Endodontic management of traumatic dental injuries

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Based on **Mahmoud Torabinejad, Richard E. Walton,** ENDODONTICS: PRINCIPLES AND PRACTICE 4th edition

Epidemiology of traumatic dental injuries

The oral region

- 1 % of the total body area

Injuries of the oral region

- 5 % of all body injuries

  <u>17 % in preschool children</u>

Incidence: 1-3 %

Prevalence: 20 -30 % (permanent, primary dentition)

- Most frequent during the first 10 years of life

Etiologic factors

Vary with age groups:

- Falls
- Sports
- Hits by another person
- Traffic accidents

History

- chief complaint
- present injury
  - date and time
  - how the injury took place
  - any other injuries in the past
  - actual problems with the tooth/teeth -pain, mobility, occlusal interference
- medical history

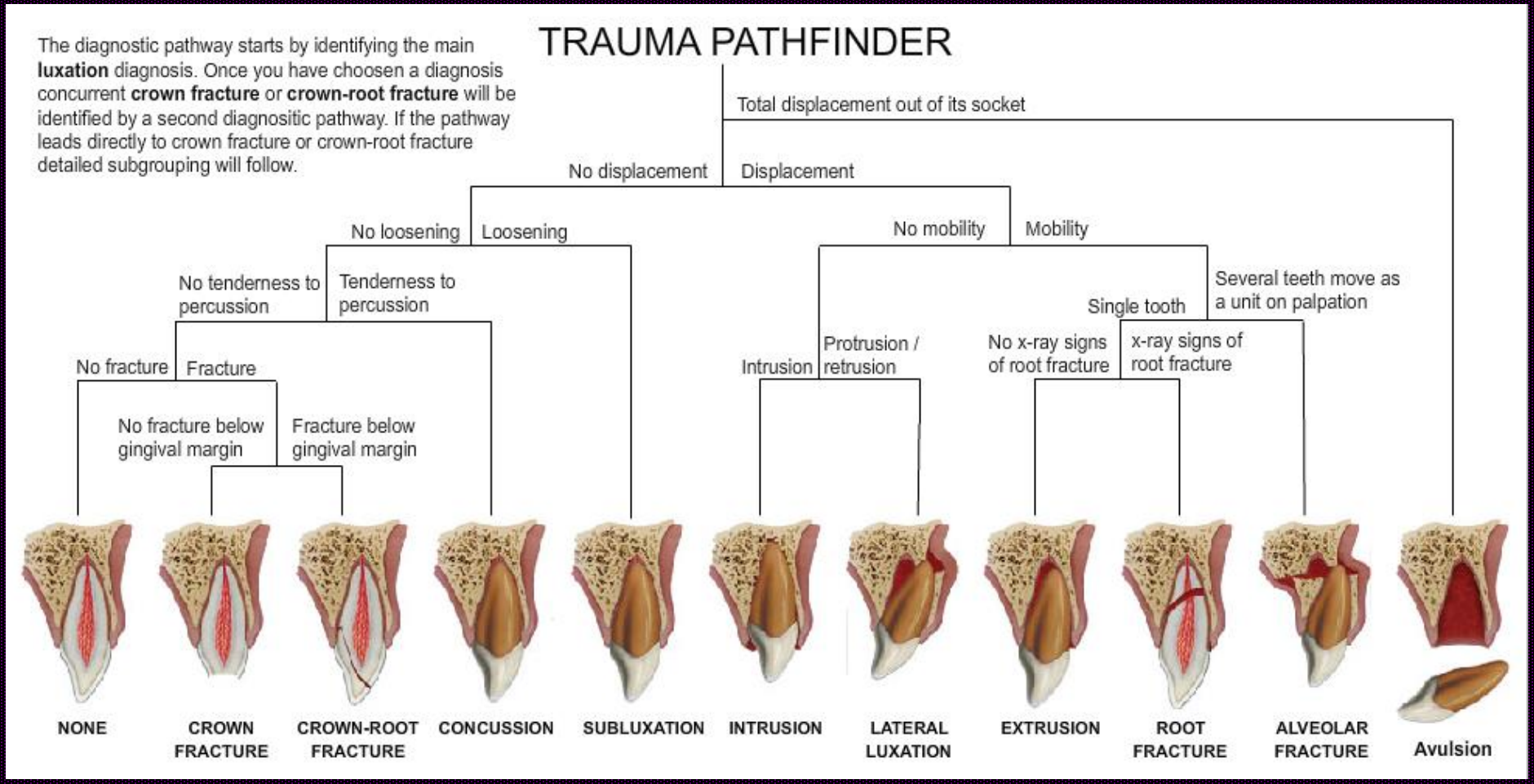
Tetanus prohylaxis depends on the circumstances of the injury, and the tetanus immunisation status of the patient.

- deep, destructed, contaminated injuries
- active / passive Tetanus immunisation

Clinical examination

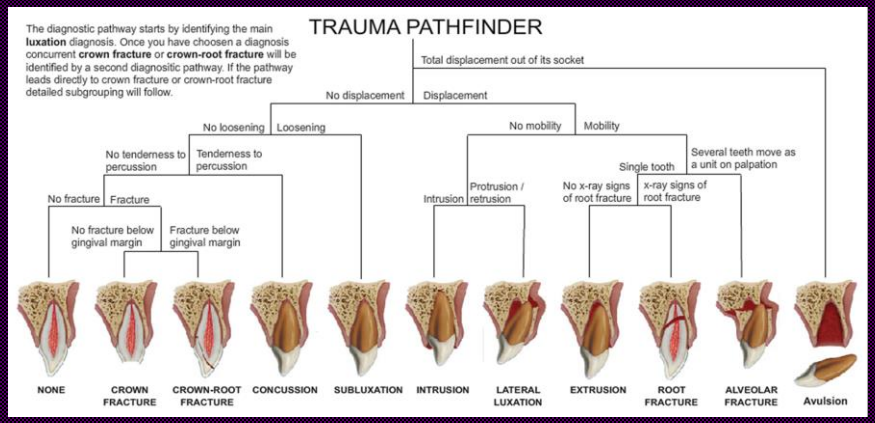
- Soft tissues
- Facial skeleton
- Teeth and supporting tissues
  - Displacement (luxation)
  - Mobility (0→3; metallic sound of ankylosis)
  - Periodontal damage (swelling, bleeding, sensitivity to percussion)
  - Pulpal injury (symptoms, clinical tests: EPT, CO_2 ice test)
  - Radiographic examination (multiple exposures, standardized radiographic images)

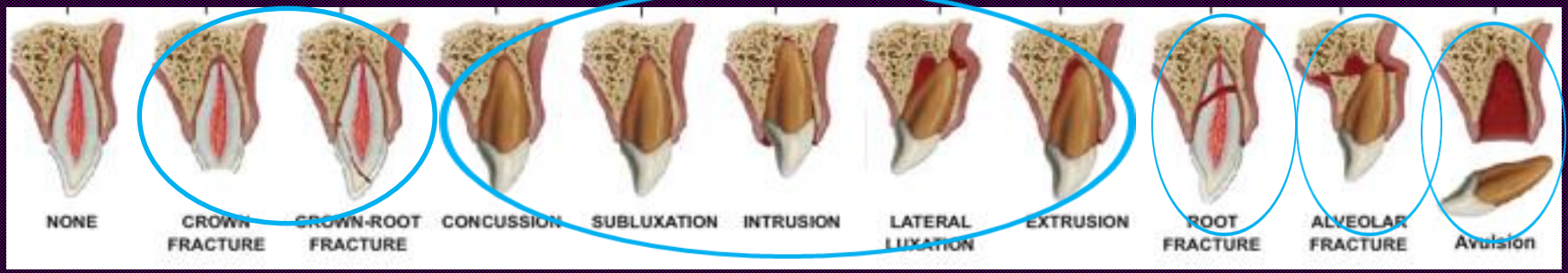
Diagnosis


TRAUMA PATHFINDER
The diagnostic pathway starts by identifying the main **luxation** diagnosis. Once you have choosen a diagnosis concurrent **crown fracture** or **crown-root fracture** will be identified by a second diagnositic pathway. If the pathway leads directly to crown fracture or crown-root fracture detailed subgrouping will follow.
Total displacement out of its socket
No displacement
Displacement
No loosening
Loosening
No mobility
Mobility
No tenderness to percussion
Tenderness to percussion
Several teeth move as a unit on palpation
Single tooth
No fracture
Fracture
Protrusion / retrusion
Intrusion
No x-ray signs of root fracture
x-ray signs of root fracture
No fracture below gingival margin
Fracture below gingival margin
NONE
CROWN FRACTURE
CROWN-ROOT FRACTURE
CONCUSSION
SUBLUXATION
INTRUSION
LATERAL LUXATION
EXTRUSION
ROOT FRACTURE
ALVEOLAR FRACTURE
Avulsion

