Radiologic findings of Trauma

DR MASUME JOHARI

ASSOCIATED PROFESSOR OF MAXILLOFACIAL RADIOLOGY

- in patient with trauma to the teeth and jaws → Radiologic examination is an integral component of the diagnostic evaluation

- In acute trauma → MDCT and MRI, depending on the clinical presentation

  with conventional oral and maxillofacial images if needed

- Images provides information about

presence, location, and orientation of fracture planes and fragments

involvement of adjacent vital anatomic structures

presence of foreign objects embedded within the soft tissue

As a baseline for following examination

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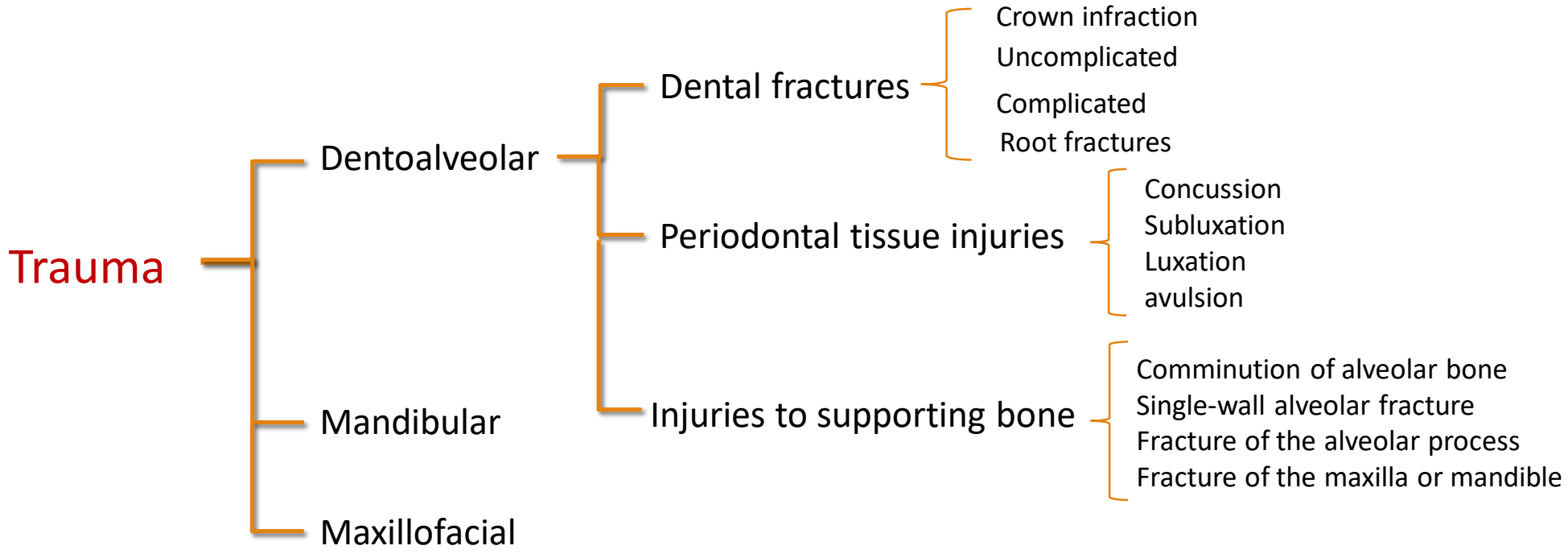
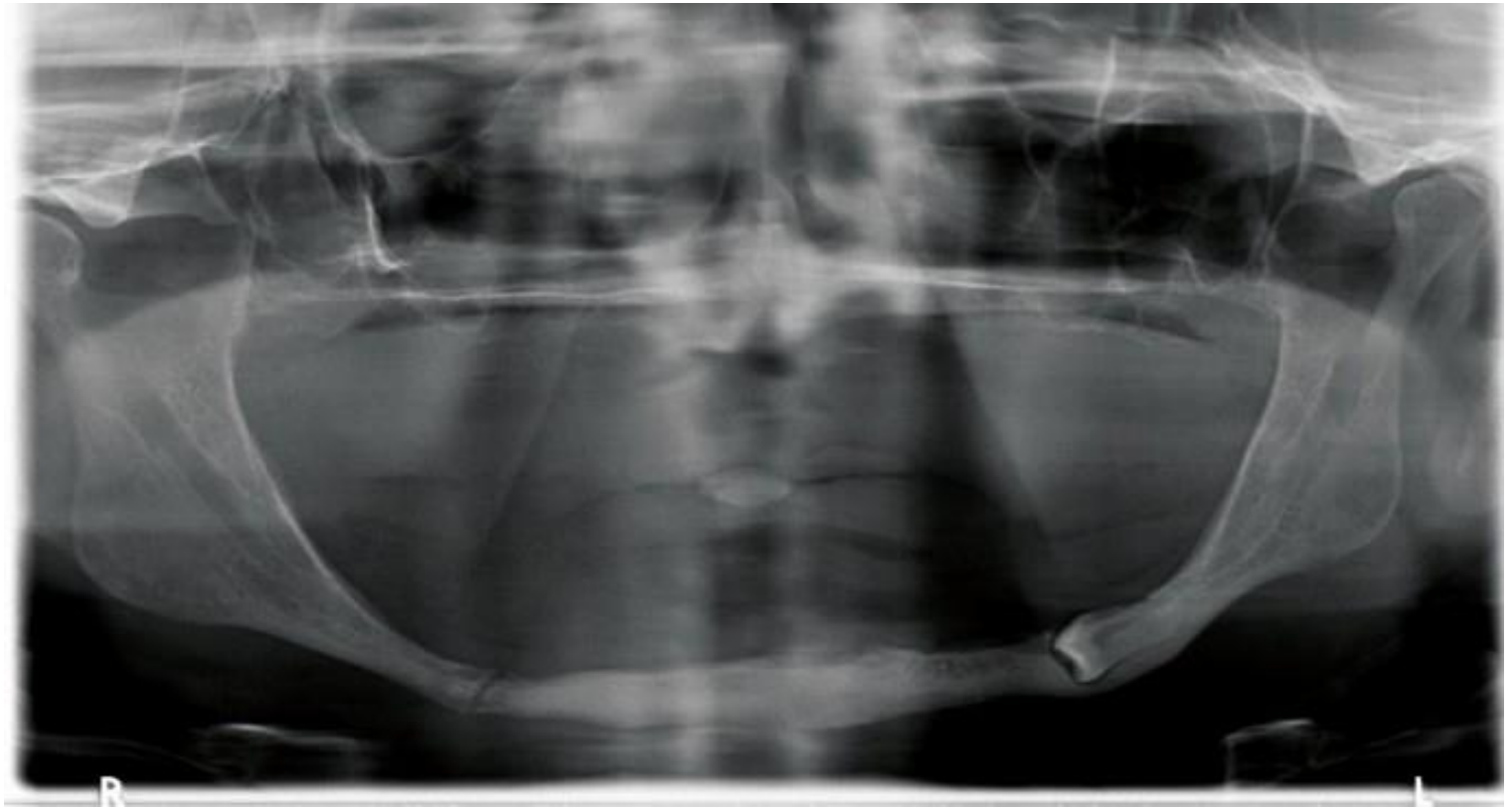


