental in origin.

In early pulpitis the patient often cannot localise the pain to a particular tooth or jaw because the pulp does not contain any proprioceptive nerve endings. As the disease advances and the periapical region becomes involved, the tooth will become tender and the proprioceptive nerve endings in the periodontal ligament are stimulated.

In cases of pulpitis, the decision the operator must make is whether the pulpal inflammation is reversible, in which case it may be treated conservatively, or irreversible, in which case either the pulp or the tooth must be removed, depending upon the patient's wishes. (Table 36.1)

Table 36.1: Formulation of a pulpal diagnosis

Symptom, test, supporting information	Necrotic Pulp	Irreversible Inflammation	Reversible Inflammation
Pulp Test	Negative	Postive	Positive
Key Factors			
Pulpal enposure		Present	Absent
Pain to percussion		Present	Absent
Related factors			
Severe pain		Present	Absent
Spontaneous pain		Present	Absent
Past history of pain		Present	Absent
Deep throbbing/Lingering pain		Present	Absent
Pain aggravated by hot and releived by cold		Present	Absent
Factors related to treatment plans			
Age, Periodontal disease, previous pulpal insults		Questionable	Questionable

If symptoms arise spontaneously, without stimulus, or continue for more than a few seconds after a stimulus is withdrawn, the pulp may be deemed to be irreversibly damaged. Applications of sedative dressings may relieve the pain, but the pulp will continue to degenerate until root canal treatment becomes necessary. This may then prove more difficult over time, if either the root canals have become infected or if sclerosis of the root canal system has occurred. The correct diagnosis, once made, must be adhered to with the appropriate treatment.

36.2.2 Clinical Examination

A careful, methodical approach to the clinical examination will reduce the possibility of overlooking or missing important details.

Extra-oral Examination

- 1) **Soft Tissue:** The soft tissue around the oral cavity, especially the lips and cheeks should be carefully examined for signs of injury, foreign bodies and potentially disfiguring defects which might need immediate attention.
- 2) **Bony Landmarks:** These are crucial in determining if there are fractures involving the facial bones. The maxilla, mandible, and temporomandibular joint should be examined visually and by palpation, seeking distortions, malalignment, or indications of fractures. These areas should be followed up radiographically.

Intra-oral Examination

Stepwise examination of the following should be undertaken

- 1) **Soft Tissue Lacerations:** The evaluation should be thorough and should include lips, oral mucosa, gingival, hard and soft palate and floor of the mouth. The lips, cheeks, and tongue adjacent to any fractured teeth should be carefully examined and palpated.

- 2) **Tooth Mobility:** Mobility should be evaluated and recorded. Examine the teeth for mobility in all directions, including axially. If multiple teeth move simultaneously with the tooth being tested, suspect alveolar fracture. Root fractures often result in crown mobility, the degree depending on the proximity of the fracture to the crown. The degree of mobility can be recorded as follows: 0 for no mobility, 1 for slight mobility, 2 for marked mobility, and 3 for mobility and depressibility.
- 3) **Occlusion:** Derangement in occlusion is often due to facial fractures and may need immediate attention and or alterations in the treatment plan.
- 4) **Clinical Crowns:** The crowns of the teeth should be cleaned and examined for extent and type of injury. Crown infractions or enamel cracks can be detected by changing the light beam from side to side, shining a fiber-optic light or light cure light through the crown, or using disclosing solutions. If tooth structure has been lost, note the extent of loss: enamel only, enamel and dentin, or enamel and dentin with pulp exposure. If a crown fracture extends subgingivally, the fractured part often remains attached but loose. Also check for discoloration of the crown or changes in translucency to fiber-optic light. Both may indicate pulp change.
- 5) **Displacement:** Note any displacement of the teeth that may be intrusive, extrusive, or lateral (either labial or lingual) or complete avulsion
- 6) **Sensitivity to Percussion:** Denotes injury to periodontal ligament and alveolus include all teeth suspected of having been injured with several adjacent and opposing ones. The results may be recorded as “normal response,” “slightly sensitive,” or “very sensitive” to percussion. Gentle tapping with a mirror handle is the norm. In cases of extensive apical periodontal damage, however, it may be advisable to use the fingertip for percussion.

36.2.3 Diagnostic Tests

Most of our job is done by the time we have finished taking the history and the clinical examination. These following diagnostic tests further take us to the proper diagnosis and help us to formulate our treatment plan.

Electric Pulp Tester (EPT)

The EPT uses electric current to stimulate the sensory nerves of the dental pulp. Measurement of electric voltage in teeth may be inconsistent due to thickness of enamel and dentin, dryness and electrical resistance of enamel, infractions, restorations, pits, fissures and caries. Where the electric pulp tester is placed on the tooth crown is critical. It has been shown that the incisal edge on anterior teeth and the mesio-buccal incisal edge on lower teeth is the optimal placement site for the EPT to determine the lowest response threshold. This is true of the cold tests as well .

Pulp testers should only be used to assess vital or non-vital pulps; they do not quantify disease, nor do they measure health and should not be used to judge the degree of pulpal disease. Pulp testing gives no indication of the state of the vascular supply, which would more accurately indicate the degree of pulp vitality. The only way pulpal blood-flow may be measured is by using a Laser-Doppler Flow Meter, not usually available in general practice!

Traumatic Injuries

Heat: The tip of a gutta-percha stick may be heated in a flame and applied to a tooth. Take great note that hot gutta-percha may stick fast to enamel.

Cold: Different methods may be used to apply a cold stimulus to a tooth. The most effective is the use of a -50°C spray(Pulpofluorane , Septodont), which may be applied using a cotton pledget. This test is a simple and efficient test for most clinical situations though not necessarily conclusive.

Fibre-optic Light: A powerful light can be used for transilluminating teeth to show interproximal caries, fracture, opacity or discoloration. To carry out the test, the dental light should be turned off and the fibre-optic light placed against the tooth at the gingival margin with the beam directed through the tooth. If the crown of the tooth is fractured, the light will pass through the tooth until it strikes the stain lying in the fracture line; the tooth beyond the fracture will appear darker.

1) Radiographic Examination

- a) Intra-oral views of affected teeth: At least two views should be taken from different angulation to see if there is any fracture line present and occlusal films should be taken to check for the signs of trauma to teeth.
- b) Extra-oral views as necessary.
- c) Panoramic view: Facial bone projection or CAT scan should be done to see for any fracture lines.

Check Your Progress 1

- 1) What is the role of soft tissue examination in diagnosis and treatment planning?

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- 2) Describe a systematic approach for evaluation of traumatized teeth.

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36.2.4 Injuries To The Gingiva/Alveolus

GINGIVA

Let us first familiarise ourselves with various types of injuries, which affect the gingiva or oral mucosa

a) **Laceration**

- These are shallow or deep wound in the mucosa, which results from a tear usually caused by a sharp object.

b) **Contusion**

- A bruise caused by a submucosal haemorrhage, from impact by a blunt object with no break in the mucosa.

c) **Abrasion**

- Caused by rubbing or scraping of the mucosa and is a superficial wound with raw, bleeding surface.