Classification of dental injuries

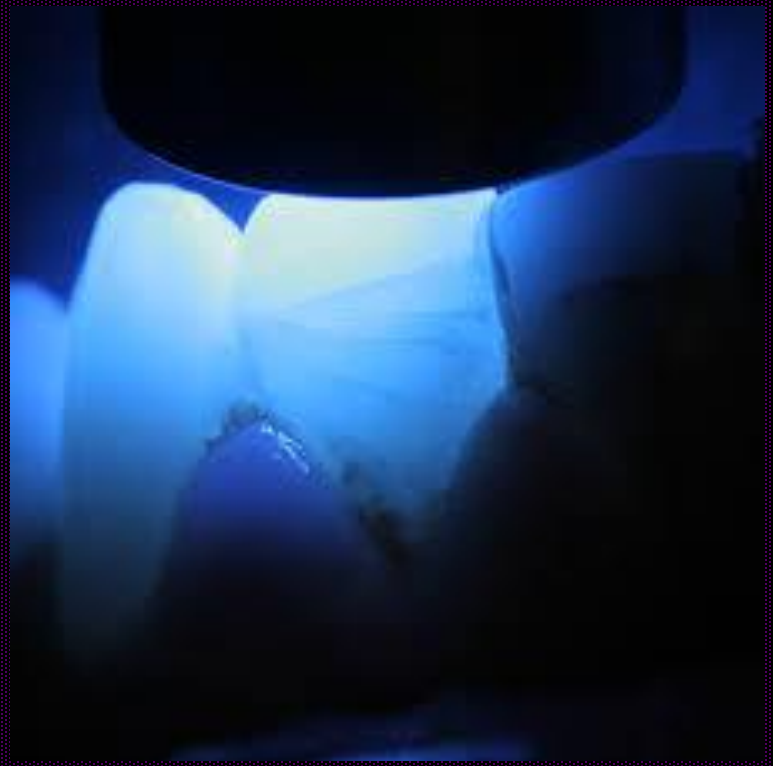
I. Fractures
II. Luxations
III. Avulsion
IV. Alveolar fracture





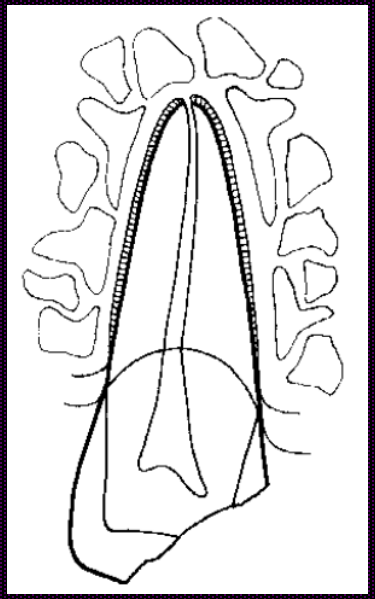
Enamel fracture

- Involves the enamel only
- Includes enamel chipping
- Incomplete fractures
- Enamel cracks



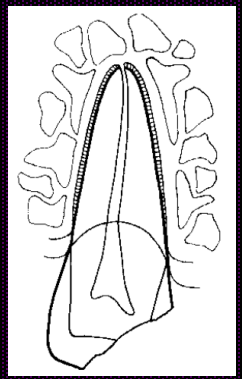
Crown fracture without pulp exposure

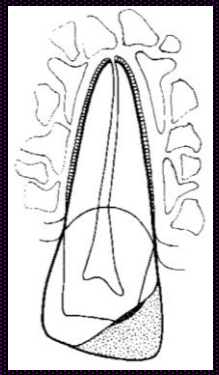
- **Uncomplicated crown fracture** involving enamel and dentin with no pulp exposure



Crown fracture without pulp exposure

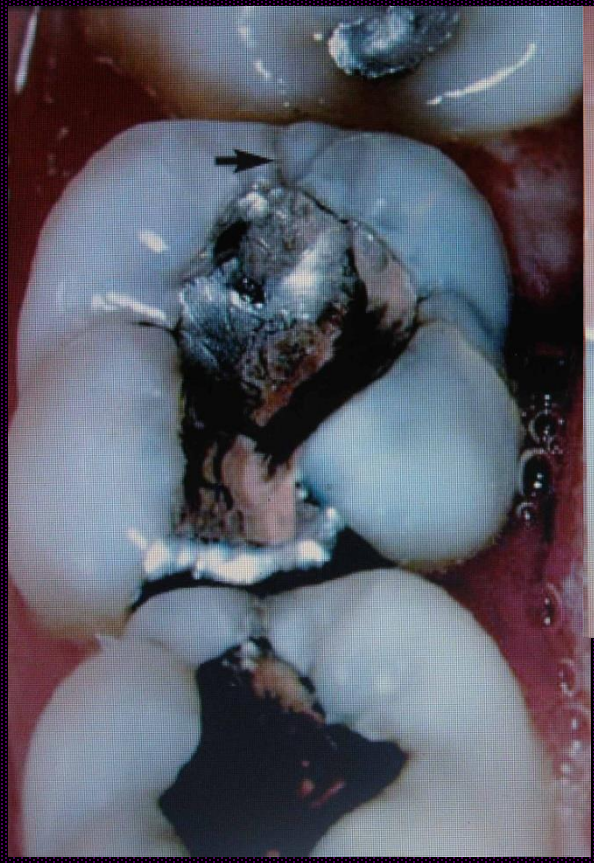
- Treatment:
  - Reattachment of separated enamel-dentin fragment
  - Restoration with composite resin
  - Indirect veneer (at a later date, ↑esthetics, function)
- Prognosis: good





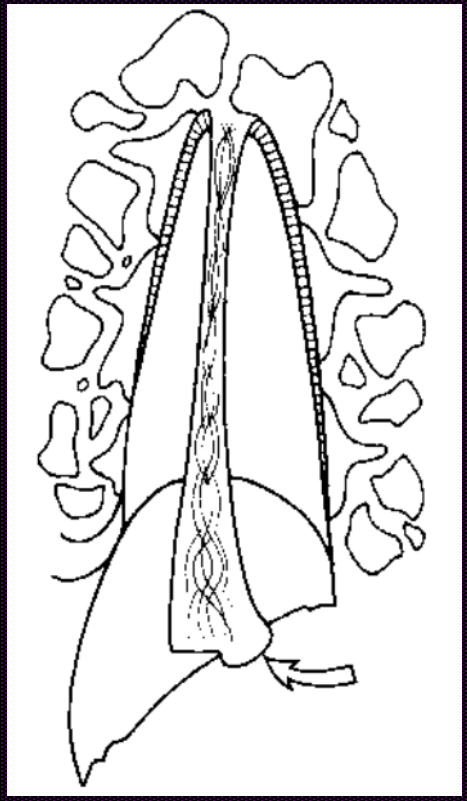
Crown fracture without pulp exposure

Cusp fracture



Crown fracture with pulp exposure

Complicated fracture involving enamel and dentin and exposure of the pulp



Crown fracture with pulp exposure

- **Extent of fracture**
  - Vital pulp th. + acid-etched composite restauration
  - Root canal treatment + post and core-supported crown
- **Stage of root development**
  - Immature teeth: shallow (partial) pulpotomy + acid-etched composite restauration / reattaching the fractured segment
- **Lenght of time since injury**
  - Time ↑ prognosis ↓

Treatment of crown fractures with pulp exposure

- **Vital pulp therapy**
  - Pulp cupping
  - Pulpotomy: Cvek technique (shallow) / conventional technique (to or below the cervical level)