Dentoalveolar Fractures

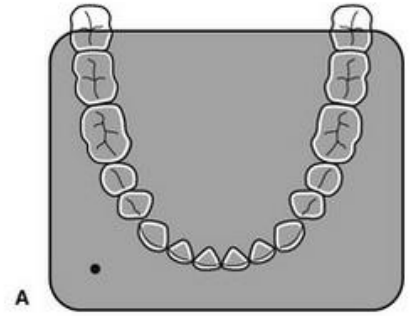
- Intraoral images are the first choice (best image resolution)
- two periapical at different horizontal angulations **to identify root fractures**
- cross-sectional occlusal images **when mouth opening is limited**
- Panoramic images → examine a broad anatomic region; localize dentoalveolar injuries; detect mandibular fractures

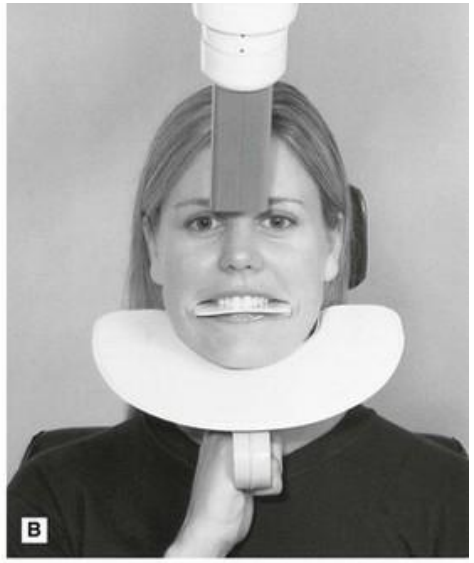
Periapical radiography

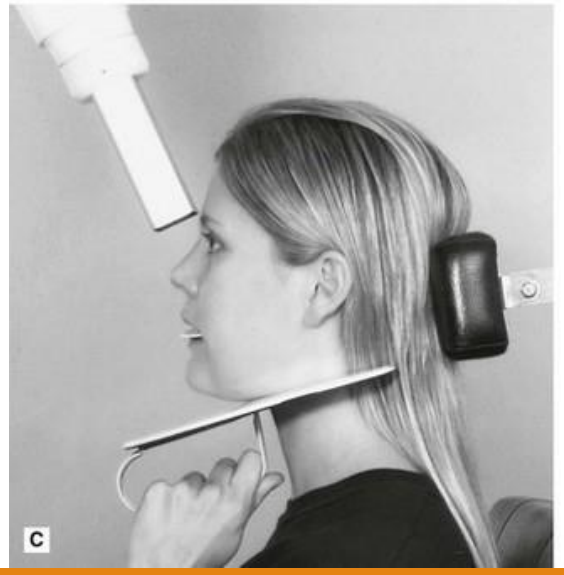
Panoramic radiography

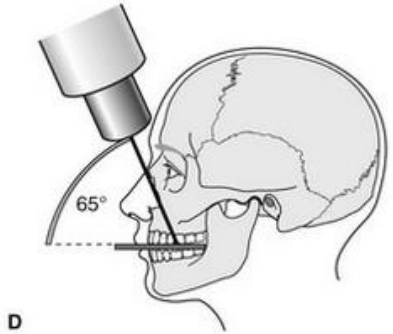


Occlusal radiography



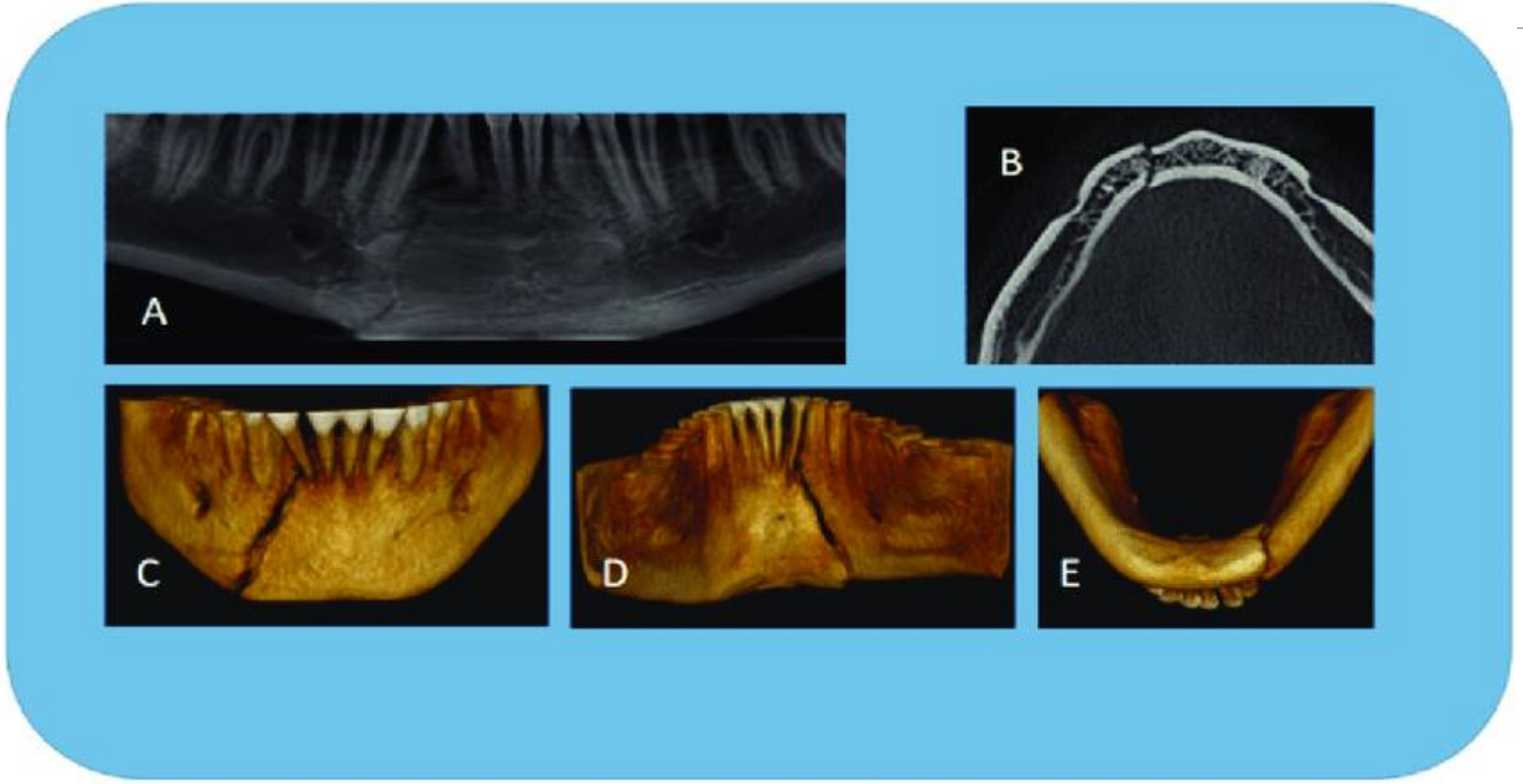






- CBCT with small FOV
- chest or abdominal image
- intraoral receptor placed adjacent to the traumatized soft tissue
- mandibular occlusal in tongue laceration

CBCT



Mandibular Fractures

- Panoramic imaging
- cross-sectional mandibular occlusal
- CBCT or preferably MDCT
- MRI

Maxillofacial Fractures

- CT is the method of choice for imaging fractures of the maxillofacial skeleton, particularly when they involve multiple bones

- MDCT is preferred to CBCT

Radiologic Signs of Fracture

- fracture of a tooth or bone:

1. The presence of one or two usually sharply defined radiolucent lines within the anatomic **boundaries** of a structure.
2. A change in the normal anatomic **outline** or shape of the structure.
3. A loss of continuity of an outer border. (step-type defect)
4. An increase in the radiopacity of a structure. (“doubly” radiopaque)

DENTOALVEOLAR TRAUMA

BOX 27.1 Classification of Dentoalveolar Injuries

Andresen classification

Dental Fractures
Crown infraction
Crown fracture, uncomplicated
Crown fracture, complicated
Fracture of enamel, dentin, and cementum, uncomplicated
Fracture of enamel, dentin, and cementum, complicated
Root fracture