ALVEOLUS

a) **Fracture of Alveolar Socket Wall**

Fracture confined to the facial or lingual socket wall usually caused by luxation of the tooth within the socket. It is always associated with lateral luxation. It can also be found with other injuries - e.g., avulsion.

b) **Fracture of the Alveolar Process**

This injury involves fracture of the whole alveolar process, generally detected when there is mobility of multiple teeth as a single unit. It may or may not involve the tooth socket

36.3 TRAUMATIC INJURIES & THEIR MANAGEMENT

Traumatic injuries to tooth may involve one or the other part of tooth or adjoining periradicular structures. Let us go through them one by one, but before that let us look at the general principles of treating traumatic injuries.

General Principles for Treating Trauma

The general principles for treating trauma that must be kept in mind are:

1) History, examination and assessment

Establish priorities based on the nature and severity of injuries. Potentially life threatening complications need to be handled on priority basis.

2) Protection of

a) Pulp (if exposed)

b) Root surface (e.g., during repositioning)

The pulp and root surfaces should be carefully handled to prevent iatrogenic complications and promote healing

3) Reposition – Immediately of Teeth, bone, soft tissues

Traumatic Injuries

All soft and hard tissues should be repositioned and stabilised at the earliest.

- 4) Stabilisation of
 - a) **Bone and Teeth:** splint (rigid or flexible) .Stabilisation of hard tissues may involve intraoral or extra oral devices .
 - b) **Soft Tissues:** Sutures should be placed as required especially in esthetically critical areas e.g. in cases of split lip. All efforts should be made to promote healing by primary intention
- 5) Temporary restorations.

Restorations should be placed at the earliest to protect the pulp and for esthetic rehabilitation
- 6) Medications
 - a) **Systemic:** tetanus, antibiotics, analgesics, anti-inflammatory agents should be prescribed as necessary.
 - b) **Local:** Intra-canal dressings like chlorhexidine gel or Calcium hydroxide paste may be required to promote healing and or prevent resorption.
- 7) Follow-up- a systematic regime of follow up should be instituted to monitor healing.

36.3.1 Crown Fractures

Crown fractures represent the majority of dental trauma in the permanent dentition (26–76% of dental injuries), while crown–root fractures only represent 0.3–5%. The dentist plays a key role, as the success of treatment and prognosis of the traumatised tooth depends on his accurate diagnosis and treatment procedures.

Crown fractures can be broadly classified as follows:

a) **Crown Infraction**

In this there occurs a crack of enamel and hence is also termed as “Incomplete fracture”. There is no loss of any tooth substance

Enamel/dentine cracks are possible pathways for bacterial penetration into the root canal system of teeth.

The application of dentine bonding agent may help prevent infection of the pulp .



Fig. 36.1: Crown infraction

b) Uncomplicated Crown Fracture

These are fractures confined to enamel OR involving enamel and dentine (Fig 36.2) & there is no pulpal exposure.



Fig. 36.2: Uncomplicated crown fracture



Fig. 36.3: Enamel dentine fracture

c) Complicated Crown Fracture

Fracture involving enamel and dentine AND the pulp is exposed (Fig. 36.4 and 36.5).

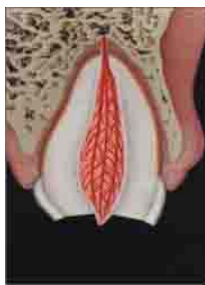


Fig. 36.4: Complicated crown fracture



Fig. 36.5: Pulp exposure

Treatment of Crown Fracture

- i) Restore fractured portion of tooth
- ii) Protect pulp
 - If pulp is exposed, we have to do partial pulpotomy or pulpectomy depending on stage of root development
 - If pulp is not exposed then indirect pulp capping is done.
- iii) Finish off with a composite resin restoration. The final restorative treatment for such teeth is deferred until such time that the pulpal status is clear.

Restoring the Fracture

There are numerous methods of restoring the fracture as listed below.

- 1) Restoration with fragment.
- 2) Celluloid crown form.
- 3) Single build-up with matrix.
- 4) Layered build-up with matrix or partial crown form.
- 5) Ceramic Veneers

Restoration with Fragment. (Fig 36.6–36.8)



Fig.36.6: Fracture incisor



Fig.37.7: Broken fragment



Fig.38.8: Fragment reattached

Fractured tooth reattachment is psychologically very positive for the patient and gives good esthetic results. If the fragment fits well with the broken portion of the tooth, it should be reattached.

- When patient calls, instruct them to find the fragments if possible with the hope of re-attachment.
- Fragments should be stored in milk or water.
- If brought dry, re-hydrate the fragment before re-attaching.
- Acid etch fragments and teeth.
- Place hybrid layer and bonding agent.
- Position fragment.
- Light cure for 40 sec from all the sides.
- Fracture lines are generally visible at this stage.
- Use diamond football to cut bevel into ½ the depth of enamel and taper to feather edge.
- Place enamel shade composite onto the surface and light cure.
- Polish with disks and paste.
- Apply glaze to maintain the finish for a long time.



Fig. 36.9:Fracture Incisor tooth



Fig. 36.10:Broken fragment



Fig.36.11: Lingual view



Fig. 36.12: Post Inserted



Fig. 36.13: Fragment



Fig. 36.14: Post Operative

If pulp is damaged and pulpectomy is required complete the endodontic procedures and reattach the fragment. (Fig. 39.14).

2) Celluloid crown form. (Figs 39.15-36.18).



Fig. 36.15:



Fig. 36.16:



Fig. 36.17:



Fig. 36.18:

This is an easy and quick way to build up the tooth to proper anatomic form with composite resin.

- 1) Bevel fracture line 1.5 mm using a tapered diamond. Provide a small bevel lingually as well (Fig. 36.15).
- 2) Select an appropriate celluloid crown form, and trim to correct dimensions (Fig. 36.16).
- 3) Condition the tooth and complete bonding procedures. Cure the bonding agent
- 4) Place appropriate shade of composite into the crown form and seat it onto prepared tooth after bonding (Fig. 36.17).
- 5) Cure the composite; remove the crown form by slicing it.
- 6) Finish and polish the restoration (Fig. 36.18).

3) Double shade build up using putty index

Putty index is used to build up the palatal surface of the tooth. Without this, it is difficult to control the contour of the composite on the palatal aspects.

- 1) Do a mock build up of the tooth using composite resin without bonding. You could also make a model and complete the mock build up on the model with wax (Fig. 36.20).
- 2) Using putty addition silicone create a putty index of the palatal surface (Fig. 36.20).
- 3) Remove the mock build up from the tooth , bevel, condition and place bonding agent on the tooth (Fig. 36.21).
- 4) Replace the putty index in the mouth and build up first palatal layer with opaque composite (shade OA3). Cure for 40 secs (Fig. 36.22).
- 5) Remove the index and build up the rest of the tooth with 2 or 3 increments of desired shade of composite (Fig. 36.23-36.24)
- 6) Complete finishing and polishing procedures.
 - Preoperative view (Fig. 36.19)



Fig.36.19: Preoperative

Fig. 36.20 Putty Build Up



Fig. 36.21 Beveling 1.5 to 2 mm



Fig. 36.22 Tooth etched and bonded Index in place.