168 hours
2mm

- **Root canal therapy**
  - Accommodating to prosthetic requirements

Vital pulp therapy

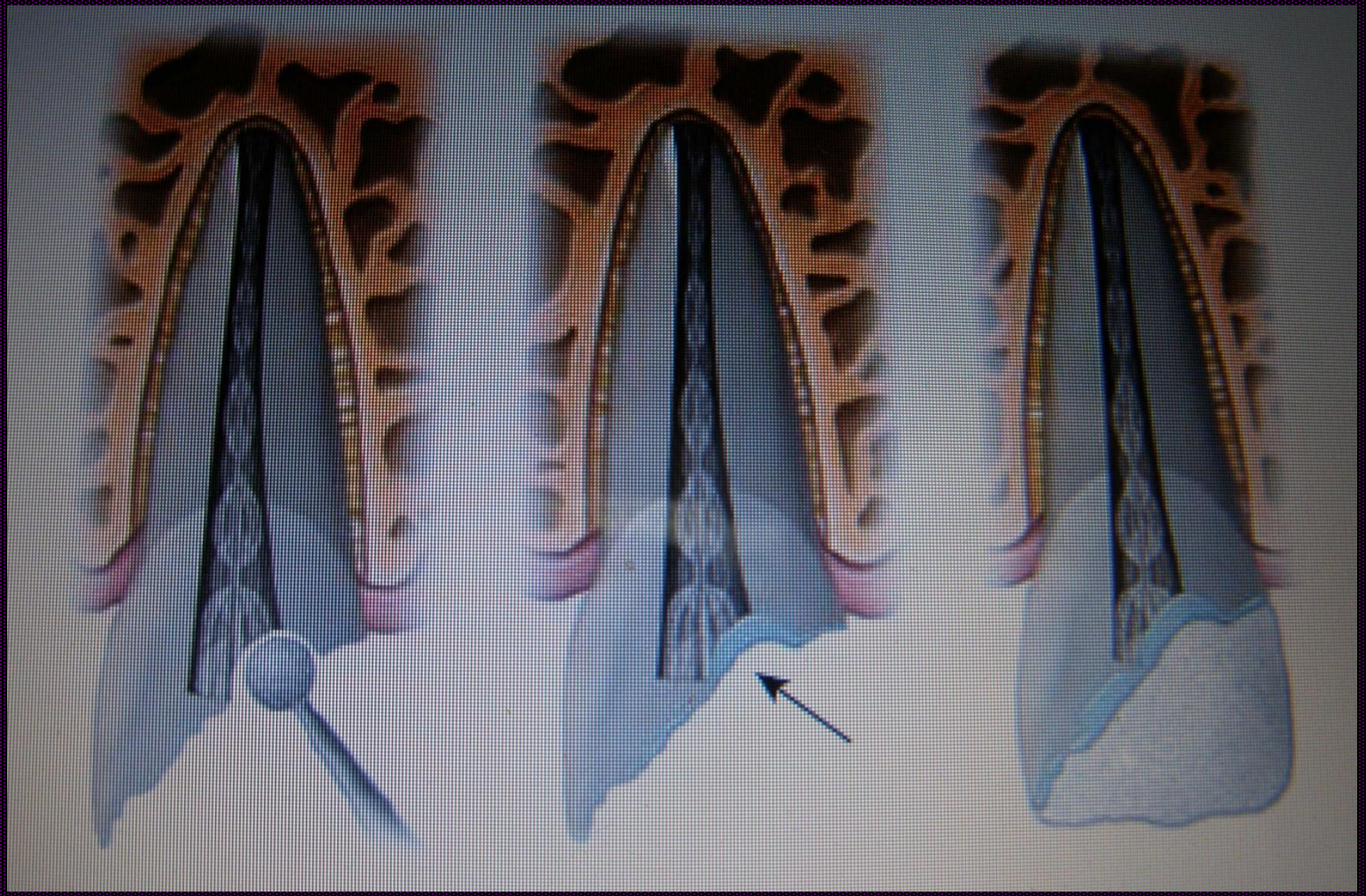
Indication:

- **immature teeth** that can subsequently be restored with acid-etched composite

- **mature teeth*** that can subsequently be restored with acid-etched composite

  * age ? compliance? date and circumstances of the accident?

Technique of shallow (Cvek) pulpotomy



Technique of shallow (Cvek) pulpotomy

1. Anesthesia
2. Rubber dam isolation
3. Exposed dentine is washed with saline or sodium hypochlorite solution
4. Extruding granulation tissue is removed with a spoon excavator →determination of the size and location of the exposure
5. Pulp tissue is removed to a depth of about 2 mm below the exposure (shallow)-water cooled small round diamond in the high-speed handpiece

Technique of shallow (Cvek) pulpotomy

6. The wound is washed with sterile saline
7. Haemostasis can be expected within 5 minutes
8. The wound is washed again to remove the clot
9. The wound is dressed with calcium hydroxide or MTA cement
10. Cavity is sealed with a hard-setting glass ionomer cement (when using Ca(OH)2)
11. Acid-etched composite restauration

Calcium hydroxide versus MTA

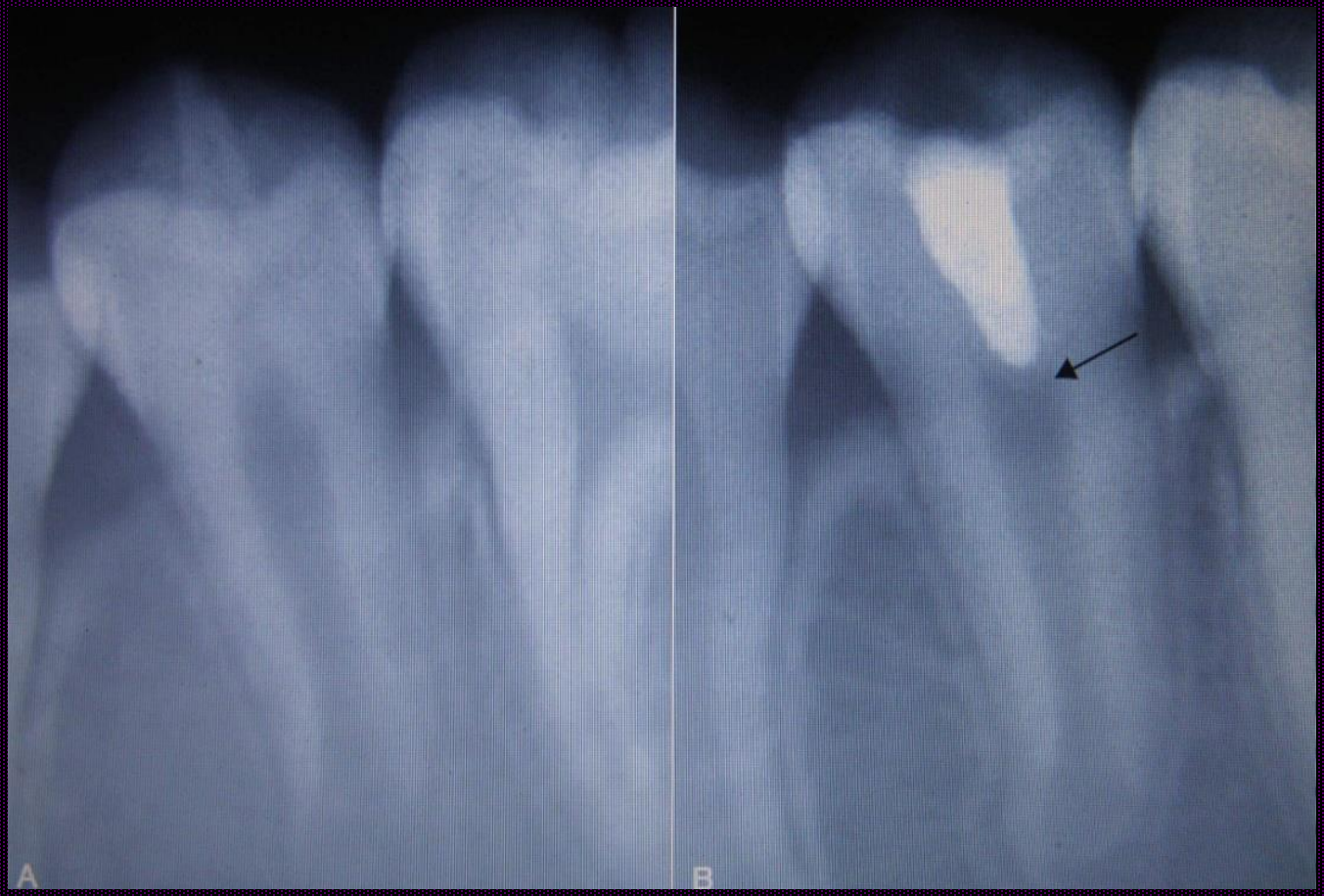
Calcium hydroxide

- Desintegration with time
- After 6-12 month the tooth should be reentered
- Replace calcium hydroxide with a dentin bonding material

MTA

- Can be placed directly onto the pulp tissue
- Long curing time (-)
- Non-resorbable
- No need to reenter the tooth

