


**Diagnosis and Emergency Care of Dental Trauma**



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**Why Dental Trauma Discussion is Important for All Dentists?**

Of all dental issues this topic crosses most, if not all dental specialties, so it is important for all have to have some knowledge because;

In case of emergency treatment:

- Any dentists (general and specialists) can be called to action!
- No dentists can have the excuse "I do not know."
- Every case is an emergency that very often is very time sensitive, such that if the correct treatment is not rendered within minutes to an hour the tooth/teeth are likely to be lost.


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**[www.iadt-dentaltrauma.org](http://www.iadt-dentaltrauma.org)**

dentaltraumaguide.org

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Next annual meeting



**WCdT TOKYO 2024**  
 July 12-15

22nd World Congress on Dental Traumatology  
 In Celebration of Jens Ove Andreasen

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**Dental Trauma**

*World traumatic dental injury prevalence and incidence, a meta-analysis*

– One billion living people have had traumatic dental!

"Dental trauma is a neglected condition which could rank fifth if it was included in the list of the world's most frequent acute/chronic diseases and injuries."

(Petti S, Glendor U, Andersson L 2018)

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**Dental Trauma**

*World traumatic dental injury prevalence and incidence, a meta-analysis*

"Traumatic dental injuries would be the fifth most prevalent disease or injury after:

- permanent caries,
- tension-type headache,
- iron-deficiency anaemia,
- age-related and other hearing loss

AND preceding migraine and genital herpes."

(Petti S, Andreasen JO, Glendor U, Andersson L, Lancet 2018)

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**Dental Trauma**

*Contradictions in the treatment of traumatic dental injuries and ways to proceed in dental trauma research.*

"Almost all treatment procedures used for dental traumas are still today not evidence-based, a fact, which makes it difficult to analyze the long-term outcome of healing and its relationship to treatment."

(Andreasen et al 2010)

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**Dental Trauma**

*Contradictions in the treatment of traumatic dental injuries ....*

For ethical reasons, it will be difficult to perform randomized studies on trauma victims!


We will therefore be forced in the future to rely on experimental animal studies supported by clinical observational studies.

(Andreasen et al 2010)

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**Guidelines of IADT**

Available on [www.dental-trauma.org](http://www.dental-trauma.org)



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**Guidelines of IADT**

Available:

And as a app in Apple and Play Store – "ToothSOS"



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**Clinical Procedures**

Adherence to the IADT guidelines for treatment of dental trauma may lead to more favorable outcomes when compared to cases treated without compliance to the guidelines:

When IADT guidelines were followed:

- Complication rates were significantly lower than for cases treated without adherence to the guidelines.
- The Results indicate that early follow-up visits are essential to promptly treat complications.

(Bücher K et al. 2013)

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**Dental Trauma**

**Prevalence**

If a child or teenager has very severe overjet (8 mm or more in vertical direction) then the incidence increases up to 50 – 60%.

Many contend that this group requires early orthodontic intervention to reduce the risk of trauma

- has not been well confirmed in studies partly because of trauma often occurring prior to early intervention.

Forsberg & Tedestam 1993  
Ehmer U et al. 1999

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**Prevalence and Incidence of Dental Trauma**

*Incidence of dental trauma among adolescents: a prospective cohort study.*  
2 year follow-up, 416 (1/2 with history of trauma), aged 11-13 years.

**History of previous trauma:**  
4.85 times greater odds ratio for additional trauma compared to the non-trauma group.  
P = 0,005 after adjusting for incisal overjet, lip coverage and mother's schooling.

A systematic review by Magno MB et al. 2019 confirmed 2-5 times greater odds ratio .  
(Ramos-Jorge ML. et al. 2008)

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**Prevalence and Incidence of Dental Trauma**

Incidence of dental trauma among obese adolescents – a 3-year-prospective study  
3 year follow-up, 785 (422 boys, 363 girls, BMI) age as start 13 years, dropout rate 2.86%.

The overall prevalence of Traumatic Dental Injury:

Children with obesity and overweight were 2.78 times greater chance  
(after adjusting for socioeconomic status, lip coverage, incisal overjet and previous history of trauma)

(Basha S. et al. 2015)

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**Violence and abuse: core competencies for identification and access to care**

Violence and abuse is a significant public health problem, especially for females.