Fig. 36.23 First layer Opaque A3 shade placed on index and cured.



Fig. 36.24 Build up completed with shade A3 nano composite.



Fig. 36.25 Completed restoration after final polishing



4) Restoring the tooth using layering technique (Fig. 36.26-36.30)



Fig. 36.26

layering technique, using enamel and dentin shades of composite gives more esthetics to the build up tooth structure.

- 1) Do a mock build up of the tooth using composite resin without bonding. You could also make a model and complete the mock build up on the model with wax.
- 2) Using putty addition silicones create a putty index of the palatal surface.
- 3) Remove the mock build up from the tooth, bevel condition and place bonding agent on the tooth.
- 4) Replace the index and build up the first layer using Enamel shade appropriate for that tooth and build a palatal shell. Cure for 40 secs. Fig. 36.27.



Fig. 36.27

- 5) Build up the incisal edge using an incisal shade in cases with high incisal translucency.(Fig.36.28).



Fig. 36.28

- 6) Build up next layer using appropriate body and dentine shades. Cure as recommended. (Fig 36.29).



Fig. 36.29

Traumatic Injuries

- 7) Place a layer of Enamel shade. Cure as recommended.
- 8) Finally pace an appropriate layer of translucent composite (white enamel, yellow translucent etc), cure as recommended.
- 9) Complete finishing and polishing procedures. (Fig. 36.30).

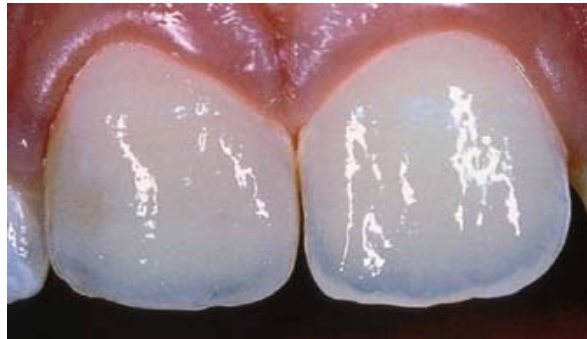


Fig. 36.30

5) Ceramic Veneers

When esthetics is of prime concern ceramic veneers offer a conservative treatment option. (Fig. 36.31-36.34) The cost of this procedure is higher as compared to the other treatment options.



Fig. 36.31: Fractured Tooth



Fig. 36.32: Preparation for veneer



Fig. 36.33: Ceramic veneer prepared



Fig. 36.34: Veneer cemented

Check Your Progress 2

1) How would you manage a case of uncomplicated crown fracture involving enamel and dentine?

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2) How would you protect the pulp in cases of fractures involving dentine but not the pulp?

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Treatment and Prognosis of the Pulp

Inflammatory changes are transient as long as the pulpal vascular supply remains intact and bacterial invasion is prevented. This may be achieved by efficiently sealing the dentin: only in the case of improper sealing will further irreversible pulpal lesions occur. Therefore, indirect pulp capping, as it used to be performed to protect the pulp, is not necessary, because it would prevent resin tag penetration into the tubules, and hence reduce sealing efficacy and bond strength of the future restoration. Prognosis of the pulp is very good. Long-term clinical studies show very little response to enamel–dentin fractures and subsequent restorative procedures; as long as there is no concomitant periodontal injury and that the restoration is efficiently sealed. Prevalence of pulp survival equals 94–98%.

Crown Fractures—Complicated (With Pulp Exposure)

Crown fractures involving enamel, dentin, and pulp are called complicated crown fractures .The degree of pulp involvement varies from a pinpoint exposure to complete exposure of the coronal pulp. The exposure of the pulp in complicated crown fractures makes the treatment more difficult. The incidence, compared with all types of dental injuries, ranges from 2 to 13%.

Protection of Pulp (Fig. 36.35)

The aim is to preserve pulp vitality especially in incompletely developed teeth. This will allow further root development and improves the long-term prognosis of tooth.

The various options includes:

- a) Pulp Capping (Fig. 36.35 A & B)
- b) Pulpotomy - Partial, Cervical (Fig. 36.35 C & D)
- c) Pulpectomy - Partial, Total (Fig. 36.35 E & F)

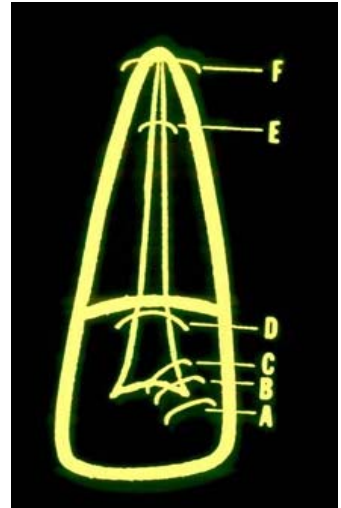


Fig. 36.35

The healing potential of exposed pulp after crown fractures depends on the severity of damage to the pulp as well as the treatment protocol employed. The success rates of the different procedures are enumerated below:

- Pulp Capping- 72 - 81 %
- Partial Pulpotomy – Cvek 94 - 96 %
- Cervical Pulpotomy - 72 - 79 %

The Cvek’s procedure is universally accepted as the most successful technique and can be safely used in most cases of pulpal exposure. You must read about the other procedures from standard textbook.

The Cvek Procedure-Partial Pulpotomy Technique

It should be done for a case with small area of pulp exposure which is less than 48 hrs. of post trauma.

- After anesthesia and rubber dam isolation, remove granulation tissue from the exposure site using a spoon excavator.
- With a small round bur or diamond remove 1-2 mm of the pulp. Provide water coolant at all times and avoid heat build up. Fig 36.36/36.37/ 36.38.

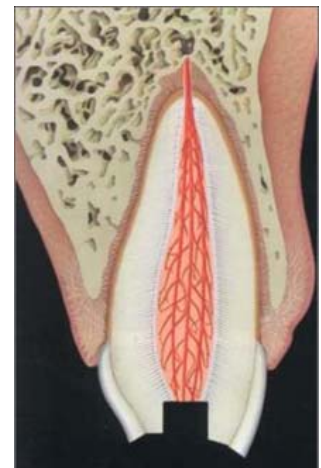


Fig. 36.36

- After preparing the pulp tissue, rinse the wound with saline and allow the bleeding to stop. This step is crucial when calcium hydroxide is being used.
- Establish clot.

- Wash the site with normal saline.
- Cover the prepared site with light cured Ca(OH)_2 material. Fig 36.39

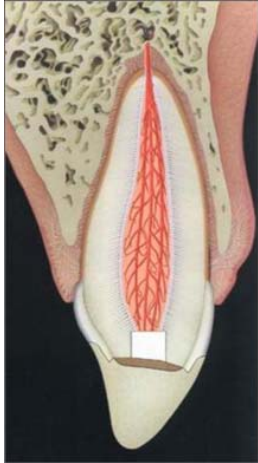


Fig. 36.37



Fig. 36.38



Fig. 36.39

- The various layers seen after pulp capping with Ca(OH)_2 can be seen in Fig 36.40.