Pulpotomy , apexogenesis

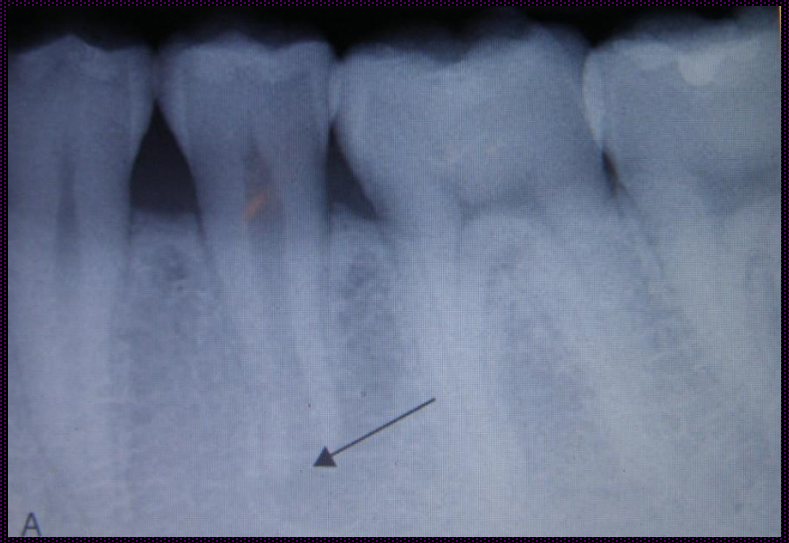


Vital pulp therapy

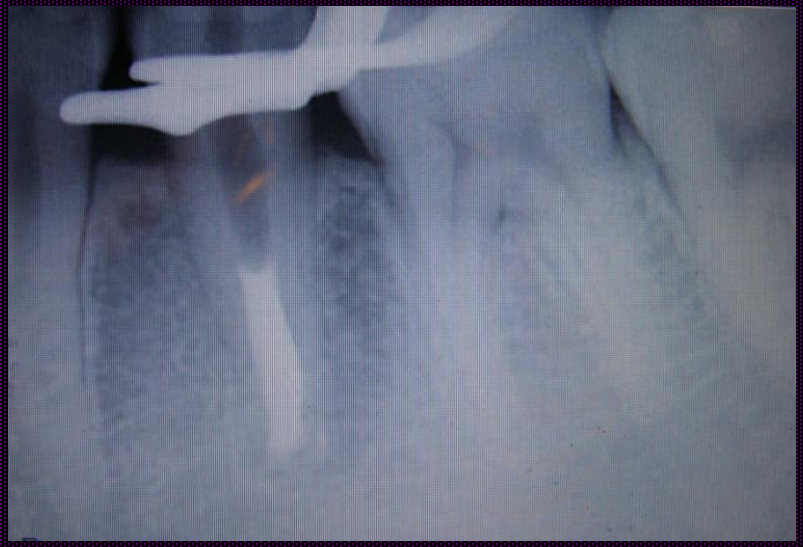
- Treatment evaluation: after 6 month, than yearly
- Criteria for successful shallow pulpotomy:
  - Asymptomatic tooth, proper function
  - No radiographic evidence of apical periodontitis
  - No indication of root resorption
  - Tooth responds to pulp testing
  - Continued root development is evident radiographically

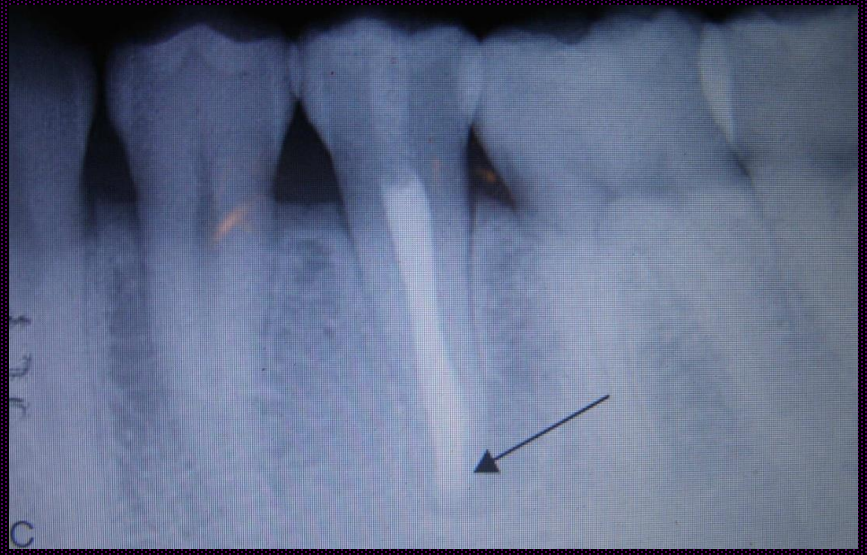
Necrotic pulp or arrested root formation → apexification

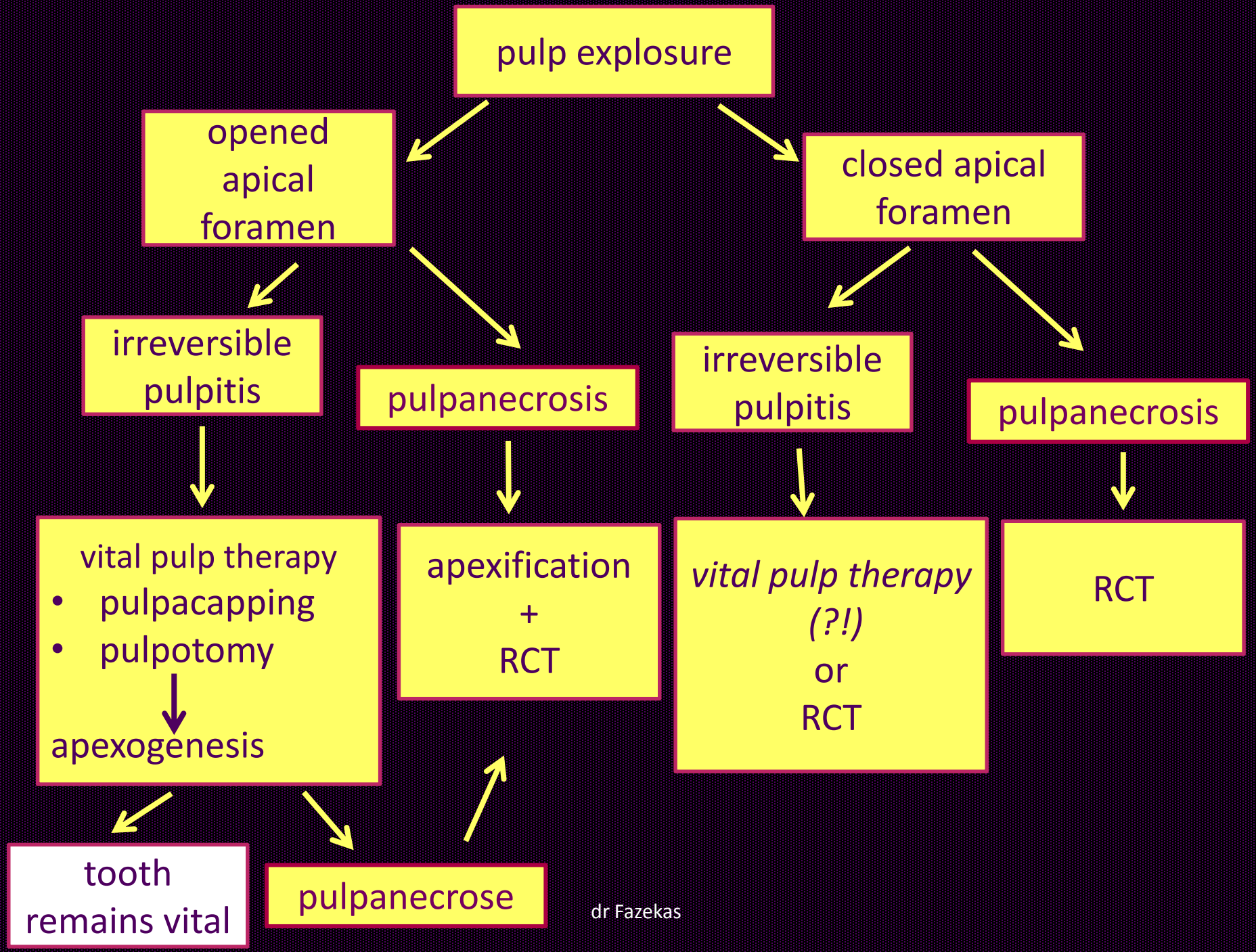
Apexification



Apical closure with an artificial barrier (MTA) „one session therapy”