Periodontal Tissue Injury
Concussion
Subluxation
Luxation
Avulsion

Injuries to Supporting Bone
Comminution of alveolar bone
Single-wall alveolar fracture
Fracture of the alveolar process
Fracture of the maxilla or mandible

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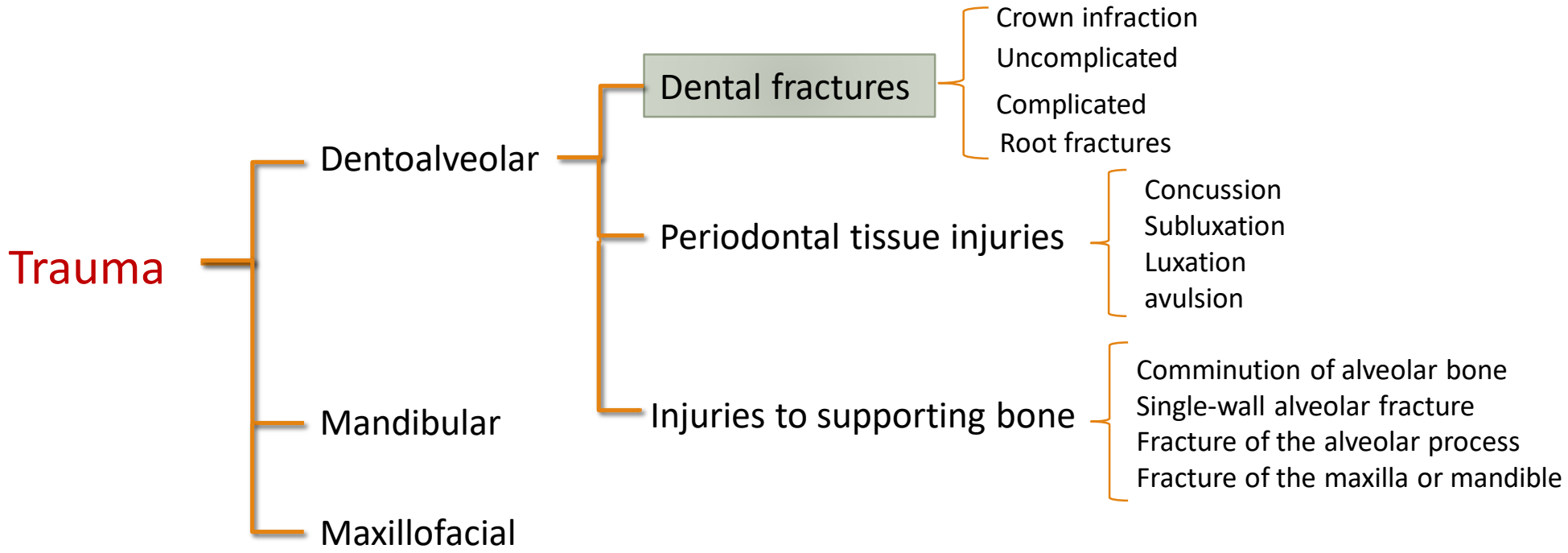
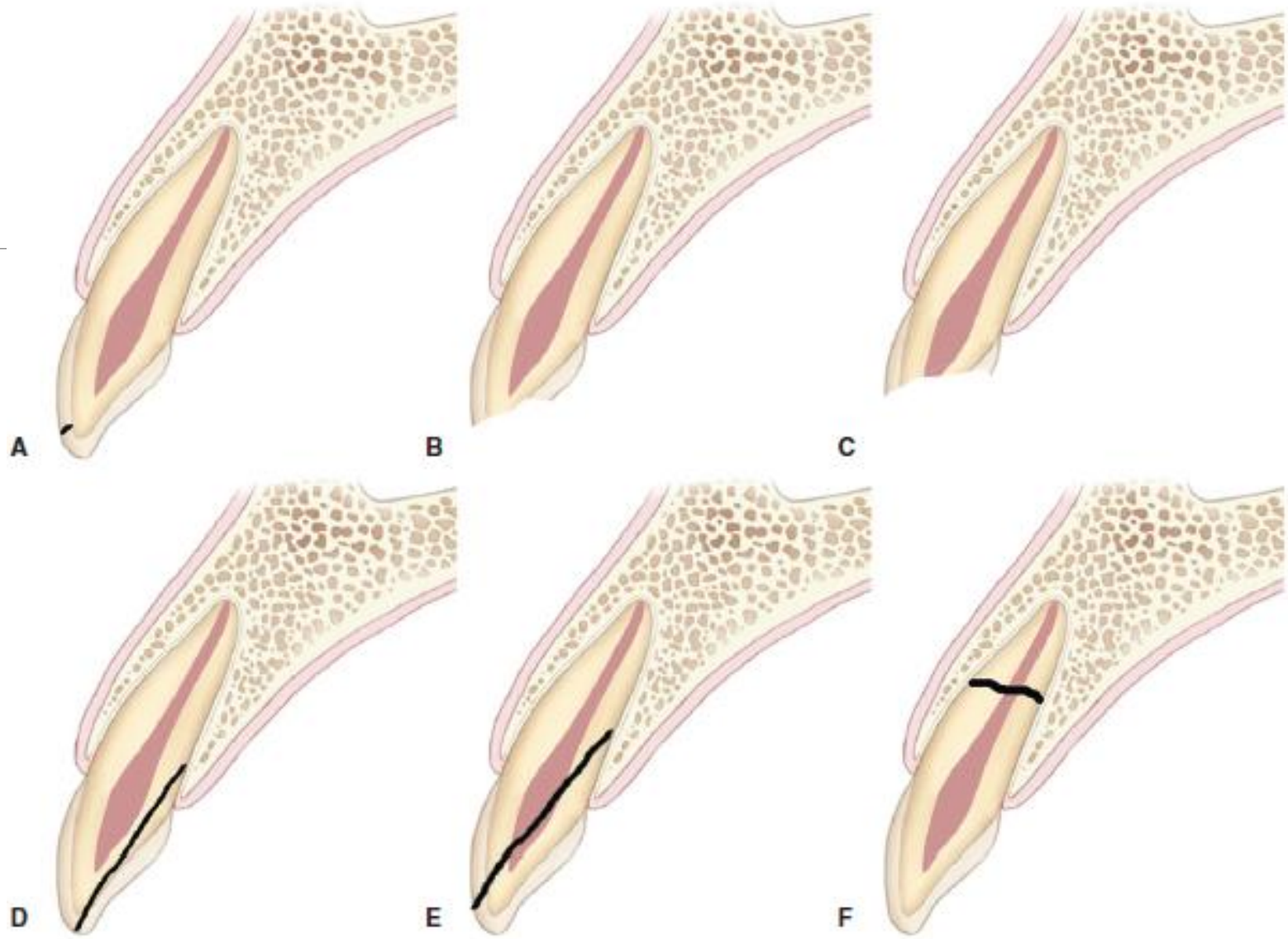