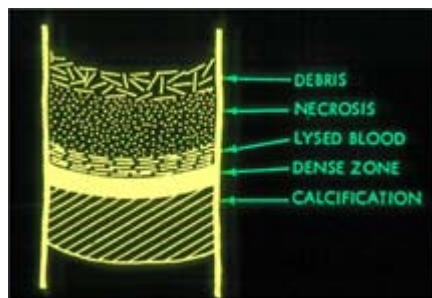


Fig. 36.40

- Place a Resin modified glass ionomer base.
- Restore with dentine adhesives and composite resin as described earlier.

Other Treatments: Full Etch Dental Bonding Agent

There has been considerable controversy over the use of bonding agents as pulp capping agents. The broad consensus seems to favour the use of more biocompatible materials like MTA (Mineral Trioxide Aggregate), which give more predictable results. Self-etching primers have been successfully used for the treatment of pulpal exposures and seem to perform better than other dentinal adhesives. The technique suggested by Dr Charles Cox seems to be the most successful and is described here. The key to success in any pulp capping procedure lies in providing a sterile environment and a complete seal. This technique has been described to complete the list of available procedures and not to suggest that it is a treatment of choice.

Suggested Clinical Protocol for Successful Direct Capping of an Exposed Pulp

- 1) Place a small drop of caries detector (e.g. Kuraray Caries Detector) onto the cavity as directed with an appropriate small sponge or cotton pellet, rinse

Traumatic Injuries

thoroughly and remove excess fluid with high evacuation. DO NOT DRY. Remove the dark stained (red-purple) infected dentin. It is RECOMMENDED that you should use a large (#8 or #10) round bur at slow speed revolution. A too heavy and forceful hand instrumentation may often unroof the underlying dentin, leaving a large exposure, forcing carious debris into the subjacent pulp-with damage.

- 2) Flush the exposure site with sterile water and gently cover the exposure with a small cotton pellet only immediately saturated with a 5% solution of medical grade NaOCl for 20-30 seconds. Remove the pellet and gently flush the exposure site with sterile water. If hemorrhage persists, reapply a fresh cotton pellet dampened with 5% NaOCl and leave until hemorrhage is controlled and remove as described above. This is essential.
- 3) Place a small cotton pellet fresh dampened with a 2% to 5% NaOCl over the exposure and then place an acid etchant of your choice onto the dentin walls and floor AROUND THE NaOCL SATURATED COTTON PELLETT, avoiding the exposed pulp. Acidic solutions will only cause new hemorrhage and biofilm contamination. Remove the pellet with high-speed evacuation and gently rinse with sterile water. Gently air disperse the cavity from approximately 10-cm. Gently apply a bond coat onto the cavity dentin around the cotton pellet, as recommended to avoid pulp hemorrhage and lightly air disperse from 10 cm.
- 4) The choice of a direct capping agent remains the choice of the attending clinician. If you so choose to use a $\text{Ca}(\text{OH})_2$ agent, you must provide a “bacteriometric” seal to prevent long-term complications as discussed above.
- 5) If you choose to use an adhesive system for direct capping, place the two-step self-etching bonding system onto the dentin, allowing it to gently flow over the exposure site taking care to avoid recurring hemorrhage. Light cure for 3-5 seconds so as to prevent pulp damage from an abrupt increased temperature rise from rapid polymerization. This will also prevent polymeric shrinkage from the pulp-dentin interface. Be aware that NO hemorrhage should occur around the dentin-pulp interface.
- 6) Place thin increments of an antimicrobial adhesive over the area and again use a short ramped light cure sequence. Complete the restoration to contour and finish to functional anatomy with your choice of instrumentation.
- 7) To enhance the “bacteriometric” nature of the final restoration, acid etch the enamel-restoration cavosurface interface with phosphoric acid, rinse gently, air dry and seal with the an antimicrobial bonding resin to seal any interfacial gap.

Mineral Tri-oxide Aggregate (MTA)

An alternative to the use of calcium hydroxide is a new material, mineral trioxide aggregate (MTA) (ProRoot MTA, Tulsa Dental/Dentsply, Tulsa, Okla.), which has found many uses in endodontics. MTA is a powder that consists of fine trioxides and other hydrophilic particles, which sets in the presence of moisture.

Hydration of the powder results in the formation of colloidal gel which solidifies to a hard solid.

MTA has a high pH when mixed (12.5) Similar to $\text{Ca}(\text{OH})_2$

It is hydrophilic, sets in the presence of moisture and has high compressive strength (70 Mpa after 21 days).

It has been shown to be very effective in vital pulp. The technique for managing a traumatic pulp exposure using MTA is in many ways similar to that used with calcium hydroxide, with some minor modifications:

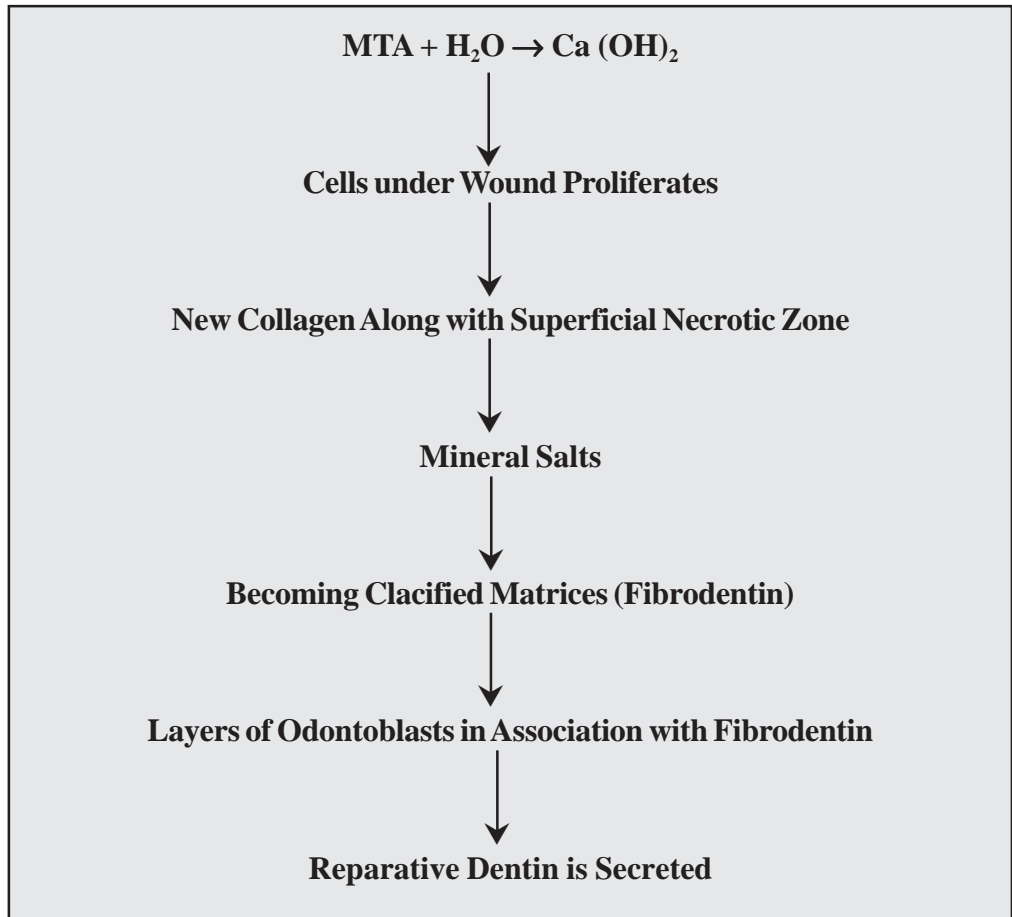
- 1) The tooth must be anesthetized and should be isolated with a rubber dam.
- 2) The tooth, fractured surface, and wound area should be disinfected using a solution such as sodium hypochlorite.
- 3) A shallow pulpotomy (Cvek's type) is done to provide space for the MTA. A round diamond stone is used in a high speed handpiece with water irrigation to remove exposed pulp tissue to a depth of at least 2 mm into the pulp proper.