Injuries to the head, neck, and/or mouth are clearly visible to the dental team during examination.

Every one that deals with dental trauma should be familiar with diagnostic tools and surveys for identifying victims of all ages.

(Thompson LA et al. 2013)

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**Signs to look for in case of suspected child abuse**

- Signs of old injuries without the patient being previously examined/treated.
- Vague explanation on how the injury occurred; explanation may differ depending on who you ask.
- Given explanation not in accordance with clinical findings / type of trauma.
- The child makes statements that are different from the parents'.
- Abnormal child-parent dialogue + child looks sad, or frightened + abnormal parents' behavior
- Parents contact the dentist late.

(Bakland LK & Andreasen JO, 1996)

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**“Your duty of care to patients experiencing domestic abuse”**

Identify - Be aware that domestic abuse is a possibility.  
Recognize signs, create an environment to support disclosure and ask sensitively.

Respond - Listen to what they say, show empathy, be non-judgmental, validate their experience and ask what they need.

Support - Assess risk and enhance safety, provide information and help them connect to support services.  
(Halkett G 2021)

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**Domestic Violence against Women Detected and Managed in Dental Practice: a Systematic Review**

Among the dental care professionals:

- only 1-7.1% of the dentists included injury search and examination of their patients for signs of violence.
- less than 47% had knowledge to identify violence injuries.

When it comes to knowledge to identify signs of domestic violence, positive answers were below 24%.

(Nascimento CTJS et al. 2022)

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## Dental Trauma

Which teeth are most likely to be involved?

1. Central upper incisors (40 – 60%)
2. Lateral upper incisors (20-30%)
3. Lower incisors (20-30%)

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## Traumatic Injuries

### Diagnosis of dental trauma

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## Traumatic Injuries

- ✓ Fact finding
- ✓ Clinical exam
- ✓ Radiographic exam
- ✓ Pulpal tests

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## Traumatic Injuries

### ✓ Fact finding

1. Patient's name, age, sex, address, and contact numbers and for young pt. weight.
2. Any CNS symptoms after the injury?

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## Traumatic Injuries

### ✓ CNS issues:

"Many times, facial fractures tend to distract our attention from more severe and often life threatening injuries"

(Hohlrieder M et al. 2004)

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## Traumatic Injuries

### ✓ CNS issues:

*Meta-analysis:*

- The mean prevalence of intracranial haemorrhage after mild head injury was 8% (95% confidence interval 3% to 13%) in 13 studies with 12,750 patients.

- Loss of consciousness or post traumatic amnesia occurred in 61% to 100% of patients in individual studies (most commonly 100%).

(Hofman PA et al. 2000)

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## Traumatic Injuries

### ✓ CNS issues:

- Fluids from ear/nose.
- Loss of/ or diminished consciousness.
- Situational confusion.
- Headache getting worse.
- Nausea / vomiting.
- Behavioral changes / unexplained irritation.
- Ataxia.
- Blurred vision / uneven pupils.
- Lack of concentration.
- Change in breathing.
- Difficulty of speech / slurred speech.

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## Traumatic Injuries

### ✓ CNS issues:

Remember:

Epidural Hematoma can be with a late onset of symptoms!

Pt. appears quite normal, then in minutes, hours or even days later symptoms appear.

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## Traumatic Injuries

### ✓ Fact finding

1. Patient's name, age, sex, address, and contact numbers and for young pt. weight.
2. Any CNS symptoms after the injury?
3. General health.
4. **WHEN** did injury occur?
5. **WHERE** did injury occur?
6. **HOW** did injury occur?
7. Treatment elsewhere.
8. History of previous dental injuries.

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## Traumatic Injuries

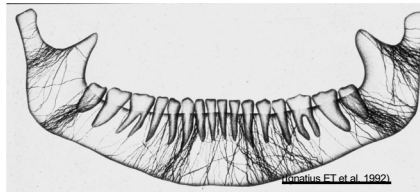
### ✓ Fact finding

9. Is there any disturbance in the bite?
10. Do the teeth react to thermal changes, sweet or sour sensitivity?
11. Are the teeth sore to touch, or during eating?
12. Is there spontaneous pain from the teeth?

