East Texas Dental Society
Diagnosis and Treatment
of Oral Trauma

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Traumatic Injury Form

Caldwell RB. A form to aid in the clinical examination of a traumatized anterior tooth. JADA 2004;135:202-203.


Name__________ Age____ Date____

- Chief complaint
- Medical history/Allergies
- Tetanus protection
- Past dental history/trauma
- Place, date and time of injury
- Time elapsed since injury
- Treatment for injury
- How injury occurred

Tetanus Toxoid

- Booster recommended every 10 years to re-stimulate the immune response.
- Immunization ages 5 and 11.
- Spores of Clostridium tetani live in soil.
- Wounds to head and face are more dangerous.
- Needed if dirty wound & more than five years since last Tetanus w/in 48 hours.

Suspected Abuse

- Injury to head and associated areas 50% of the time.
- Bruises and injury to upper lip and labial frenum.
- Delay in seeking treatment.
- Child very quiet and parent will not permit child to be alone with healthcare provider.


Pediatric Concussion Syndrome

A child who is pale, drowsy, with continuous vomiting and/or has a headache should have a neurological evaluation in a hospital.

If no vomiting, and only headache may “watch” for 30 minutes.
- Loss of consciousness
- Confusion
- Nausea and vomiting
- Blurred vision
- Loss of short term memory
- *Headache
- *Perseverating
- *Labile mood

Pediatric and adolescent age group sustain majority of concussions.

- Girls more often than boys (weaker neck musculature & smaller head mass).
- Physical and cognitive rest is the primary management.


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**Degloving Injuries**

- Irrigate well with sterile saline.
- If bone is exposed, give antibiotic-PCN or Erythromycin if PCN allergic to avoid osteomyelitis or soft tissue infection.
- Resorbable sutures loosely sutured prn (Gut).


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**Penetrating Injuries**

- Toothbrush is most commonly impaled object.
- CT scan necessary to determine relationship to adjacent structures.
- Observation most frequent treatment.
- Spontaneous healing with minimal intervention.


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- 1% of children who have penetrating palatal trauma may have a stroke.
- The puncture may cause internal carotid artery compression with resulting thrombosis and cerebrovascular injury.
- Sticks most often the source of the injury.


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Moderate to severe penetrating injuries of the oropharynx area, particularly those of the hard and soft palate, should be covered with an antibiotic that is effective against gram negative bacteria ex: Clindamycin, in order to avoid a mediastinal infection or abscess.

CT scans are superior for detecting mid-facial fractures.


Greenstick Fracture

- Common in children due to elasticity of bone.
- Incomplete fracture without displacement.
- Non-displaced are managed with close observation, dietary and activity limitations.


Infracapsular fractures occur most often in children under age six.

- Subcondylar fractures occur predominately in children age six and older.


- Mandible deviates to affected side on opening with condylar fracture.

Non-surgical management is the treatment of choice.

- Soft diet


Condylar Fracture

- Panoramic
- CT Scan
- Reverse Townes’


Battle Sign

- Bruising of the mastoid region.
- Associated with base of skull fracture.

Antibiotic Coverage

- If there is skin contamination in the wound, the drug must cover for staph as well.
- Use Augmentin (amoxicillin-clavulanic acid) or clindamycin.

Augmentin (Amoxicillin-Clavulanic Acid)

25-45mg/kg/24 hr given in divided doses
- 200, 400mg/5ml suspension
- 200, 400mg chewable
- 875mg tablet
  BID dosage

Clindamycin

- 10-30mg/kg/24 hr in divided doses TID or QID PO
- 75mg/5ml (100ml) suspension
  75, 150, 300mg capsules
  (check price 150mg vs 300mg caps)

Radiographs

- Occlusal, periapical - 3 views, panoramic.
- Obtain different periapical views by changing the angle of the cone by 10 degrees. Periapical central angle, periapical mesial eccentric and periapical distal eccentric.
- May also obtain a PA of the opposite arch.
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The accuracy of predicting a root fracture was the same for both conventional and digital radiography.

Obtaining several images from different angles is the best method to for diagnostic accuracy with a suspected root fracture.