Bleeding is allowed to stop before MTA is placed directly into the pulp wound. The presence of a small amount of blood in the wound area is not a contraindication to placing MTA; in fact, some moisture is required for the proper curing of the material.

- 4) The MTA powder and liquid should be mixed to consistency such that it can be carried from the mixing pad to the pulp wound using a dental instrument such as a cement carrier. A small amount of MTA should be placed on the wound surface and gently tapped with a moist cotton pellet so that it covers the exposed pulp. Next, the entire access into the pulp should be filled in a similar manner using small amounts of MTA. Any excess moisture should be removed from the surface of the MTA using a dry cotton pellet.
- 5) Note that MTA can be grey or white depending on esthetic requirements. Both however seem to have minor differences in terms of properties and healing potential.
- 6) The rubber dam can then be removed, and the patient can be dismissed. Leaving the MTA exposed to saliva will allow it to cure. A minimum of 6 hours should be allowed for the material to adequately cure, but clinical experience indicates that waiting at least 24 hours is better. The tooth can then be restored with a definitive restoration.

The mechanism of action is elucidated below.

PULPAL REACTION



Check Your Progress 3

What is the best technique to protect the exposed pulp?

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36.3.2 Crown-root Fractures

A crown-root fracture extends below the Cementoenamel Junction (Fig 36.41-36.43). It may or may not affect the pulp.

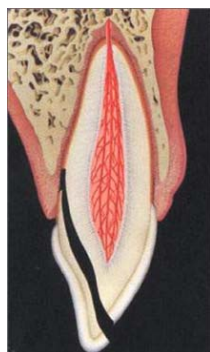


Fig. 36.41



Fig. 36.42



Fig. 36.43

Diagnosis is made by clinical examination, mobility testing, and radiographic examination. If the fragment is still kept in place by fibers of the periodontal ligament, the patient will generally complain about sensitivity to pressure and/or percussion due to the slight mobility of the fragment. Otherwise, if the fragment is lost, the tooth will react like an enamel–dentin fracture with or without pulpal involvement (Fig. 36.44).



Fig. 36.44

Treatment and Prognosis

Crown–root fractures have immediate implications for the endodontic, restorative, and periodontal prognosis due to the subgingival position of the line of fracture. Treatment objective must, therefore, be aimed at exposing the fracture margins juxtagingivally or supragingivally, so that all clinical procedures can be managed with strict moisture control and bleeding control.

The prognosis of the tooth may also be improved through better plaque control by the patient at the level of the fracture. This very often implies a multidisciplinary approach with an endodontist, an orthodontist, a periodontist, and a prosthodontist.

Table 36.2: Treatment of Crown Root Fractures

Type of Treatment	Advantages	Disadvantages
Fragment Removal	Conservative	Poor Pulp / Restoration Prognosis
	Restoration soon after injury	
Gingivectomy + Osteotomy if required	Easy to perform	Not in an esthetic sensitive region
	Restoration soon after injury	
Forced orthodontic extrusion	Ideal in esthetic region	Time consuming
	Bone and gingiva follow tooth	Root canal treatment required
Forced surgical extrusion	Fast , esthetics not impaired	Root canal treatment required
		More trauma
		Risk of resorption

Table 36.3 : Prognosis of Pulp for Different Levels of Fractures

Level of Fracture	Prognosis of Pulp
Enamel Infarction	Pulp Survival 97-100%
Enamel Fracture	Pulp Survival 99-100%
Enamel-Dentin fracture, Uncomplicated crown fracture	Pulp Survival 75-98%
	Pulp canal obliteration 0.2-0.5%
Enamel dentine fracture, complicated crown fracture	Pulp survival after
	Direct Pulp capping 72-81%
	Vital Amputation 94 – 100%

36.3.3 Root Fractures

This type of fracture involves the roots only: cementum, dentin, and pulp. Root fractures are not always horizontal; in fact, probably more often than not, the angulation of fractures is diagonal. One additional film angulation (foreshortened or 45 degrees) will, when combined with the standard 90- degree positioning, reveal most of the traumatic root fractures. If there is no mobility and the tooth is symptomless, the fracture is likely to be in the apical one-third of the root, and no treatment is necessary. If the coronal fragment is mobile, treatment is indicated. The initial treatment consists of repositioning the coronal segment (if it is displaced) and then stabilizing the tooth to allow healing of the periodontal ligament supporting the coronal segment.

Treatment

Treatment depends on level of fracture coronal, middle or apical third

First principles:

- a) Reposition and rigid splint is a must.
- b) Antibiotics contra-indicated
 - i) Lower rate of pulp healing with antibiotics.
- c) No endodontic treatment initially, reassess over time and if there is pulp necrosis (usually only coronal fragment is affected) then:
 - i) Only treat to fracture line
 - ii) Long-term $\text{Ca}(\text{OH})_2$ for hard tissue repair

The treatment also depends on the type of fracture.

Coronal Third Root Fractures (Fig. 36.45/36.46)



Fig. 36.45



Fig. 36.46

- 1) Orthodontic Extrusion
 - Time consuming
 - Prolonged retentive phase
 - Should be followed by circumferential supracrestal fibrectomy
 - The tissue and bone levels are most favourable
 - No loss of root support
- 2) Crown Lengthening
 - Surgical procedure involving flap elevation followed by osseous correction to provide enough biologic width for subsequent placement of restoration
 - Loss of support due to osseous recontouring could lead to unfavourable crown root ratios.
- 3) Extraction and post extraction implant placement.