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## Traumatic Injuries

### ✓ Clinical exam



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## Why do we take radiographs immediately after a dental trauma?

- ✓ To assess the situation
- ✓ To be able to decide on appropriate treatment
- ✓ To have a base line to compare to

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### Guidelines of IADT

Radiographic examination for every injury incl. crown fractures: As a routine, several angles are recommended:

1. One parallel periapical radiograph aimed through the midline to show the two maxillary central incisors.
2. One parallel periapical radiograph aimed at the maxillary right lateral incisors (should also show the right canine and central incisor).
3. One parallel periapical radiograph aimed at the maxillary left lateral incisor (should also show the left canine and central incisor).



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### Guidelines of IADT

Radiographic examination for every injury incl. crown fractures: As a routine, several angles are recommended:

4. One maxillary occlusal radiograph.
5. At least one parallel periapical radiograph of the lower incisors centered on the two mandibular centrals.

However, other radiographs may be indicated if there are obvious injuries of the mandibular teeth (eg, similar periapical radiographs as above for the maxillary teeth, mandibular occlusal radiograph).



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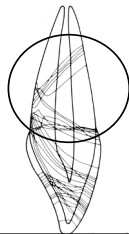
### Why do we take radiographs immediately after a dental trauma?

Need to take:

- ✓ Several radiographs
- ✓ Quality radiographs with minimal distortion
- ✓ Reproducible radiographs

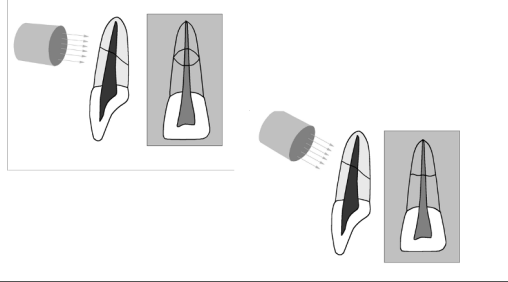
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### Crown-Root fractures



(From Dr. Andreasen 1979)

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### Radiographs

What is appropriate radiograph?

- Investigate the trauma!
- Conclude on possible injuries
- Then look for more injuries!

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### Why not CBCT?

A CBCT investigation of dental trauma is probably best evaluation!

However:

- Access to the machine has to be immediate, not refer to another practice.
- ALARA principle (As Low As Reasonable Achievable) for radiation, remember even LFV covers large portion of the head of young individuals.
- Most radiologist do not recommend using CBCT for follow-ups.

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### Diagnosis of Dental Trauma Why not CBCT for every case?

A CBCT investigation of dental trauma seems to be best evaluation!

However:

- The highest incidence rate of dental trauma is between the age of 8 to 14 years old. (Andreasen & Ravn 1972)
- Research evidence concerning CBCT indications in children remains limited. (Oenning A. et al. 2018)

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### Diagnosis of Dental Trauma Why not CBCT for every case?

*A Review of Doses for Dental Imaging in 2010–2020  
Development of a Web Dose Calculator*

CBCT imaging:

The child phantoms received about 29% more effective dose than the adult phantoms received.

The maximum CBCT effective dose with a small FOV for children, 245.2  $\mu$ Sv, about 8% of the effective dose that a person receives on average every year from natural background radiation, 3110  $\mu$ Sv.

(Lee H and Badal A, 2021)

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### Sensibility tests

Cold test is most effective  
Place cold on incisal 1/3 if possible.  
False negatives common soon after injury.  
Needs to be repeated at all recall appointments!  
- > At least two signs and symptoms are necessary of make the diagnosis of necrotic pulp.

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### Aim of Treatment in Dental Trauma

Regain or maintain  
pulp vitality !!!