Periapical RL
Periradicular RL
PDL intact
Calcific Metamorphosis
Internal Resorption
External Resorption

Endodontic treatment should be instituted on teeth with pulpal obliteration (calcific metamorphosis) only when periapical pathology is evident.


Internal Resorption occurs within the root.
External resorption occurs on the outer surface of the root.
Inflammatory resorption occurs when necrotic pulp toxins travel to root surface and create an inflamed PDL.

Progression of resorption is slower after full growth is reached.
No known endodontic treatment to stop replacement root resorption.


External Resorption/Replacement Resorption
PDL destroyed by tearing away with avulsion or from toxins in the infected pulp.
Bone is now in direct contact with cementum.
Osteoclasts (resorption) and osteoblasts (lay down bone) create union with bone.
This leads to ankylosis and eventually infraocclusion.

Decoronation
Need to intervene before the effect of infraocclusion negatively effects the final prosthetic result.
Alveolar bone growth is arrested with anklyosis.

**Autotransplantation**
- Replacing the incisor with an unerupted mandibular premolar
- Local anesthesia
- 1-1.5 hours for procedure
- Candidates are limited
- High success rates


**Pulp Vitality Testing**
- Recently traumatized teeth give unreliable results.
- Young permanent teeth with open apices, erupting permanent teeth and primary teeth unreliable results.

**Percussion Testing**
- Percussion is a good indicator of pulpitis at follow-up, indicating that infection has traveled from the radicular tissue, causing inflammation of the PDL.
- Sensitivity may indicate undetected alveolar fracture if persists at follow-up.
- If the incisor is lodged in the socket, percussion will not be felt on the lingual surface.


- Monofilament fishing line-50pound.
- Flexible splint of .016” stainless steel arch wire, with or without orthodontic brackets, for 1-2 weeks to re-establish the PDL support of the tooth for both OPEN & CLOSED apex.
- Bond into place with flowable resin.
- Bonded on buccal surfaces to enable endodontic access.
- Also avoids occlusal interferences.
- Keep clean! Chlorhexidine rinses wick through sulcus.

**Splint**
- Two weeks: Subluxation, extrusive luxation and avulsion
- Four weeks: Lateral luxation, avulsion dry longer than 60 minutes, middle third root fracture and alveolar fracture
- Four to eight weeks: Intrusion repositioned surgically or orthodontically
- Four months: Cervical third root fracture

**Pediatric Dental Trauma Card**
American Academy of Pediatric Dentistry

10 pack for $11.00 plus s/h
1-312-337-2169
Treat within a few hours for most favorable response:
- Avulsion—unless tooth replanted at the time of the avulsion, then subacute
- Alveolar fracture
- Extrusion
- Lateral luxation
- Root fracture—may also be subacute

Delaying treatment for several hours does not affect the outcome:
- Intrusion
- Concussion
- Subluxation
- Crown fracture with pulp exposure

Delaying treatment more than 24 hours may still have good response:
- Crown fracture with no pulp exposure

Permanent tooth replantation following an avulsion

Consensus from 2008 AAPD Dental Trauma Symposium with the Recommended Guidelines of the American Association of Endodontists for the Treatment of Traumatic Dental Injuries 2004

Parents must be informed of the future costs that may be necessary by replanting the tooth.


May replant tooth acknowledging future ankylosis and resorption, but the tooth can function for several years prior to extraction.


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American Association of Endodontics Spring 2006
Include risk of root resorption and ankylosis, need for endodontic treatment, surgical extraction, bone graft, interim prosthetics, implant and future prosthetics.

Even after experiencing all of the consequences of replanting a permanent incisor, 80% of parents still would choose replanting the incisor.


Hanks Balanced Salt Solution

- Debris may be soaked away from PDL with gentle agitation.
- Similar osmolality to PDL cells.
- Lost PDL nutrients replenished: Provides metabolites & glucose.

Phoenix-Lazerus, Inc. 1-888-788-6684
www.save-a-tooth.com

Desiccation should not be more than 15 minutes.

- By 30 minutes, most cells are dead.

- Teeth that have been dry for 15 to 60 minutes will demonstrate less resorption if soaked for 30 minutes in HBSS prior to replantation.