- **Middle third root fractures (Fig. 36.47/36.48)**



Fig. 36.47

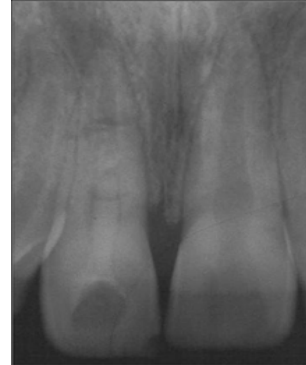


Fig. 36.48

The amount of dislocation and the degree of mobility of the coronal segment affect the prognosis because the more severe the dislocation (and therefore the mobility), the less likely it is that fracture reduction can be accomplished, and also more likely it is that the pulp has been severely injured. If a tooth can be stabilized long enough for repair to occur, the location of the fracture is immaterial.

The treatment options are many:

- 1) Root canal therapy of both segments. This may be indicated in fracture cases when the segments are not separated, allowing passage of files and filling materials from the coronal segment across the fracture site into the apical segment .
- 2) Root canal treatment of the coronal segment only. This is the current recommendation, particularly with the view that the apical segment may contain vital, healthy pulp tissue (Fig. 36.49).

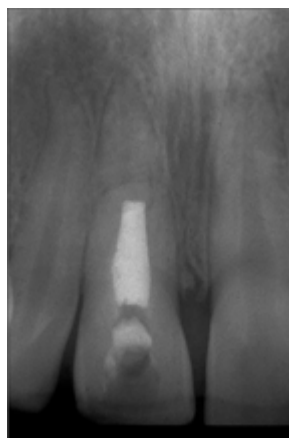


Fig. 36.49

- 3) Both segments are treated endodontically. Following root canal filling, a post space is prepared in the canal to extend from the coronal segment into the apical one, allowing placement of a rigid-type post (cobalt-chromium alloy) to stabilize the two root segments.

Apical Third Root Fractures (Fig. 36.50)

These types of fractures very often need no treatment at all. At most if the tooth exhibits slight mobility then it might be necessary to use a physiologic splint for a week. In case of pulpal necrosis associated with such a tooth, Endodontic therapy followed by follow up is the course of action. Resection of the apical fragment may be the treatment of choice, only if apical infection persists after endodontic therapy.



Fig. 36.50

Prognosis

Longitudinal fractures in the coronal and middle third have a poorer prognosis as compared to transverse fractures. Pulp canal obliteration is a common sequela.

Check Your Progress 4

1) What is the most favoured technique for management of coronal third root fractures?

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2) What are the current concepts on Endodontic management of middle third root fractures?

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36.3.4 Luxation Injuries

- **Concussion**

This is the mildest form of luxation injury, and it is characterized by sensitivity to percussion only. No displacement takes place, and there is no mobility as a result of the injury. Concussion is probably present in most cases of crown, root, and crown-root fractures. Usually no treatment is required. The teeth should be monitored periodically to evaluate pulpal status. Many of these teeth will give a false negative response to pulp testing in the initial stages. This is primarily due to the shock to the neurovascular complex and resolves over time. In most cases there is complete recovery. Pulpal status should be evaluated over a period of months and endodontic therapy should be instituted only if the vitality status is negative consistently or the patient has symptoms of irreversible pulpitis.

- **Subluxation (Fig. 36.51)**



Fig. 36.51

When a tooth, as a result of trauma, is sensitive to percussion and has increased mobility, it is classified as subluxated. Electric pulp test results may be either no response or positive; if they are the former, damage to the apical neurovascular bundle is more severe, and pulpal recovery becomes questionable, except in developing teeth.

Treatment initially may be none, except to recommend minimal use, or it may be necessary to stabilize the tooth for a short period of time (2 to 3 weeks) to promote periodontal ligament recovery and reduction in mobility.

- Relieve occlusion
- Splint NOT required
- Unless marked loosening (subluxation)
- Review pulpal status for upto 2 years.

Prognosis

Prognosis is usually good. The incidence of post operative complications is enumerated below.

	Concussion	Subluxation
Pulp Necrosis	2 %	6 - 47%
Pulp canal obliteration	2.2 %	26 %
Resorption	-----	4%

- **Lateral Luxations (Fig. 36.52)**

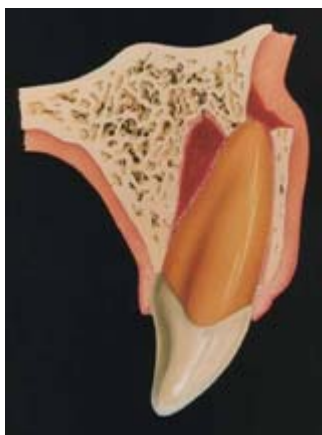


Fig. 36.52

Traumatic injuries may result in displacement of a tooth labially, lingually, distally, or mesially. Such displacement is called lateral luxation, and it is often very painful, particularly when the displacement results in the tooth being moved into a position of premature occlusion. The tooth is highly mobile and is likely to be continually traumatized by contact with opposing teeth, owing to the premature occlusal condition, all of it contributing to patient discomfort and severe tooth mobility

Initial, urgent care for lateral luxation cases includes:

- 1) Repositioning the tooth and stabilization, if the tooth is mobile after being repositioned.
- 2) Repositioning a laterally luxated tooth may require pressure application at the apical end of the root in the direction of the root apex's original location or by partially extracting the tooth with forceps prior to repositioning.
- 3) The splinting, if needed, should be non-rigid and may need to be in place for 3 to 4 weeks, depending on how soon the supporting tissues recover. Longer periods of rigid splinting up to 8 weeks are required if there is concomitant fracture of bone.
- 4) Definitive treatment for laterally luxated teeth includes root canal therapy, except in developing teeth, which may revascularize.
- 5) The prognosis for lateral luxation is good if proper endodontic therapy is performed when indicated.

- **Extrusive Luxation (Fig. 36.53)**

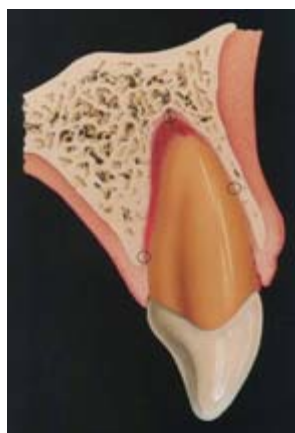


Fig 36.53

Traumatic Injuries

Displacement of a tooth axially in a coronal direction results in a partial avulsion. The tooth is highly mobile and is likely to be continually traumatized by contact with opposing teeth, owing to the premature occlusal condition, all of it contributing to patient discomfort and severe tooth mobility).

Immediate urgent care consists of:

- 1) Repositioning the tooth, usually more easily accomplished than in lateral luxation, and stabilizing it by a functional splint for 4 to 8 weeks.
- 2) The relatively long stabilization period is to allow realignment of the periodontal ligament fibers supporting the tooth. It is important during this period that gingivitis be prevented. Gingival inflammation will negate any attempt of the tissue to repair itself.
- 3) During recovery, progress can be monitored by periodontal probing. When reattachment has occurred, probing depth should be similar to pre-trauma depth.