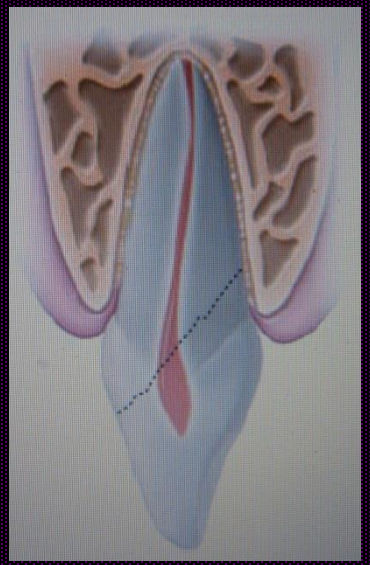


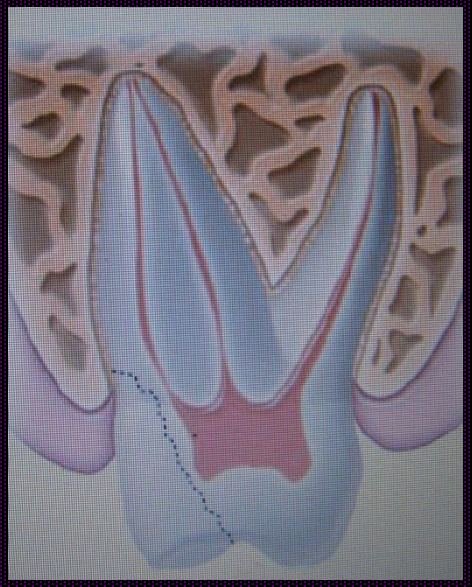


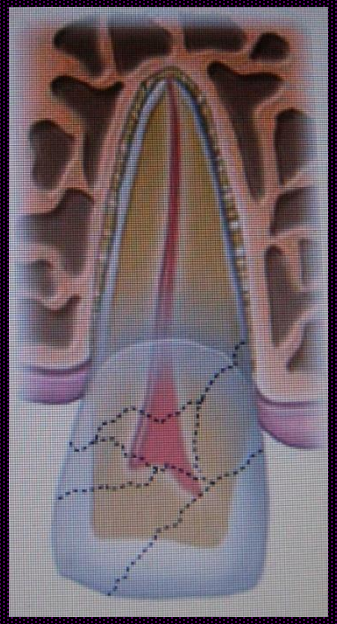

pulp explosure
opened apical foramen
closed apical foramen
irreversible pulpitis
pulpanecrosis
irreversible pulpitis
pulpanecrosis
vital pulp therapy
• pulpacapping
• pulpotomy
apexogenesis
apexification + RCT
vital pulp therapy (?!) or RCT
RCT
tooth remains vital
pulpanecrose
dr Fazekas

Crown-root fracture

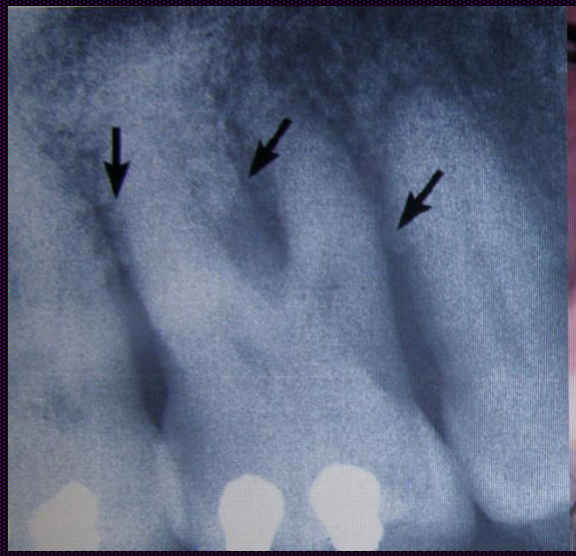
- Includes enamel, dentin, and root cementum and may or may not include the pulp
  - Chisel-type fracture: anterior teeth
  - Shattered crown: pieces are held in place only by the part of a fractured segment still attached to the periodontal ligament



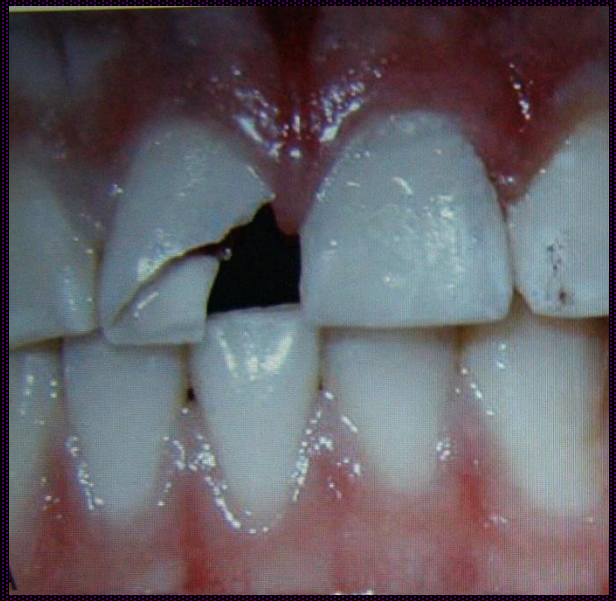




Crown-root fracture



Crown-root fracture



Examination:

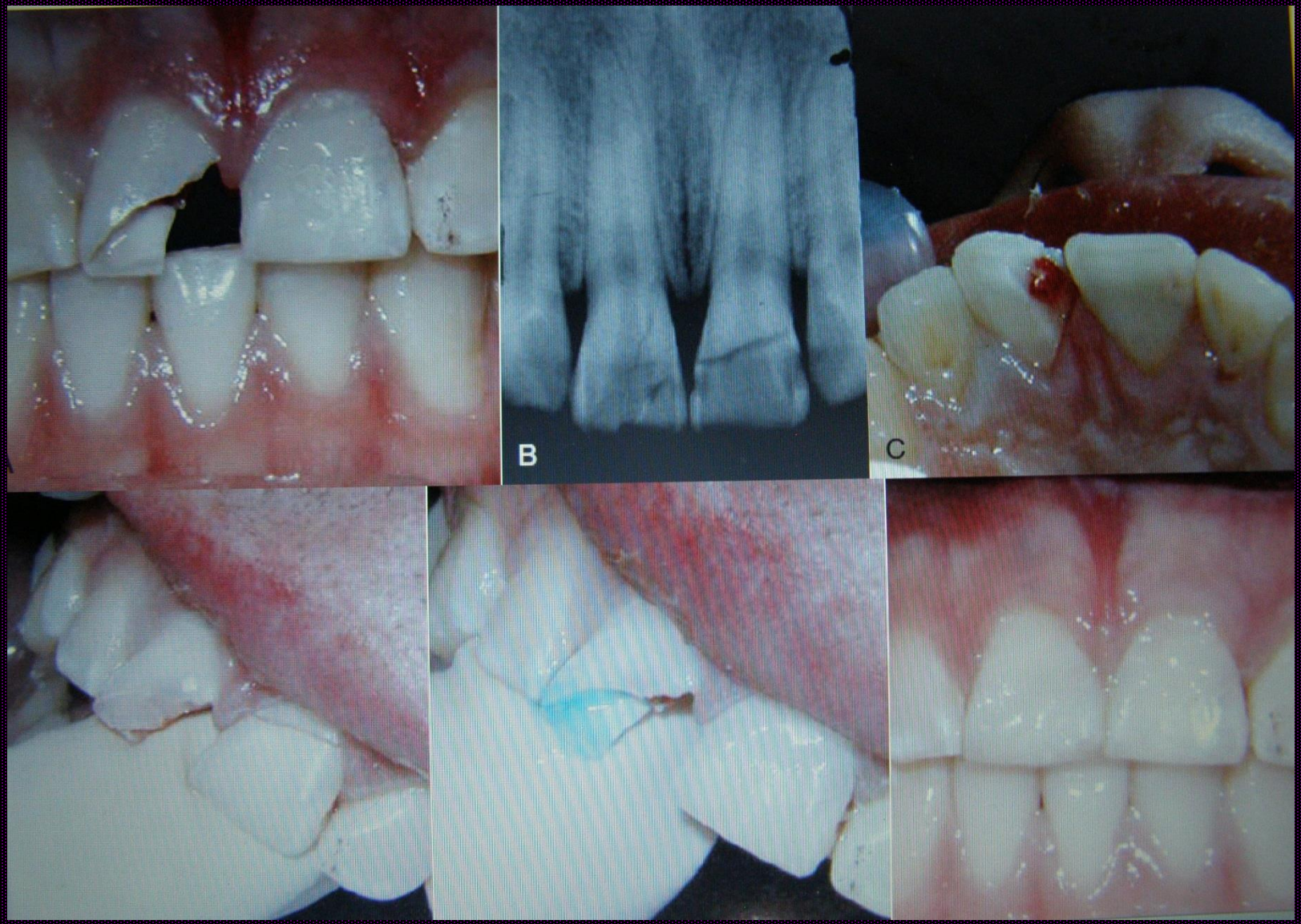
- Loose fragments
- Additional radiographs

Remove all loose fragments ???