DENTAL FRACTURES

Dental Crown Fractures

- 25% of traumatic injuries to the permanent teeth
- 40% of injuries to the deciduous teeth
- The most common event responsible for the fracture of permanent teeth is **a fall.**
- Fractures involving only the crown:

1. **Crown infraction**
2. **Uncomplicated crown fractures**
3. **Complicated crown fractures**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Dental Crown Fractures

Clinical Features

- More common in anterior teeth

1. indirect light or transillumination (enamel infraction)
2. the contrast between dentin and the peripheral enamel (**Uncomplicated**)
3. bleeding exposed pulp or droplets of blood forming from pinpoint exposures (**complicated**)

- In the permanent dentition, uncomplicated are more common
- in the deciduous teeth, complicated and uncomplicated nearly equal

Dental Crown Fractures
Imaging Features

- The objectives of imaging
  - to identify
  1. the location
  2. extension of the fracture
  3. relationship to the pulp.
  - provides a baseline record
- Intra oral imaging
- Soft tissue

Dental Crown and Root Fractures

- most often complicated
- permanent teeth are affected about twice

- anterior teeth: **direct trauma**
- Posterior teeth: **large restorations or extensive caries**

Dental Crown and Root Fractures
clinical feature

- **Anterior Tooth**

fracture plane extends obliquely:

from the labial surface (near the gingival third of the crown)

to the palatal surface (apical to the gingival attachment).

- Tender to percussion
- Pain when the tooth is loaded
- Displacement is usually minimal
- The coronal fragment may be mobile
- Occasionally bleeding of the pulp

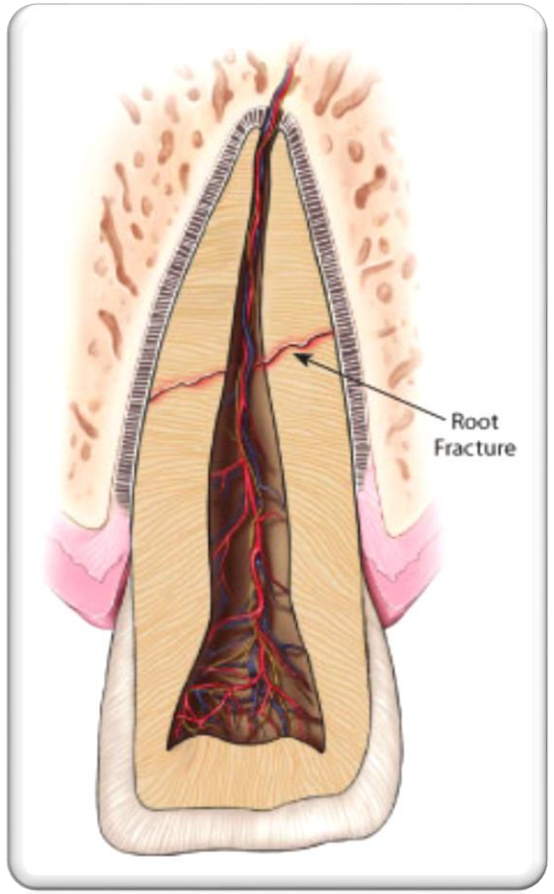
Dental Crown and Root Fractures
Imaging Features

Fracture Manifestation on 2D images depends on:

1. Angulation of x-ray beam
2. degree of separation of the fragments

- single well-defined radiolucent line
- poorly defined single line
- two discrete lines that converge at the mesial and distal surfaces of the root

Dental Root Fractures



Dental Root Fractures

- Depend on the orientation of the fracture plane:
  - horizontal
  - vertical
- Both involve the pulp
- Horizontal fracture

  the plane of cleavage vary from more oblique to more horizontal
- Vertical fracture

  fractures run lengthwise from the crown toward the apex of the tooth usually through the facial and lingual root surfaces