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### Dental Trauma Crown Injuries

Types of trauma:

- ✓ Crown infraction
- ✓ Enamel fracture
- ✓ Uncomplicated crown fracture
- ✓ Complicated crown fracture
- ✓ Uncomplicated crown-root fracture
- ✓ Complicated crown-root fracture

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Crown Fractures  
 Crown Infraction  
 Clinical Presentation  
 Craze lines  
 "Use fiber optic light"

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**Crown Infraction**

Treatment:

Baseline Sensibility tests  
 Radiographs: Peri-apical film indicated if other signs or symptoms are present




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**Crown Infraction**

Follow-up

No follow-up generally needed unless associated with lux. injury or other fracture type.  
 \*Providing sensibility test normal



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**Uncomplicated Crown Fracture**

Biologic Consequences:

Minimal!!

Pulp will most likely defend it self\*  
 \*unless we, the dentists, mess things up!

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**Uncomplicated and Complicated Crown Fracture**

Treatment

1.Account for tooth fragment

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**Uncomplicated and Complicated Crown Fracture Treatment**

1.Account for tooth fragment  
 2. Sensibility tests  
 Sensibility tests should be done prior to any treatment!

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### Uncomplicated and Complicated Crown Fracture Treatment

1. Account for tooth fragment
2. Sensibility test
3. Radiographic evaluation:
  - periapical,
  - occlusal,
  - eccentric,
  - radiograph of lip/cheek if skin is broken.

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### Uncomplicated Crown Fracture Treatment

1. Account for tooth fragment
  2. Sensibility tests
  3. Radiographic evaluation
  4. Esthetic repair \*
- \* If there is not time for an esthetic repair, a glass-ionomer or composite bandage should be placed on the exposed dentin at the initial visit.

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### Uncomplicated Crown Fracture

Treatment  
4. *Esthetic repair:*  
Dentin bonding  
Vs.  
Ca(OH)<sub>2</sub> base

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### Uncomplicated Crown Fracture

Young human teeth (n=353):

Odontoblast numbers and dentine repair activity was more influenced by cavity variables, than of cavity filling materials or patient factors.

The most important variable was the remaining dentine thickness;  
below 0.25mm the numbers of odontoblasts decreased by 23%, and minimal reactionary dentine repair was observed.

(I. About et al. 2001)

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### Uncomplicated Crown Fracture

When remaining dentine thickness was less than 0.5 mm, but not exposing the pulp,  
the % of viable odontoblasts was found to be:  
calcium hydroxide (100%),  
polycarboxylate (82.4%),  
zinc oxide eugenol (81.3%),  
composite (75.5%),  
enamel bonding resin (49.5%)

(I. About et al. 2001)

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### Dentin Bonding of Fragments

The key is to get the best approximation possible:

- Etch and dry (don't over dry!!) both pieces
- Use minimal bond and no Ca(OH)<sub>2</sub> coverage if remaining dentin on the pulpal side is > 0.5mm
- If pulpal coverage is less than 0.5 mm then Ca(OH)<sub>2</sub> coverage over the deepest part and the corresponding area of the broken piece has to be dimpled appropriately.

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### Dentin Bonding of Fragments

*Effect of dehydration and rehydration intervals on fracture resistance of reattached tooth fragments using a multimode adhesive*

Bovine teeth n=84

Conclusion: Rehydrating a tooth fragment for 15 minutes before bonding with a multimode adhesive appears to maintain sufficient moisture to increase reattachment strength.

(Poubel DLN, et al. 2017)

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### Uncomplicated Crown Fracture

#### Follow-up

6-8 weeks and 1 year\*

Incl: Sensibility test and Radiographic evaluation

\*Providing sensibility tests are normal



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### Crown Fractures

**Crown Infraction**

**Uncomplicated crown fracture**

***Complicated crown fracture***

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### Complicated crown fracture

#### Definition

Crown fracture involving enamel, dentin and pulp

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### Complicated Crown Fracture

#### Treatment

1. Account for tooth fragment
2. Sensibility test
3. Radiographic evaluation:
  - periapical,
  - occlusal,
  - eccentric,
  - radiograph of lip/cheek if skin is broken.