Emergency care:

- Bonding loose tooth fragments, at least temporary (immature teeth!)
- Pulp therapy

Urgent care for crown-root fracture



Crown-root fracture

Treatment planning:

- Pulpotomy or pulpectomy
- Remaining tooth structure
- Level of the subgingival fracture: root extrusion, gingivoplasty, alveoplasty
- Extraction: bridge, implant, orthodontic treatment

Definitive treatment of crown-root fracture

Fragment removal

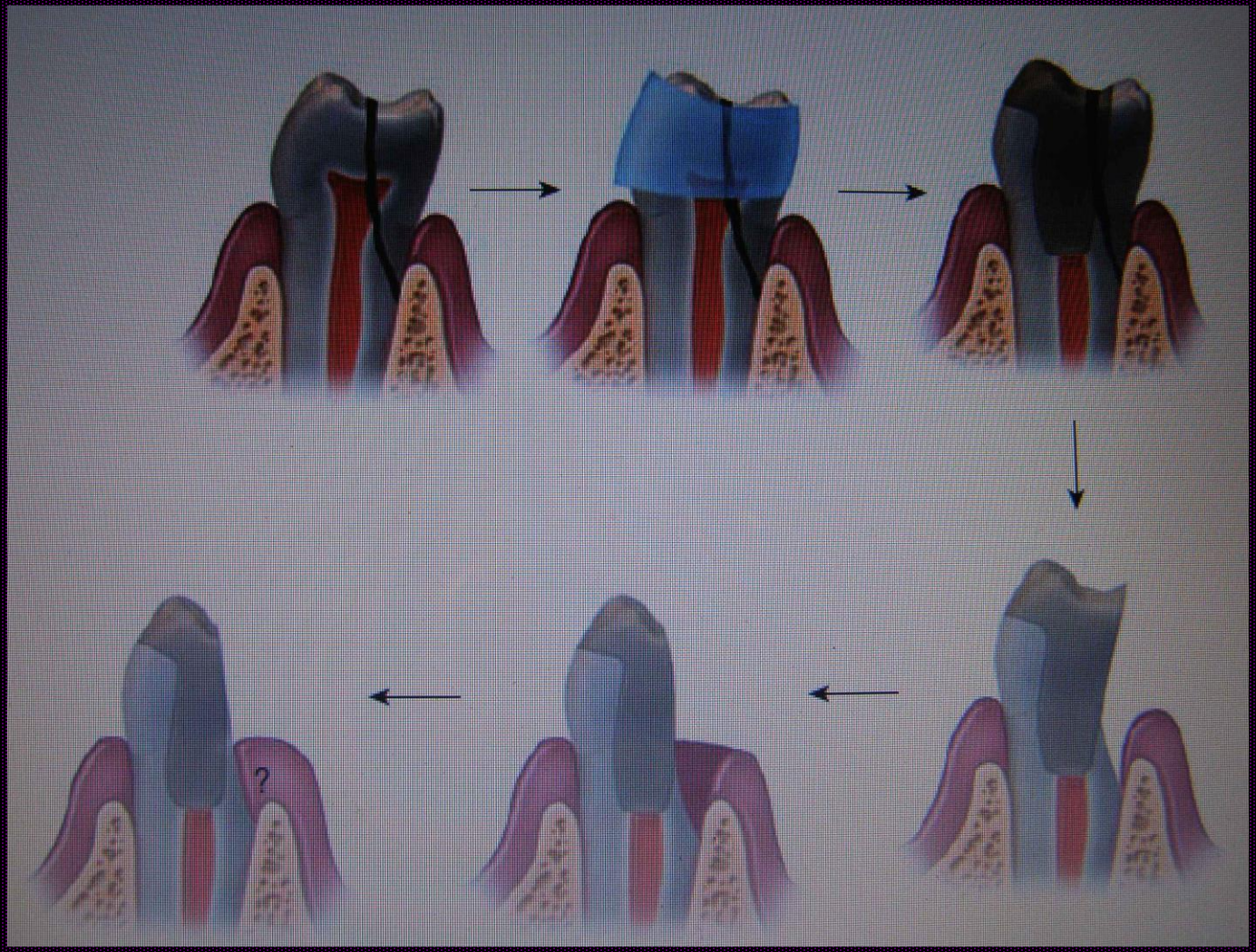
- gingivectomy (ostectomy), endodontic treatment and restoration with a post-retained crown
- Orthodontic extrusion of apical fragment

Decoronation (Root submergence)
maintaining the volume of the alveolar process for later optimal implant installation

Extraction

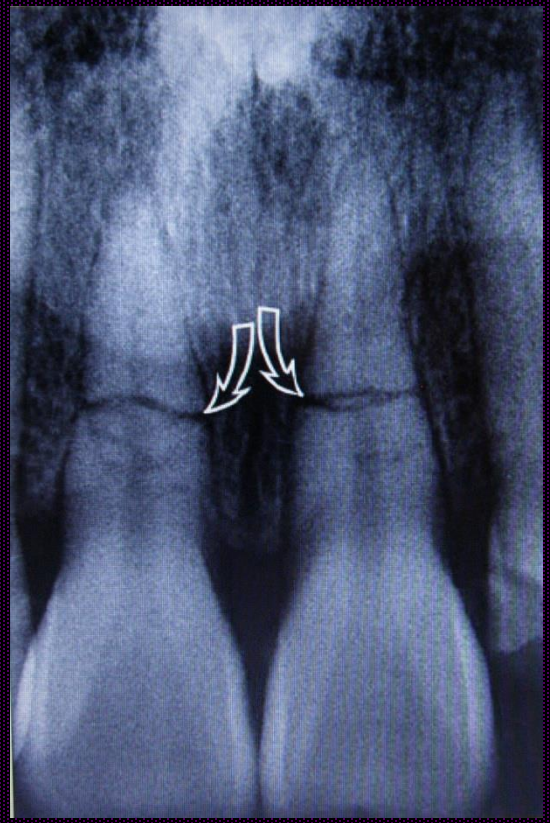
- with immediate or delayed implant-retained crown restoration or a conventional bridge.

A technique for managing certain split teeth and cusp fractures

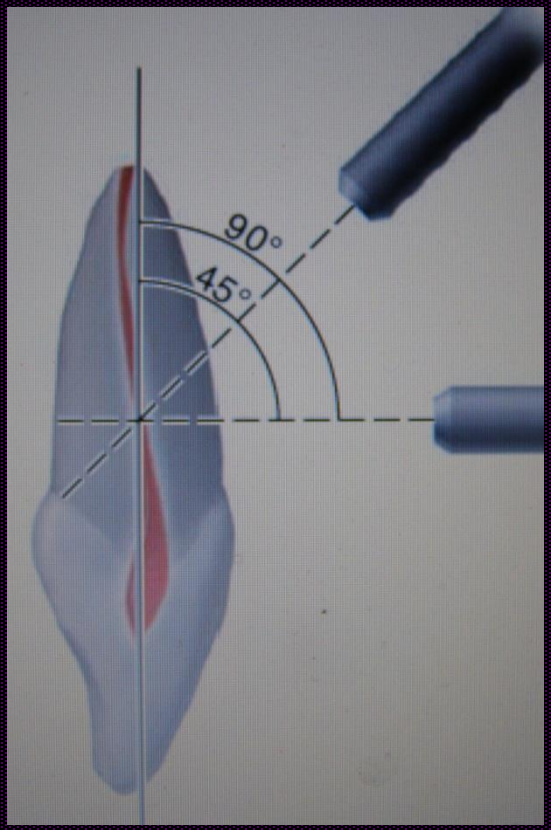


Root fracture

- Involve cementum, dentin and pulp
- Also referred to as
  - intraalveolar
  - horizontal
  - transverse root fracture



Root fracture



Generally mild symptoms:

- Mobile or displaced tooth
- Pain on biting

X-ray: additional angle!