Prognosis

	Lateral Luxation	Extrusive Luxation
Pulp Necrosis	58 %	64 – 98 %
Root canal obliteration	24 %	24 %
Resorption	7 %	7 %
Bone Loss	6- 31 %	—————

• **Intrusive Luxation (Fig. 36.54)**



Fig. 36.54

A tooth may be pushed into its socket, resulting in a very firm, almost ankylosed tooth. Such intrusive luxations require diverse treatment approaches depending on the stage of tooth development: little or no treatment for very immature teeth, aggressive initial treatment for more mature teeth.

Endodontics — In cases of intrusive luxation of developing, immature teeth, the theory behind not doing anything initially is based on the expectation that a tooth with a wide open apex has the potential to re-erupt spontaneously and establish a normal occlusal alignment within a few weeks or months.

Treatment Protocol

- A) Reposition immediately (Fig. 36.55.36.56)



Fig. 36.55



Fig. 36.56

Reasons

- i) Avoids pressure necrosis of periodontal ligament and hence less chance for external replacement resorption
 - ii) Fully developed teeth unlikely to erupt
 - iii) Allows access to root canals. Fully developed teeth need immediate endodontic treatment to prevent inflammatory resorption
 - iv) Avoids surgery for orthodontic extrusion to attach brackets, wires
- B) Other Options:
- i) Allow to re-erupt spontaneously. This is only likely in incompletely developed tooth
 - ii) Orthodontic extrusion
- 1) Later — if no re-eruption spontaneously
 - 2) Complicates early management
 - 3) Splint — Rigid (Fig 36.56). this is usually required -
 - a) Since there is a concomitant bone fracture
 - b) For 6 - 8 weeks

Traumatic Injuries

- 4) Suture soft tissues
- 5) Endodontic treatment
Should be immediately — IF fully developed tooth
Same regime as for avulsed teeth is to be followed and done.
To prevent inflammatory resorption
- 6) If incompletely developed — monitor pulp.
- 7) The exception to endodontic treatment is when spontaneous eruption takes place in young, developing teeth. Every effort should be made to promote revascularization of pulps in traumatized, developing teeth to allow continued root formation.
- 9) Review regularly

PROGNOSIS

	Intrusion
Pulp Necrosis	96 %
Pulp Canal Obliteration	4 %
Resorption	5 – 15 %
Arrested root development	16 %
Bone Loss	6-31 %

36.3.5 Avulsion(Fig 36.57/36.58/36.59)

An avulsed tooth is completely displaced out of its socket; this trauma has also been referred to as an exarticulation. The length of extra-alveolar time determines both treatment procedures and prognosis. If the tooth has been left dry for less than 1 hour or kept in milk for no more than 4 to 6 hours, the protocol for treatment is described as “immediate” replantation; more than 1 hour of dry time is “delayed” replantation.



Fig 36.57



Fig. 36.58



Fig. 36.59

- **Immediate Replantation**

Replantation in the office must be preceded by a careful evaluation of the traumatized alveolus and the avulsed tooth.

- 1) Look for evidence, both clinically and radiographically, of alveolar fracture.
- 2) Inspect the alveolar socket for foreign bodies and debris, taking care not to scrape the bony walls.
- 3) The blood clot in the socket can be gently suctioned and the socket irrigated with saline.
- 4) Check the avulsed tooth for debris on the root; if such debris cannot be rinsed off with saline or water, gently pick it off with tweezers.
- 5) While inspecting the tooth, it can be held by the crown using gauze moistened in saline, which permits examination of the tooth without touching the root surface.
- 6) Gently insert the tooth into the socket.
- 7) The insertion should be slow and gentle so that pressure is minimized.

Traumatic Injuries

- 8) When the tooth is nearly in place, have the patient complete the process by biting on a piece of gauze.
- 9) Check occlusion. It is most important that it should not be in hyperocclusion. Such premature contact would delay or prevent recovery.
- 10) Need for splinting would depend on degree of mobility.
- 11) The physiologic splint should be left in place only long enough for the initial reattachment of periodontal ligament fibers; in most cases that can be expected to take place in 1 to 2 weeks, after which the splint should be removed. (Fig. 36.60).



Fig. 36.60

- 12) Antibiotics should be administered for 5-7 days
- 13) Evaluate after 2 weeks and initiate endodontic therapy after 14 days. The exception to the rule of root canal therapy for avulsed teeth is when the tooth is still developing and has a wide open apical foramen. Such teeth have the potential for pulp revascularization.

• Delayed Replantation

The treatment for teeth with more than 1 hour of extra-alveolar time should include efforts to slow the inevitable replacement resorption.

- 1) Examine the avulsed tooth for debris. In contrast to avulsed teeth with less than 1-hour extra-alveolar time, those with more than 1 hour are not expected to retain the vitality of periodontal ligament cells and fibers. Therefore, it is best to remove pieces of soft tissue attached to the root surface.
- 2) Perform root canal therapy with the tooth in vitro. This can often be best accomplished by holding the tooth by the crown and proceeding with the endodontic treatment through an apical or coronal approach.
- 3) Apical approach involves resecting 2 – 3 mm of the root tip and completing extirpation, disinfection and obturation procedures.
- 4) A coronal approach will involve greater destruction of tooth structure
- 5) Soak the tooth in a 2.4% fluoride solution acidulated at pH 5.5 for 20 minutes or more. The fluoride will slow the resorptive process.
- 6) The rest of the procedure mirrors the technique in immediate replantation.
- 7) Splint for 6 weeks.

● **Protection of Root Surface**

To reduce chance of replacement resorption you must ensure the following:

- Don't allow the root to dry out since the periodontal ligament cells will necrose
- Storage media is important milk or tissue culture are the best media Saliva, Saline or Plastic Wrap are acceptable (avoid water)
- Replant/reposition immediately or as soon as possible.
- Physiologic splint to promote healing and prevent resorption due to disuse

To reduce chance of inflammatory resorption following two are required

- a) Antibiotics are prescribed orally.
- b) Endodontic treatment.

PROGNOSIS

	Avulsion
Necrosis	Up To 100 %
Root canal calcification	4 %
Resorption	74 – 96 %
Bone Loss	6- 31 %

Check Your Progress 5

- 1) What would be the immediate treatment for a palatally luxated central incisor without a root fracture but with an enamel dentine fracture?

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- 2) What precautions would you take after immediate replantation of an avulsed tooth?

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36.4 TOOTH RESPONSE TO TRAUMATIC INJURIES

The tooth will respond differently to different traumatic injuries. This depends on various factors viz. type of impact on tooth, vascularity of the canals, condition of periradicular structures, alignment of teeth etc.

- Pulpal Response

Favourable

Pulp response is favourable if it recovers & returns to its normal state. Pulp tissue could also fibrose or these may be pulp canal obliteration (PCO), which could be partial or complete.

Unfavourable

Pulp response to injury/trauma could lead to pulp necrosis or infection of the pulp space. It could lead to internal resorption of the tooth, which could be a surface resorption, inflammatory resorption or replacement resorption.

- **Peri-radicular Responses to Trauma**

Favourable

A favourable response would mean recovery and return to a normal state, fibrous healing or a transient apical breakdown.