Dry More Than 60 Minutes

- Goal is to preserve the tooth for esthetics and maintain alveolar bone contour.
- Prognosis is poor with eventual ankylosis and root resorption.
- 40-45% of PDL is torn off with avulsion.

Removing the remaining PDL with gauze (scaler or pumice) may remove the stimulus for inflammation and infection-related resorption.

- Follow with 2% sodium fluoride soak for 20 minutes because fluorapatite is more resistant to osseous replacement resorption/ankylosis than hydroxyapatite. (or 3% citric acid for 3 minutes).


- Because the PDL is torn away with an avulsion, the cementum is now in contact with bone.

- A union between cementum and bone occurs resulting in ankylosis and then infraocclusion.

- The surrounding alveolar process continues vertical growth and the ankylosed tooth submerges.
The interdental fibers are still connected to the infraoccluded incisor and the adjacent teeth---so interferes with their eruption as well.

The adjacent incisors tip as they erupt.

No marginal bone development occurs adjacent to the infraoccluded incisor.


When ankylosis was diagnosed under 10 years of age, there was a high risk of severe infraocclusion during the adolescent growth spurt.


For Both Open & Closed Apex

- Remove clot from socket with gentle rinse of sterile saline and/or curette.

- Check for fractured of socket wall and reposition with appropriate instrument such as a sterile mirror handle.

- Replant slowly with slight digital pressure.

- May loosely suture gingival lacerations, particularly in the cervical area.

- PA to verify the replanted position of the tooth.

- PA to check root status of adjacent teeth and opposite arch.

Criteria for Splint Only

- Apex open at least one millimeter.
- PDL preserved in proper transport medium.
- Less than 60 minutes extra-oral-unless in HBSS.

Revascularization is possible without additional intervention

Criteria for Apexification

- Open apex more than 60 minutes extra-oral and not stored in proper transport medium.
- Pulp is now non-vital.
- Hope is to preserve the tooth and complete root formation/apexification for endodontic therapy with gutta percha fill.
- Initiate apexification procedure.
There is weak, unreliable evidence to support the use of apexification, apical plug, or other techniques for creating an apical barrier in immature necrotic permanent incisors.


If apexification has been performed with calcium hydroxide, the tensile strength of the dentin is compromised.

Orthodontic treatment should not begin until after dentinal bridge and gutta percha obturation.


Extirpation of the pulp within 14 days was associated with a decrease in the incidence of inflammatory root resorption.

Pulp should be extirpated between 7 and 14 days


Remove splint
- 1-2 weeks if tooth kept in appropriate storage media and extra-oral dry time less than 60 minutes
- 4-6 weeks if extra-oral dry time more than 60 minutes
- Endodontic treatment at 1*-2 weeks for closed apex--before splint removed

Home Instructions
- Brush teeth with soft toothbrush after each meal - Maintain good oral hygiene
- Use a chlorhexidine (0.12%) mouth rinse twice daily for one week
- Return 1-1/2 weeks for splint removal and initiate RCT (closed apex) or monitor for revascularization (open apex)
- Avoid contact sports
- Soft diet for two weeks

Antibiotic Coverage
FOR OPEN OR CLOSED APEX

Doxycycline - Multiple formulations - must check individual formulation for use, dosage & administration

Vibramycin
- Preferable to PCN for children age 12 or older
- For patient allergic to PCN
- Take for 7 days
- Less than 45kg: 2.5-5mg/kg/24 hr PO BID
- Greater than 45 kg: 100mg capsule BID

Pen V Potassium-Brand name PenVee K
- Take for 7 days
- Children under age 12: 25-50mg/kg/24 hours divided doses every 6 hours
- Max dose: 3Gm/24 hours
- Adults: 250-500mg/dose PO every 6 hours

“The current literature neither proves nor disproves the value of systemic antibiotics in treating avulsed teeth.”


Emergency Kit
- Mirror
- Monoject syringe
- HBSS
- (100mg Doxycycline mixed in 20ml saline)
- Sterile saline, chlorhexidine
- 50 pd. monofilament fishing line/.016 arch wire
- Hard wire cutter or distal end cutter
- Flowable composite, resin, etchant
- Radiographic films


Alveolar Fracture-Permanent

- Bone segment involving the tooth/teeth is mobile. Reposition bone fragment if necessary.