Emergency care:

- Repositioning
- stabilization: 4-6 weeks of splinting

Root fracture

Treatment:

- Cervical, middle third: splinting
- apical: observation

Sequelae of root fractures:

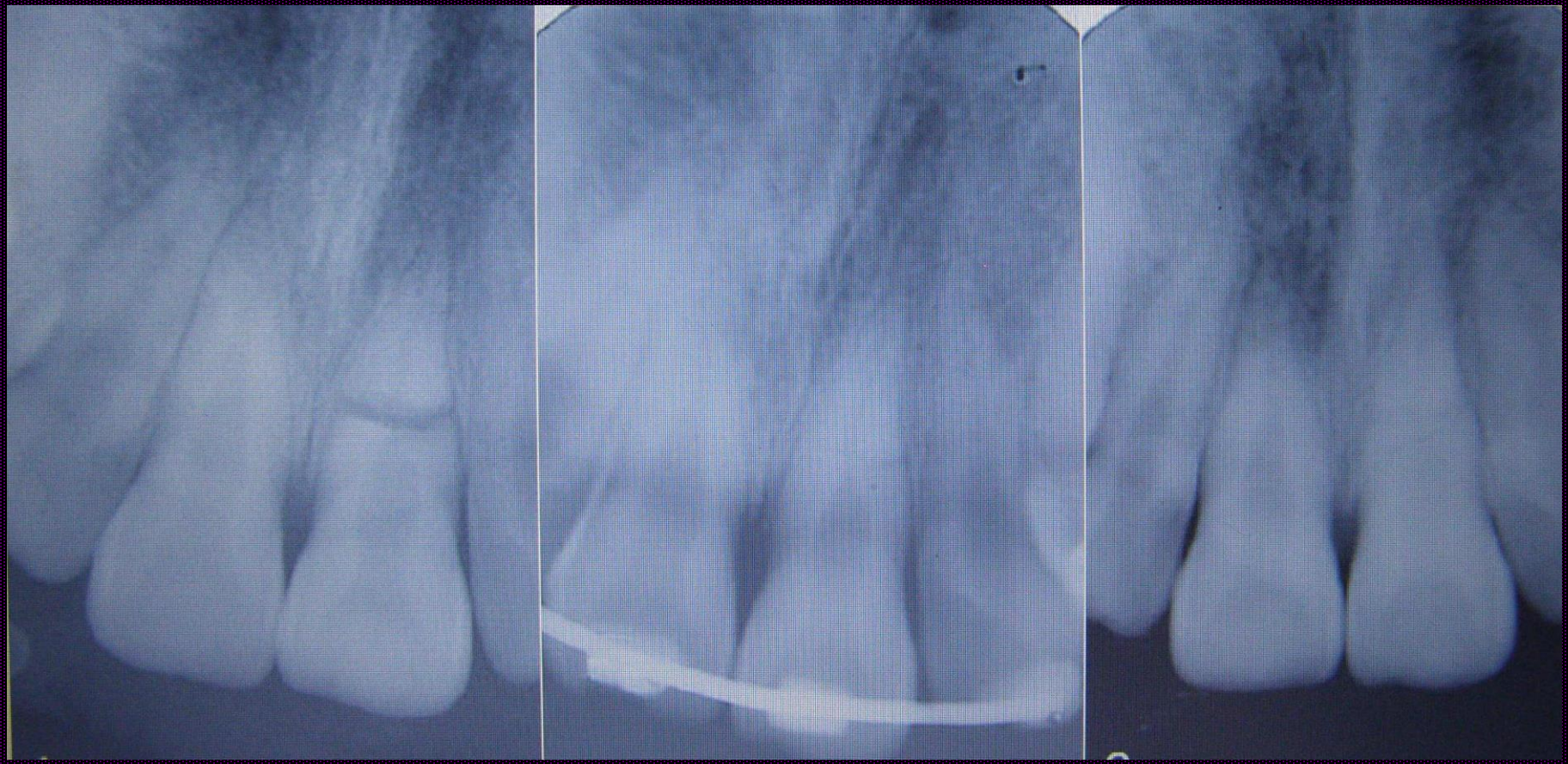
- Calcific metamorphosis (EPT!)

Root canal treatment: when pathosis is evident

Prognosis:

- ↑ heal spontaneously or after splint therapy

Stabilization of a root fracture



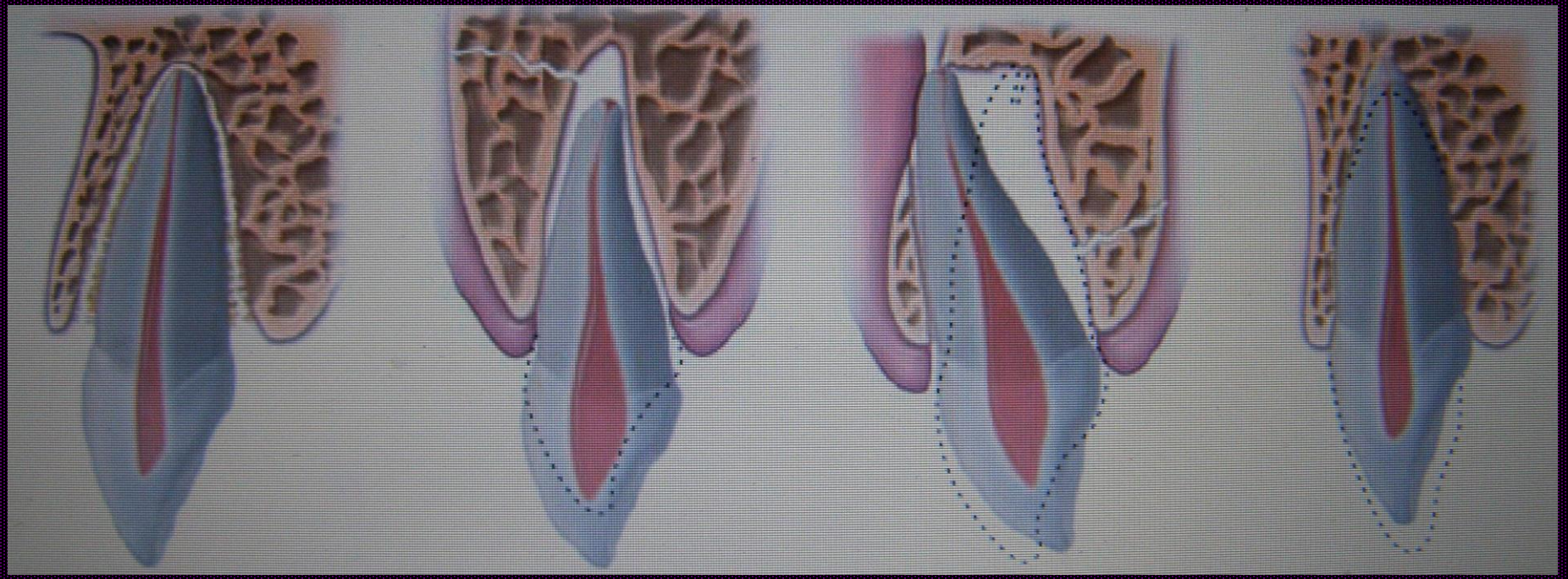
Luxation injuries

- Trauma to the supporting structures of teeth
- Often affect the neural and vascular supply to the pulp
- ↑ luxation, ↑ displacement, ↑damage