Dental Root Fractures

Clinical Features

- Horizontal root fractures more common in maxillary central incisors
- Usually the result of a direct trauma to the face, alveolar processes, or teeth
- vertical fractures most common in endodontically treated premolar and molar
- mobility of crown relates to the level of fracture

Dental Root Fractures
Imaging Features

- Horizontal fractures: Mostly occur in the apical and middle thirds of the root
- fracture plane is often diagonal

- imaging appearance of nondisplaced root fractures is usually subtle

- Subsequent inflammation of the adjacent periodontal ligament and resorption may increase the visible separation

Dental Root Fractures
Imaging Features

- Vertical root fracture:

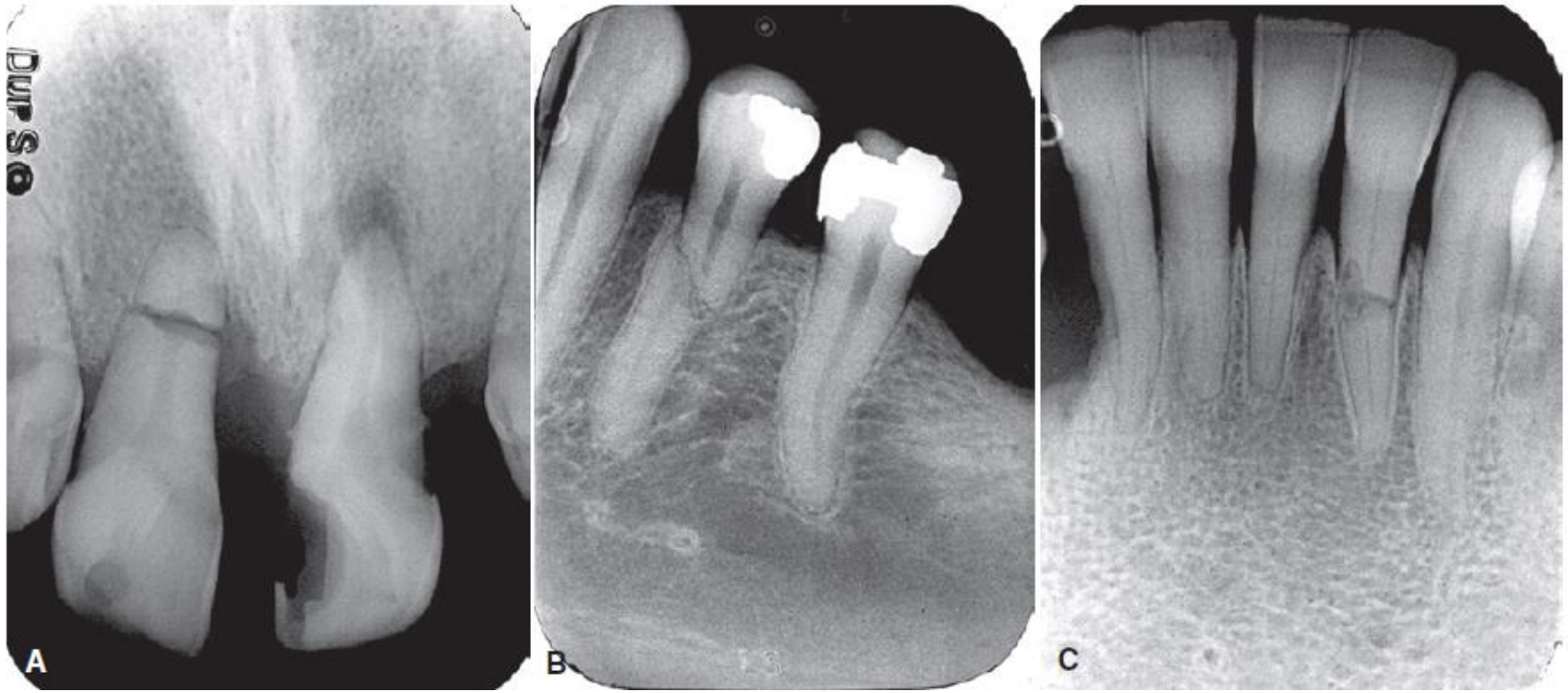
- Nondisplaced fractures, and fractures in the mesiodistal plane are often undetectable on periapical images

- recently, high-resolution small FOV CBCT used to evaluate teeth with root fractures