- Take 1 occlusal, 1 PA central angle, 1 PA mesial eccentric, 1 PA distal eccentric. Panoramic may be indicated to follow the fracture line.

- Concomitant luxation of teeth-Splint for 3-4 weeks.

- Mobility of several teeth at the same time indicates alveolar fracture.


Concomitant luxation of teeth-Splint for 3-4 weeks.

- Obliteration of the pulp chamber occurred in 45% of healed teeth, but had no effect on their survival.


Extrusion/Partial Avulsion

- Tooth is displaced from the socket in an axial direction/excessive mobility.

- PDL is ruptured and apical vessels are damaged.

- PA/Occlusal shows increased PDL space apically.

- Less than 3mm extrusion-moderate

- More than 3mm extrusion-severe

- Extrusion more than 3 mm with closed apex, endodontic treatment indicated.


Delay of treatment usually makes repositioning difficult due to blood clot formation.

Non-steroidal anti-inflammatory asap (probably not for an asthmatic).

If orthodontic appliances in place, have parent cut the wire to permit repositioning if possible.
Three months wait time is recommended prior to continued orthodontic movement.

With moderate to severe trauma/damage to the periodontium, six months wait time.


If maxillary incisors were traumatized prior to orthodontic treatment, the incidence of pulpal necrosis may be increased with orthodontic intrusion.

Obtaining a PA prior to treatment to determine pulpal obliteration is advised.


Luxation

Luxation injuries in the permanent dentition may result in inflammatory resorption.

The PDL is broken inciting the osteoblasts to replace dentin with bone.

The crown may appear normal with no mobility or may be displaced in a palatal or lingual direction. Re-position ASAP.

Can be immediately moved orthodontically.

May have to open the bite slightly with orthodontic cement or composite on occlusal surface of molars if palatal displacement.


Luxation with Uncomplicated Crown Fracture

In immature laterally luxated teeth, the risk of pulp necrosis increased from 5% to 40% with a concomitant uncomplicated crown fracture.

The fracture should be restored as soon as possible after the injury.


Luxation Injuries & Antibiotic Coverage

Left to the discretion of the clinician.

May be considered for medically compromised patients and/or those with accompanying injuries.

There is no evidence to support the use of antibiotics for luxated teeth.


Trend is toward more conservative management.
Coronal fragment is usually displaced. Apical fragment usually is not displaced.
Loss of vitality twice as high with concomitant crown fracture.

Crown fracture not protective against root fx
Crown fractures twice as likely to have root fx
No reason to suspect a complete root fx in pre-teens unless clinical signs are present.


Make sure film dark enough to see fracture.
Root fractures tend to be M-D but we shoot B-L.
Periapical shift shots - Change beam 15 degrees. First PA central angle, second mesial eccentric, & third distal eccentric for cervical third.
Occlusal may also be obtained to locate fx in apical and middle third.

Reposition tooth and stabilize the coronal fragment.
The location of the fracture has not been shown to affect pulp survival.
Preservation of the tooth with root fractures in the cervical third should be attempted.

78% of all root fractures healed spontaneously.
18% of roots that healed required endodontic treatment.
30% of cervical third root fractures healed, but most often sustained new luxation injury to the coronal fragment.
- Flexible splint preferable to rigid for 4 weeks.
- Cervical root fracture may require splint up to 4 months.
- No difference in healing between splinted and non-splinted teeth when no dislocation of root fragments.
- Mid and apical third root fractures had no benefit by splinting for more than 4 weeks.

- Open apex with root fracture may require splinting for up to 3 months with flexible splint.


- Systemic antibiotics provide no therapeutic effect.
- Delay endodontic treatment until there is a radiolucency adjacent to fracture line.


- Incisors that have sustained a root fracture should not be loaded with orthodontic forces for at least one year.


- If pulp does become infected or necrotic, endodontic treatment is indicated.


- Necrotic tissue is usually limited to the coronal segment and RCT can be confined to that segment. Apical segment may remain untreated.

Apical displacement of tooth into the alveolar bone with fracture of the alveolar socket.

- Very bad injury because strips PDL cells from root when pushed into a bony area of smaller diameter.

Occlusal, PA and lateral views (make sure not into nasal cavity).