Unfavourable

Unfavourable response would lead to cessation of root development, disturbances to root development or bone resorption which would be marginal (crestal), apical, lateral depending on the position with respect to the tooth surface.

There could be gingival recession or external root resorption which can be categorized as surface, inflammatory and replacement resorption.

- **Resorption as a Sequela to Traumatic Injuries**

Resorption is the most frequent sequela to luxation injuries; three different types of resorption have been identified:

- 1) Surface,
- 2) Inflammatory, and
- 3) Replacement (ankylosis) resorption

Surface resorption: Small superficial cavities in cementum and outermost dentin. This type is not visible on radiographs and is usually repaired by new cementum. It may be transitory or progressive. The former leads to repair, the latter to further resorption

i) Inflammatory Resorption

Radiographically seen as a bowl-shaped resorptive area of the root and associated with adjacent bony radiolucencies. It involves both tooth structure and adjacent bone. Radiographically, there is apparent tooth loss along with adjacent bony destruction. Root canal therapy can be expected to arrest inflammatory resorption that involves

replanted teeth; the resorption can be prevented by judicious timing of the root canal therapy.

ii) Replacement Resorption: External Replacement Resorption

Resorption of the root surface and its substitution by bone, resulting in ankylosis. This is a frequent sequela to replantation. As tooth structure is resorbed, it is replaced with bone that fuses to the tooth structure, thereby producing ankylosis.

iii) Invasive External Root Resorption Appears

- Usually many years after trauma
- Radiolucency — poorly defined margins
- Sub-gingival — external origin
- Resembles caries or internal resorption
- Very vascular — bleeds on probing
- Resorption is by invasive tissue and not inflammatory tissue

Factors Affecting Resorption

The following factors determine the rate of resorption

- a) Extra-alveolar time — Greater the time greater the chances of resorption
 - b) Storage conditions — Storage in appropriate media delays resorption
 - c) Damage during avulsion — Loss of supporting periodontal fibers on the root or in the socket will lead to resorption. Mechanical damage can not be controlled.
 - d) Replant procedure — During replant procedure minimise trauma. An atraumatic procedure provides the best results.
 - e) Splinting- Physiologic splinting provides greatest chances for success.
 - f) Splinting
 - i) Flexible splint:
 - 1) 7 - 10 days only
 - 2) If NO root or bone fractures
 - 3) Allows “functional” healing of periodontal ligament
 - 4) Reduces ankylosis and replacement resorption
 - ii) Rigid splint - ONLY if:
 - 1) Associated with bone fracture will take 6 weeks
 - 2) Or if root fracture will take about 3 months
 - g) Endodontic treatment at the appropriate time with medicaments as required will delay resorption.
- **Treatment of Resorption**

In case of progressive resorption, any form of treatment does not help to arrest the resorption. Eventually the tooth has to be extracted so the treatment is directed to prevent or minimise the occurrence of this type of resorption.

In case of a transient resorption, treatment is not required and it stops by itself. It is difficult to access the difference between the progressive and transient type of resorption.

36.5 FOLLOW UP SCHEDULE

- 1) Will depend on type of injuries present
 - a) Especially need for endodontic treatment
 - i) e.g. Immediate: Avulsion, Intrusion-mature teeth
 - b) And need to remove sutures &/or splint
 - i) Sutures: 5-6 days
 - ii) Flexible splint: 7-10 days
 - iii) Rigid splint: 6 wks - 3 months
- 2) If immediate endodontics not required:
 - 2 weeks
 - 1 month
 - 2 months
 - 3 months
 - 6 months
 - 9 months
 - 1 year
 - Annually for 5 years
 - Then every 3 years

36.6 LET US SUM UP

Traumatic injuries present a challenge to the most astute clinician. These injuries may involve the soft and hard tissues of the oral cavity, and present substantial challenges in their diagnosis and management.

A systematic approach towards diagnosis and treatment planning will help in treating these injuries judiciously and expeditiously. Every attempt should be made to preserve the vitality of tissues while at the same time ensuring the health of the dentoalveolar complex.

It is important to also consider the esthetic implications, and it should be our endeavour to provide the most esthetic treatment outcomes in the shortest time possible.

36.7 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) The soft tissues should be carefully evaluated to detect the presence of foreign bodies or tooth fragments. Moreover the presence of contusions or lacerations may necessitate debridement or suturing to close soft tissue defects. Facial injuries may be potentially disfiguring and hence careful evaluation is essential.
- 2) Carefully evaluate the teeth for
 - Enamel cracks
 - Discolouration
 - Displacements

- Fractures of crown or root
- Mobility
- Loss of vitality
- Sensitivity to percussion

Check Your Progress 2

- 1) The primary role in such cases is to restore the teeth into correct form and function while sealing the dentine and protecting the pulp. Direct composite restorations with resin modified glass ionomer as a base would be a restoration of choice. This procedure is often called composite “bandage” and is directed towards ensuring a healthy pulp.
- 2) A thorough evaluation of pulpal vitality is essential prior to restorative procedures. A negative response to vitality tests in the immediate aftermath of an injury is not necessarily indicative of a devitalized pulp. In the absence of symptoms of irreversible pulpitis it is imperative to protect the pulp and evaluate periodically. Resin modified glass ionomers or Calcium hydroxide bases should be used prior to restoration with composite restoration. Every effort should be made to ensure that the tooth is not further traumatized as in case of hyperocclusion.

Check Your Progress 3

- 1) The Cvek’s procedure is the safest procedure for exposed pulps and offers the best long-term prognosis. The exposure could then be covered by either Ca (OH)₂ or MTA as per personal preference. But currently MTA is the material of choice.

Check Your Progress 4

- 1) Orthodontic extrusion would be the most favoured option for management of these fractures. It is the most conservative technique which offers the best esthetics and bone support. The disadvantage is that it is time consuming and has a prolonged retentive phase.
- 2) The pulpal status should be thoroughly evaluated and Endodontic therapy initiated only if there are definite signs and symptoms of irreversible pulp damage. Even then it might be prudent to carry out Endodontic therapy only in the coronal fragment, without interfering with the apical fragment which has a good chance of retaining its vitality.

Check Your Progress 5

- 1) Reposition the tooth with gentle finger pressure under local anaesthesia. Splint with a functional splint - composite and orthodontic wire attached to one abutment tooth either side of the luxated tooth – for 2-3 weeks.

Place a composite bandage over the enamel-dentine fracture. Record clinical and radiographic data, including vitality tests and radiographs. Prescribe antibiotics (commonly amoxicillin 250 mg thrice daily) for 5 days, antibacterial mouthwash (chlorhexidine 0.2% four times a day) and a soft diet for the duration of the splint.

- 2) The following precautions are essential after replantation of an avulsed tooth:
- Make sure tooth is not in hyperocclusion
 - Splint if required and it should be physiologic and for 7 – 10 days only
 - Systemic Antibiotics to reduce risk of inflammatory resorption
 - Evaluate after 2 weeks and proceed with Endodontic therapy, unless it is a young tooth with immature apex .

36.8 FURTHER READING

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