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### Vital Pulp Therapy

#### Requirements for success

1. Capping of healthy pulp
2. Bacteria tight coronal seal
3. ? Capping material ?

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### Vital Pulp Therapy

#### Requirements for success

1. Pulpal Status

Healthy pulp - success > 90 %

Inflamed (caries exposure) pulp - success < 35%

(Al-Hiyasat AS et al, JADA 2006)

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### Complicated Crown Fractures

#### Biologic Consequences

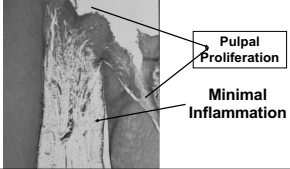
1st 24 to 48 hours - minimal inflammation of 1-2 mm and pulpal proliferation

Necrosis certain if no treatment

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### Complicated crown fracture

• 1st 24 to 48 hours



Pulpal Proliferation

Minimal Inflammation

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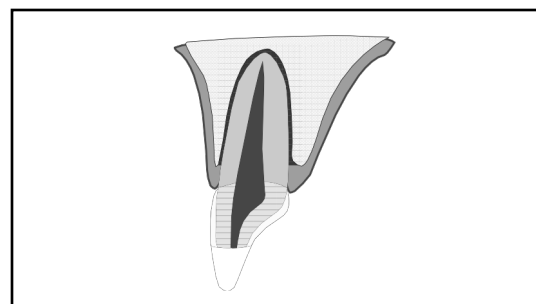
### Vital Pulp Therapy

#### Requirements for success

2. Bacteria tight seal

Cox CF et al:  
Biocompatibility of various surface-sealed dental materials against exposed pulps.  
J. Prosthet Dent 57:1987.

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### Complicated Crown Fracture

Human, n=12, 1 and 30 days

Single Bond adhesive on pulpal exposures – no caries.

Frequent gaps between the restoration and the dentin substrate;

- unpolymerized monomers,
- interface breaks with blood extravasation between the layers of the adhesive system,
- rupture of the odonto- blast layer,
- multinucleated giant cells close to the bonding agent.

(Silva GA et al. 2013)

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**Vital Pulp Therapy**  
 Requirements for success  
? Capping material ?  
 Calcium hydroxide:

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**Complicated Crown Fracture**

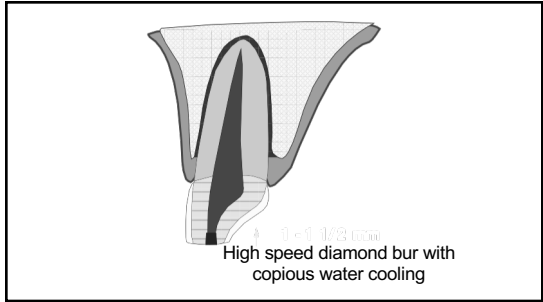
Calcium Hydroxide (Ca(OH)<sub>2</sub>):

Action unknown, possible due to the high pH (11-12) combined with inhibition of bacterial proliferation and effect on endotoxins.

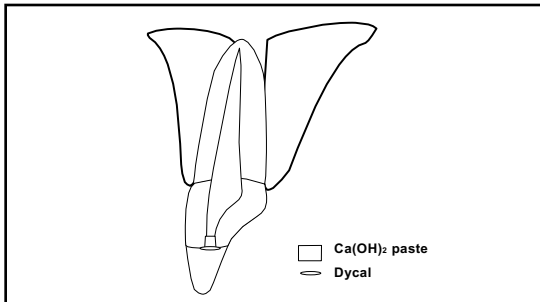
Ca(OH)<sub>2</sub> can not be used to treat an existing pulpitis

- it has no direct curative effect on inflammation,
- it does not appear to contribute Ca<sup>++</sup> to the bridge formation.

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**Vital Pulp Therapy**  
 Requirements for success  
? Capping material ?

Calcium hydroxide:  
 Mineral Trioxide Aggregate (MTA):

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**Vital Pulp Therapy**  
 Requirements for success  
? Capping material ?

Calcium hydroxide:  
 Mineral Trioxide Aggregate (MTA):  
 Biodentine:

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**Complicated Crown Fracture  
Biodentine**

Evolution of reparative dentin formation of ProRoot MTA, Biodentine and BioAggregate using micro-CT and immunohistochemistry

Results suggest that calcium silicate-based pulp-capping material induce favorable effects on reparative process during vital pulp therapy and those could be considered as alternatives to ProRoot MTA

After 6 months, regardless of blood exposure, Biodentine exhibits superior color stability compared to MTA.