Intrusion of a Permanent Incisor
Onset and rate of resorption are related to the degree of intrusion and apical development.

Antibiotic not indicated.

Neurovascular bundle and bone are crushed.

Need to shut down initial inflammatory response asap-RCT immediately. (Troupe)

With closed apex, PDL is damaged and blood vessels are compressed resulting in ischemia and loss of vitality.

Prophylactic pulp extirpation is recommended in 2-3 weeks.


Three Treatment Modalities

- Watchful waiting
- Surgical repositioning
- Orthodontic repositioning

Complete root formation

- Intruded up to 3mm, permit spontaneous eruption.
- If no movement after 2-4 weeks, surgical or orthodontic repositioning to avoid ankylosis.
- 3-7mm surgical or orthodontic repositioning.
- More than 7mm, surgical repositioning is recommended.

DiAngelis et al. 2012

Incomplete root formation

- Permit spontaneous re-eruption for 3 weeks if intrusion less than 7mm.
- If no movement, rapid orthodontic repositioning.
- If more than 7mm intrusion, surgical or orthodontic repositioning is recommended.


Surgical repositioning favored over orthodontic repositioning due to multiple visits, higher treatment costs and patient cooperation.

- Soft diet for one week.
- Maintain good OH, chlorhexidine 0.1% rinse.
- Remove splint in two weeks.
- PA and clinical exam at 2 weeks, 4 weeks, 6-8 weeks, 6 months, 1 year and yearly for 5 years.

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Intrusion of Primary Incisor

- With complete intrusion, may appear to have been avulsed
- Palpable facial bulge
- PA will confirm status
- Determine relationship to permanent incisor follicle with periapical & lateral radiographs

- Permit spontaneous re-eruption if primary incisor root is directed away from the developing permanent incisor.
- 90% will spontaneously re-erupt in 2-6 months.
- Extract if not re-erupted within 6 months.
- Inform parents of possible damage to the developing permanent incisor.

Parents must be informed that the full extent of damage to the permanent successor may not be apparent until years after the injury.

At age 24 to 30 months of age, there is a 3% chance that the crown of the succedaneous incisor will be dilacerated.


- In children 1-4 years of age, 53% of permanent successors experienced enamel hypoplasia or eruption disturbance.
- Pulp necrosis and premature loss were most frequent complications. (80%)


Concussion of Permanent Incisor

- PDL absorbs injury. Tooth tender to touch/percussion.
- Ibuprofen for PDL inflammation.
- No mobility/displacement/marginal bleeding.
Most common traumatic injury seen in children is concussion injury with associated crown fracture.

- With a closed apex, the risk of pulpal necrosis increases from 3.5% (open apex) to 11%.
- With closed apex and a negative response to electric pulp test at initial presentation, PN risk increased to 55%.


Subluxation of Permanent Incisor

- Abnormal loosening but no tooth displacement.
- PDL absorbs the injury.
- Bleeding from the sulcus confirms the diagnosis.
- Obtain one central angle periapical and one occlusal radiograph. Usually no findings.

Class II Crown Fracture

- Complicated is always Subacute within 24 hours
- Uncomplicated may be Subacute or Delayed within 24 hours or more than 24 hours


- Overjet greater than or equal to 6mm increased the incidence of trauma by fourfold.

Uncomplicated & Complicated Crown Fracture

- Periapical central, eccentric and occlusal
- Root fracture
- Root development
- Pulp chamber
- Clinical exam and periapical radiograph at 6-8 weeks and 1 year

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Class II Crown Fracture Restoration
- Porcelain veneer
- Lumineer
- Full coverage crown
- Composite or composite resin crown (CRC)
- Reattach enamel fragment

Crown Fracture with Pulp Exposure

Complicated Crown Fracture
- Size of the pulp exposure
- Time elapsed since trauma
- Root development - Open or closed apex

Treatment Choices
- Direct pulp cap - Up to one day after injury
- Vital/Partial Pulpotomy - Up to 30 hours after injury with spontaneous bleeding
- Apexification - Open Apex after 30 hours with spontaneous bleeding
- Root canal - Closed Apex

Kenny, DJ. Managing the fracture crown with a pulp exposure. Educational Reviews June/July 2005

Successful pulp capping can occur even with a large exposure.