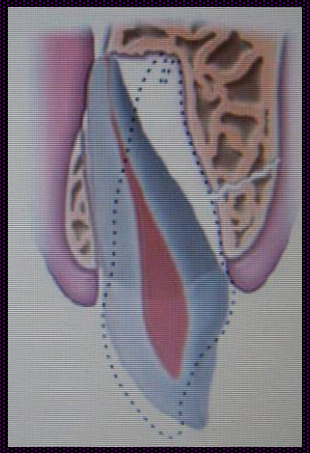
Luxation injuries

concussion

subluxation extrusive luxation lateral luxation intrusive luxation



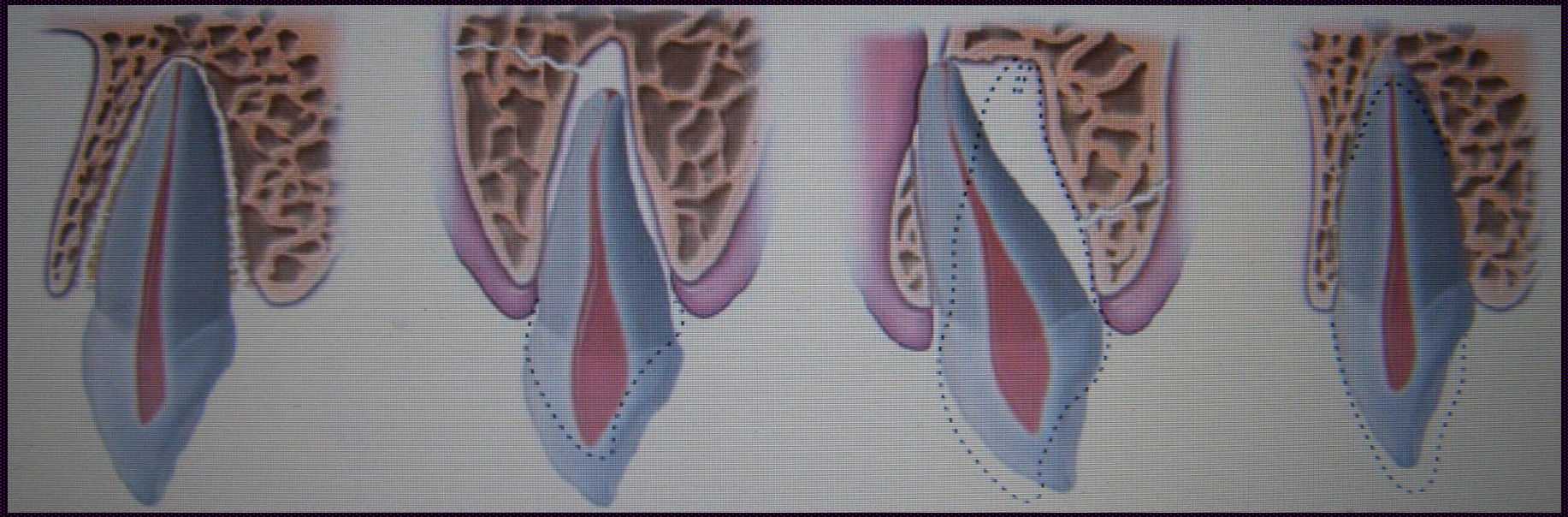
Luxation injuries



Typical Clinical Findings with Different Types of Luxation Injuries

CLINICAL FINDINGS	CONCUSSION	SUBLUXATION	EXTRUSION	INTRUSION	LATERAL LUXATION
Abnormal mobility	−	+	+	− (+)*	− (+)
Tenderness to percussion	+	+ (−)	±	− (+)	− (+)
Percussion sound	Normal†	Dull	Dull	Metallic	Metallic
Positive response to pulp testing	±	±	− (+)	− (+)	− (+)
Clinical dislocation	−	−	+	+	+
Radiographic dislocation	−	−	+	+	+

From Andreasen JO, Andreasen FM: *Textbook and color atlas of traumatic injuries to the teeth*, ed. 3, St Louis, 1994, Mosby.
*(+), Less common occurrence.
†Teeth with incomplete root formation and teeth with marginal or periapical inflammatory lesions will also elicit a dull percussion sound.



Treatment of luxation injuries

- Concussio: no immediate treetment is necessery; allow the tooth to „rest” (avoid biting), pulpal status is monitored
- Subluxation: no treatment / stabilization for 1 to 2 weeks
- Extrusion and lateral luxation: repositioning and splinting, RCT in case of irreversibile pulpitis or pulp necrosis
- Intrusion:
  - tooth with an open apex: it may reposition spontaneously
  - fully developed tooth: active extrusion and RCT

Luxated teeth in which the pulps become necrotic are indicated for root canal therapy.

Monitoring the pulpal status

- signs and symptoms
- pulp response to pulp testing (CO_2 Ice test and EPT): retesting in 4 to 6 weeks
- radiographic examination : repeating in 4 to 6 weeks
- discoloration of the crown
  - pink/ grayish/ yellow to brown
  - may be reversed

Avulsion

Complete displacement of a tooth out of its socket

- Time out of socket
- Storage media

Treatment of avulsions

1. Someone may telephone for advice, presenting an opportunity for immediate replantation
2. The patient may be brought to the office with a tooth that has been out of the alveolus for less than 1 hour
3. The tooth has been out for more than 1 hour and not kept in a suitable storage medium

First aid for avulsed teeth

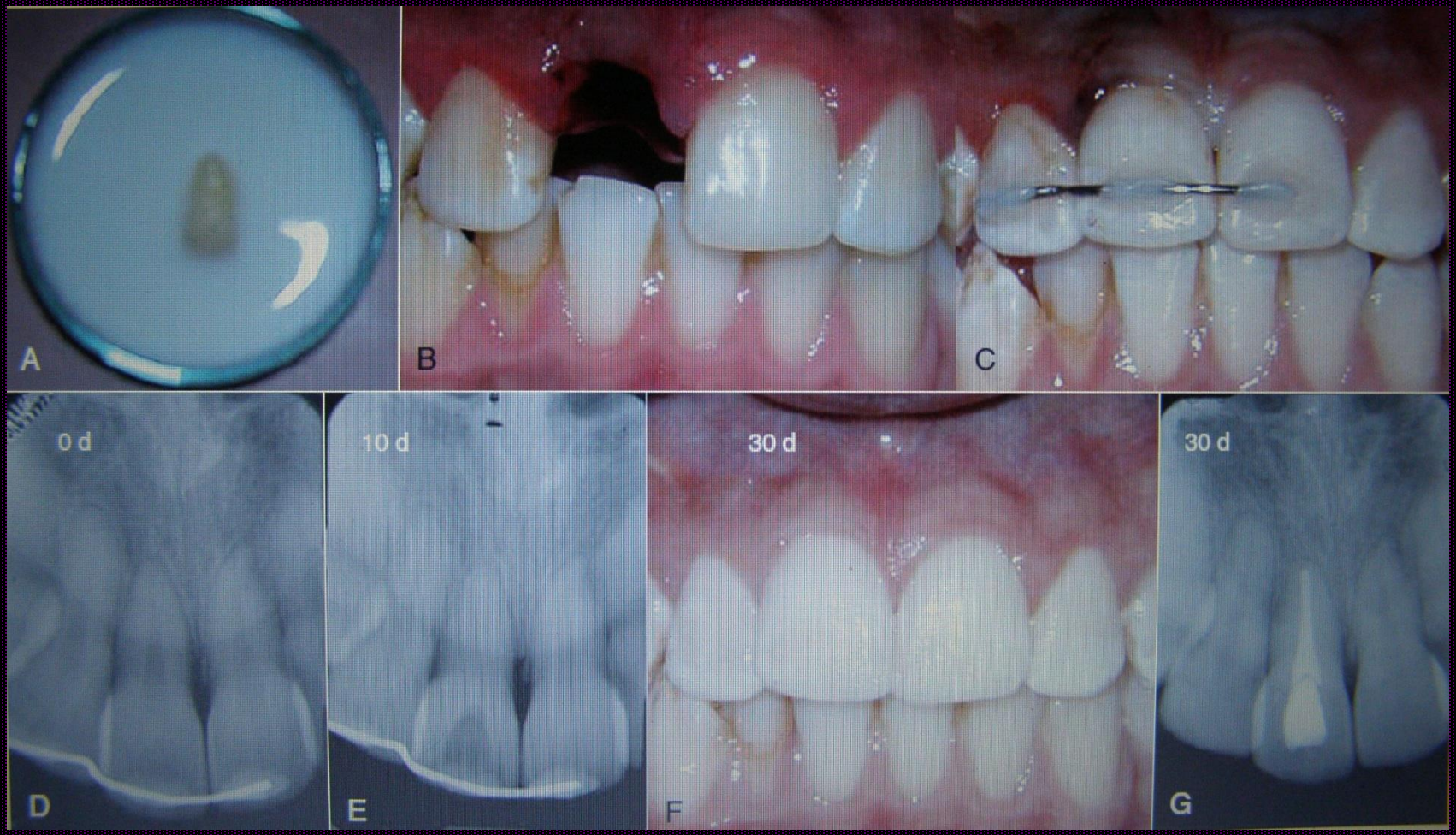
The prognosis is improved by replantation immediately after avulsion

- Rinse the tooth in cold, running tap water (10 seconds)
- Do not scrub the tooth
- Replace the tooth in the socket using gentle finger pressure
- Hold the tooth in position
- Seek dental care immediately

Suitable storage medium

- special storage solutions
- saline
- milk
- saliva
- water is inadequate!

Replantation within 1 hour of avulsion – tooth with a closed apex



Replantation more than 1 hour after avulsion – tooth with closed apex

- soak the tooth in a 2.4 % solution of sodium-fluoride for 5-20 minutes
- RCT
- Splint for 4 weeks

Sequelae to replantation

- Surface „repair-related” resorption
  - transient
- Inflammatory, „infection-related” resorption
  - loss of tooth structure
  - loss of adjacent alveolar bone
  - prevention: RCT

Sequelae to replantation

- Replacement „ankylosis-related” resorption
  - Tooth structure is resorbed and replaced by bone
  - Bone fuses directly to the root surface

Fracture of the alveolar process

Fracture or comminution of the alveolar socket, or of the alveolar process

- Initial, urgent need is splinting (surgeons)
- Examination, pulp testing, X-ray, follow up
- RCT if pulp necrosis

Take home messages

- traumatic dental injuries need a complex treatment
- every effort should make to keep alive an immature tooth
- lack of sensitivity byself is no evident sign of pulp necrosis
- a 5 year follow-up