(Kim J et al 2016, Palma PJ et al 2019)


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**Complicated Crown Fracture  
Follow-up**

6-8 weeks and 1 year\*

Incl: Sensibility test and Radiographic evaluation

\*Providing sensibility tests are normal



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**Root Fracture  
Treatment**

- reduce the displaced segment
- immobilize (?)
- follow-up critical

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**Root Fracture  
Treatment**

**- reduce the displaced segment**

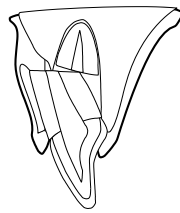
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**Root Fracture**

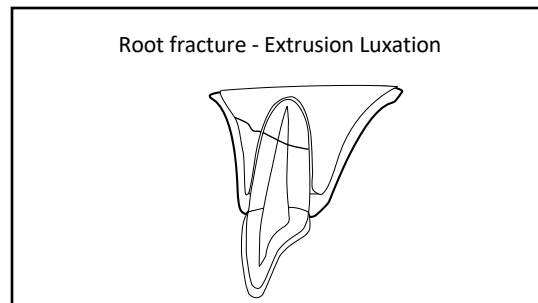
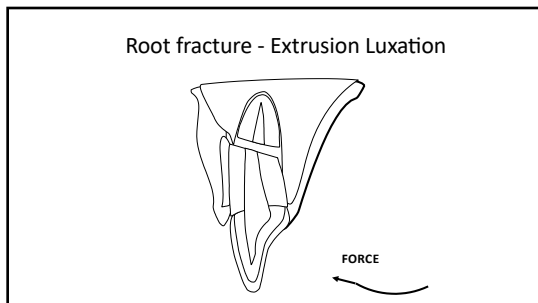
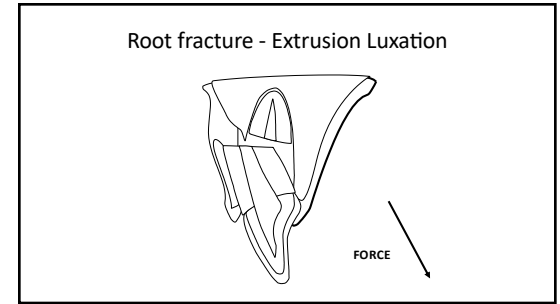
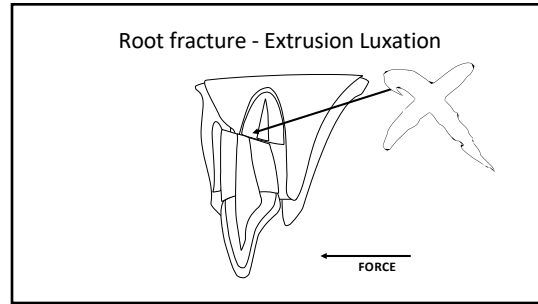
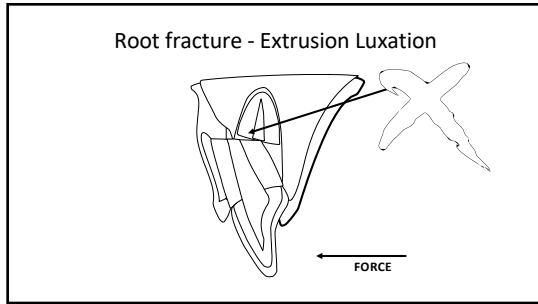
-Treatment principles:  
-Do not attempt to move the tooth unless it is very loose

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Root fracture - Extrusion Luxation



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**Root Fracture**

Prognosis:  
Pulp necrosis was found in 20%,  
70% of those (or only 14% of all fractures) successfully treated  
endodontically and almost all of them only in coronal segment.  
*(Zachrisson and Jacobsen 1975)*

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# Luxation Injuries

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**Forces on Teeth During Traumatic Injury**

Luxation injury

Concussion		
Subluxation		
Lateral Luxation	→	<u>Always</u> causes damage to the PDL. May cause a damage to the pulp.
Intrusion		
Extrusion		