Mature incisors with pulp exposure can also be treated conservatively with pulp capping, but the patient must be informed of guarded prognosis.


Direct Pulp Capping
- Glass ionomer not recommended due to hydrophilic
- Calcium hydroxide- Dycal, Ultracal XS (ultradent)
- Theracal LC (Bisco)
- MTA-use white

Bleeding must be controlled prior to placing the pulp capping agent.

Disinfecting agent is flushed away with sterile saline or anesthetic solution.

Thorough rinsing reduces the residual bacteria and removes blood that would provide an excellent medium for bacterial growth.
**CaOH**

- Dycal, Pulpdent Paste, Bio-Cap and other formulations preferable to USP powder.
- Addition of methylcellulose (Pulpdent Paste) holds the CaOH in suspension and adheres to the pulp tissue and dentin.
- USP powder has no binders/fillers and will be absorbed into the open blood vessels causing congestion, infarcts and pulp necrosis.

**MTA**

Easier to use than CaOH for pulp-capping

Less pulpal inflammation than CaOH

More predictable hard tissue formation than CaOH


**For non-contaminated exposure of short duration and no spontaneous bleeding**

- Clean with chlorhexidine solution
- Place cap agent of choice
- Place a layer of resin-modified glass ionomer cement (RMGIC)
- Restore with composite


**Vital/Partial Pulpotomy**

- For spontaneous bleeding in an immature incisor
- Up to 30 hours after exposure
- To remove the infected pulp tissue

**Cvek or Partial Pulpotomy**

Dr. Miomir Cvek 1978 Success if tx. w/in 30 hrs.

- Obtain pulpal anesthesia
- Place rubber dam
- Cleanse with chlorhexidine solution

- Use sharp curette or small sterile round diamond bur at high speed to remove superficial pulp layer, while flushing with sterile saline.
- Cvek opens entire incisal area from mesial to distal the full width of the pulp chamber.
- The pulp tissue is abraded away to a depth of 2-4mm with sterile curette.
- Dry with sterile cotton pellets.
- After complete hemostasis, apply calcium hydroxide or white MTA to pulp stump.
- Cover with RMGIC (resin-modified glass ionomer cement).
- Place flowable composite or glass ionomer.

- Pulpal healing occurs primarily due to the deposition of hard tissue and not the stimulatory effects or pH of any medicament.
- Must cover exposure to protect from bacterial microleakage.

PROVIDE A GOOD SEAL

- By removing only the inflamed pulp tissue with the Cvek technique, the pulp is permitted to remain vital.
- The procedure allows for continued dentin deposition and root apex maturation.

Highly Successful if w/in 30 hours


Pulp Cap or Partial Pulpotomy?
- Direct Pulp Cap 81-88% success
- Partial Pulpotomy 94-96% success
- Not the size of the exposure or the time of exposure that determines success.
- Retention of the restoration is the critical issue.
- Partial pulpotomy may be the more retentive preparation.

Gungor, 2013

Class I Crown Fracture
- Enamel only involved- Smooth edges if sharp.
- Periapical central, eccentric and occlusal to rule out root fracture or luxation
- Clinical exam and periapical radiograph at 6-8 weeks and one year.

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Infraction
- Incomplete crown fracture with cracks.
- Pathways for bacterial migration to pulp.
- 3.5% pulp necrosis
- When associated with subluxation, 35% chance of pulp necrosis.

Reattachment of Anterior Fragments

- Enhanced durability due to wear at same rate as other incisor.
- Natural translucency and surface finish with original esthetics.
- A 45 degree circumferential bevel does not enhance retention of crown fragment.
- A fracture sloping toward the cervical will be more retentive.

- Keep the fragment moist with saline or water.
- Reattachment of a dry fragment is not recommended.


- May reattach with both uncomplicated and complicated crown fracture.
- Flowable composite and resin composite used.
- Bond failure is the primary weakness.


- Fracture line may becomes visible after a period of time due to the discoloration of the adhesive and composite that was used for bonding the enamel fragment.
- Main cause for failure is new trauma or non-physiological use of the restored incisor.


- The use of calcium hydroxide along the fracture line significantly reduces bond strength.
- May function for up to seven years.