- Artifacts from highly attenuating materials

- the presence of focal widening of the periodontal

Dental Root Fractures



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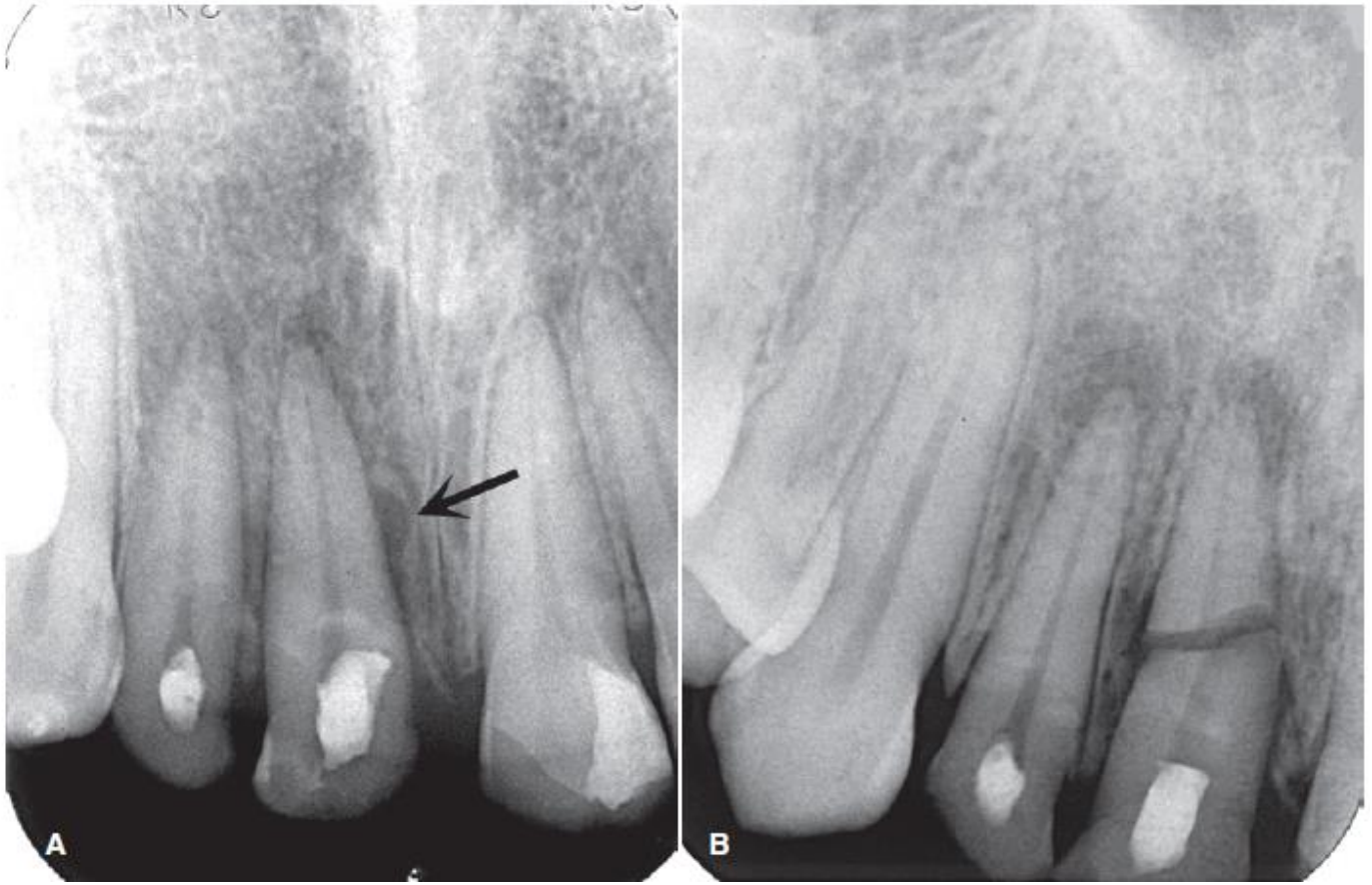

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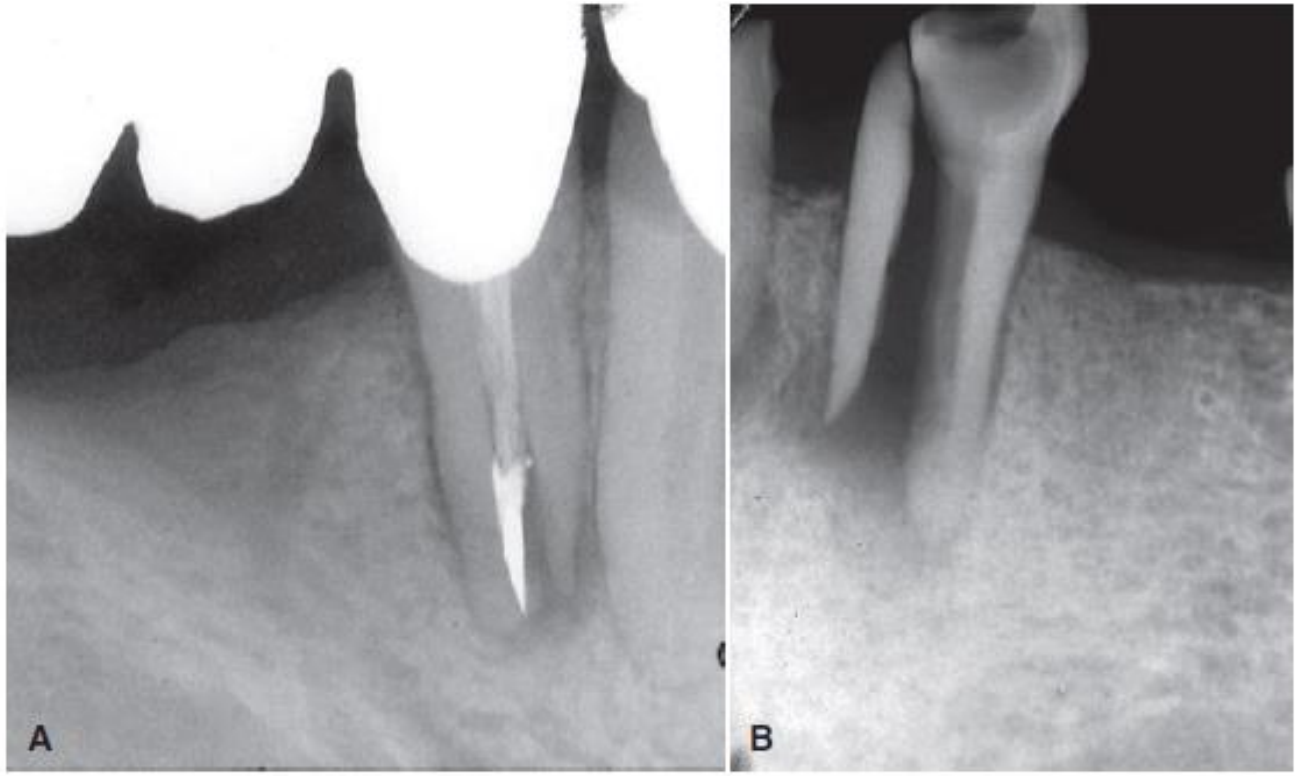