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**Luxation Injuries**

**Concussion / Subluxation**

Treatment inside the office:

- Rule out root fracture (Radiographs)
- Adjust occlusion – splint only for patient comfort.
- Baseline Sensibility tests



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**Luxation Injuries**

**Luxation**

Treatment outside the office:

Reposition tooth if easy - otherwise refer to dental office ASAP


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**Luxation Injuries**

**Luxation**

Treatment inside the office :

1. Radiographs at 3 vertical angles.
2. Reposition
3. Functional splint 2 weeks



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**Luxation Injuries**

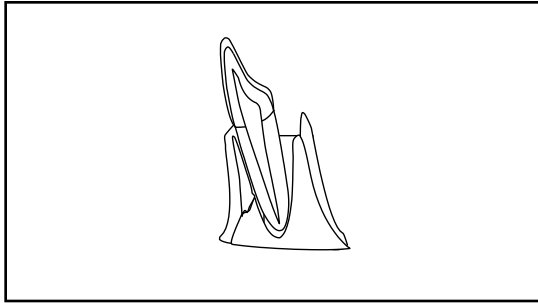
**Lateral Luxation**

Apical translocation?

Two possibilities:

- Apex in its original location

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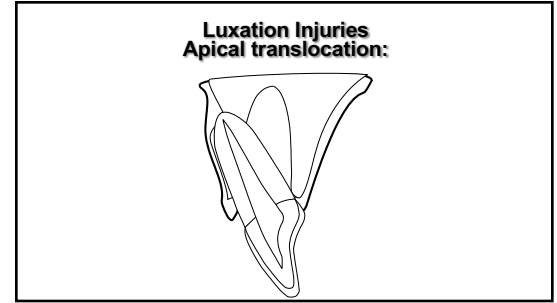
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**Luxation Injuries**

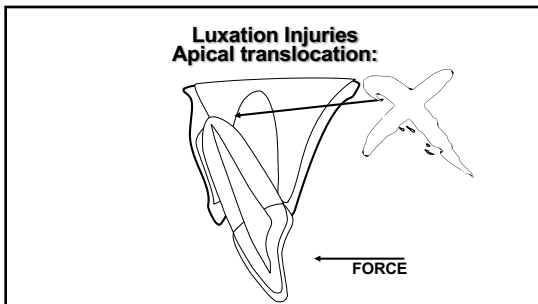
**Lateral Luxation**  
Apical translocation?

Two possibilities:  
- Apex in its original location  
- Apex moved facially

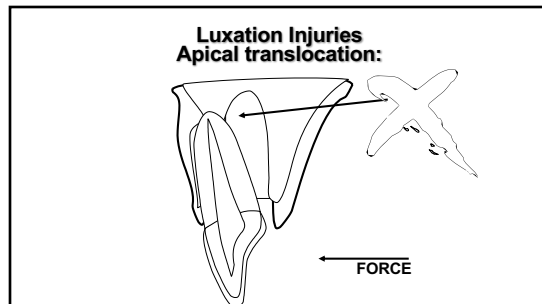
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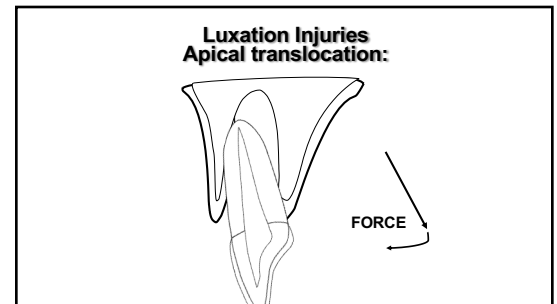
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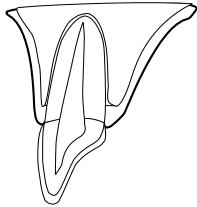
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### Luxation Injuries Apical translocation:



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### Traumatic Injuries

#### Extrusion and Lateral Luxation Treatment:

- Anesthesia (? vasoconstrictor).
- Reposition the tooth into normal position.
- Confirm the position with radiograph.
- Splint for 2 weeks if needed.
  
- Initiate root canal therapy as soon as symptoms indicate.

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### Avulsion

One of the few real emergency situation in dentistry.

At the site of the injury give the following advise:

- ✓ Keep the patient calm.
- ✓ Find the tooth and pick it up by the crown.
- ✓ If the tooth is dirty, wash briefly under cold running water and replant.
- ✓ If replant not possible place the tooth in a glass of milk or other suitable storage medium.
- ✓ Seek emergency dental treatment immediately.



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### Avulsion

Known Factors Affecting Prognosis:

- ✓ Time out of the socket
- ✓ Storage condition
- ✓ Splinting technique and time
- ✓ Condition of the alveolus
- ✓ Stage of root development

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### Avulsion

Known Factors Affecting Prognosis:

- ✓ Time out of the Socket
  - 90% of teeth replanted within 30 minutes were without root resorption
  - 43% of teeth replanted 31 - 90 minutes were without root resorption
  - 7% of teeth replanted after 90 minutes were without root resorption

(Andreasen and Hjørting-Hansen, 1966)

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### Emergency Management Outside the dental office

Place in appropriate storage

medium

- specialized media
- milk
- saline
- vestibule of mouth
- (((water)))

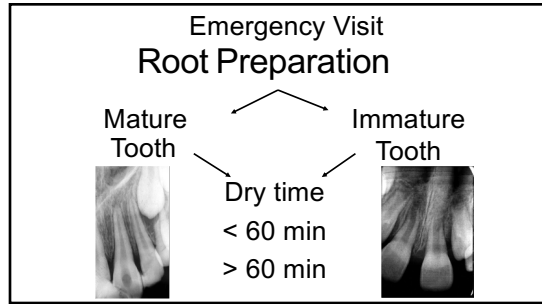
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**Milk Is Good!**

Has physiological osmolarity (230-270 mOsm/kg).  
 pH is in physiological range (6.5-6.9).  
 Can provide some nutrients to cells.  
 Pasteurized milk has very low bacterial count.

(Blomlöf et al. 1981)

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**Second Visit**  
**7-10 days**  
**Treatment Objective**  
**Prevent or treat**  
**pulpal infection**

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**Second Visit**  
**Treatment Objective**  
**7-10 days**

It was concluded that short- and long-term calcium hydroxide treatment resulted in similar healing patterns when endodontic treatment is initiated 14 days after replantation of teeth.

(Trope et al. 1992)

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*Prevention of Resorption*

Calcium Hydroxide- $\text{Ca}(\text{OH})_2$

No direct anti-inflammatory action provided.

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*Prevention of Resorption*

Corticosteroids

Block production of inflammatory stimulators including prostaglandins and leukotrienes, produced by cyclo-oxygenase and lipoxygenase pathways.

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### New Guidelines of IADT

The current guidelines of IADT give an option of using a corticosteroid or corticosteroid/antibiotic mixture for teeth after avulsion rather than using Ca(OH)<sub>2</sub>

The AAE guidelines will not.

(Fouad AF et al. 2020)

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### Why Not Using/Recommend Corticosteroids?

- No commercial FDA approved is commercially available in USA.
- If used they should be placed immediately or shortly after replantation and left in situ for at least 6 weeks.
- Some of the mixes have high risk of staining crowns.
- No solid human studies have been done to demonstrate safety and/or efficacy of the steroid paste, only rather limited animal data.
- Could be useful in healing/preventing root resorption.

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### Emergency Visit Inside the dental office

# Splint

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35 lb monofilament fishing line

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### Guidelines of IADT

What is new? Any physiological and hygienic splint acceptable; monofilament fishing line 16 to 25 lbs!

Splinting Time:

Type of Injury	Splinting Time
Subluxation	2 weeks
Extrusive luxation	2 weeks
Avulsion	2 weeks
Lateral luxation	2 weeks
Root fracture (middle 1/3)	4 weeks
Alveolar fracture	4 weeks
Root fracture (cervical 1/3)	4 months

(Andersson et al. 2012)



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### Emergency Treatment

#### Adjunctive Therapy

- \* Systemic Antibiotics???
- (Doxycycline > 8 to 10 y. old)
- \* Systemic NSAIDS
- \* Chlorhexidine rinses
- \* Tetanus booster

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