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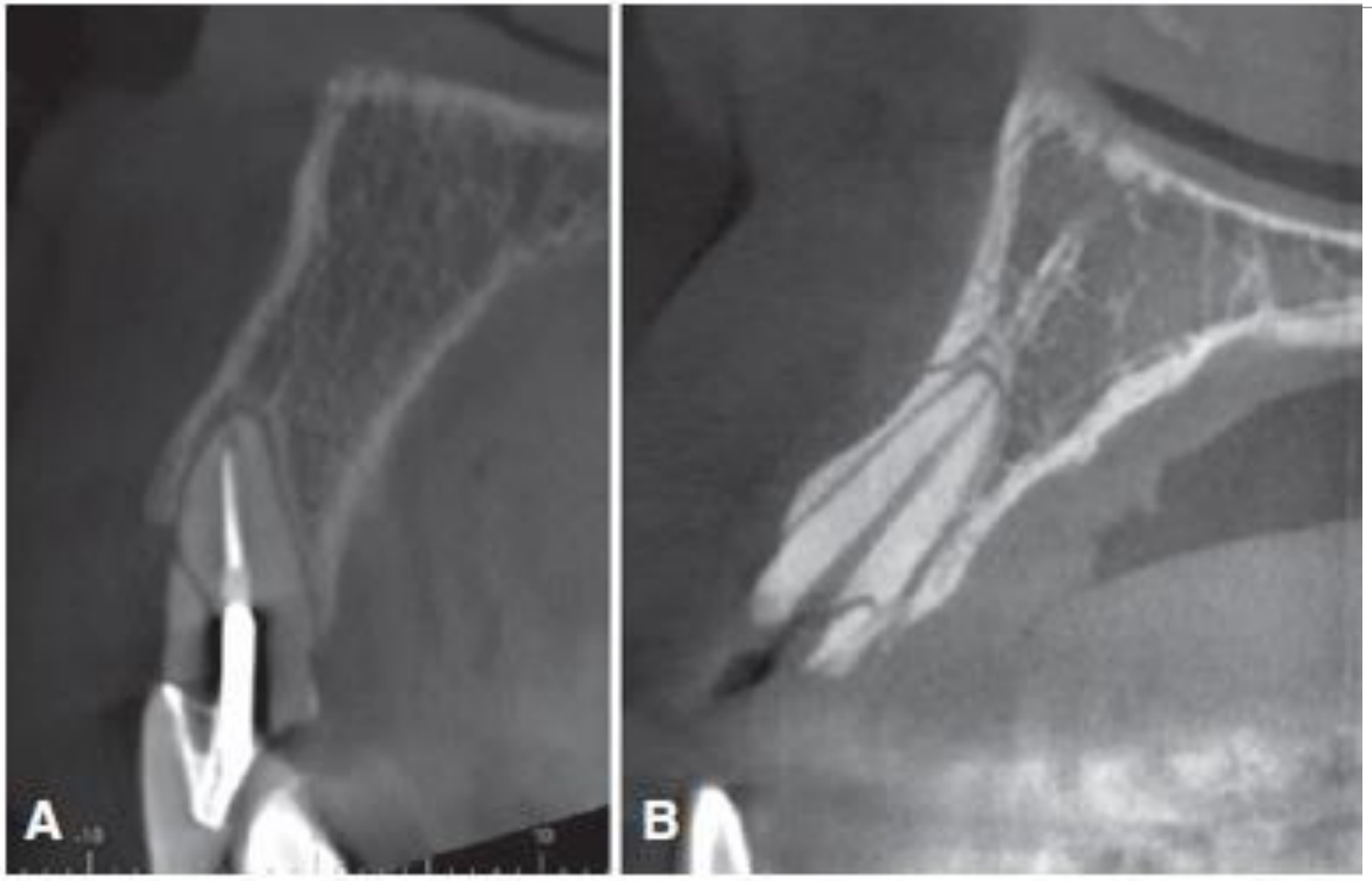
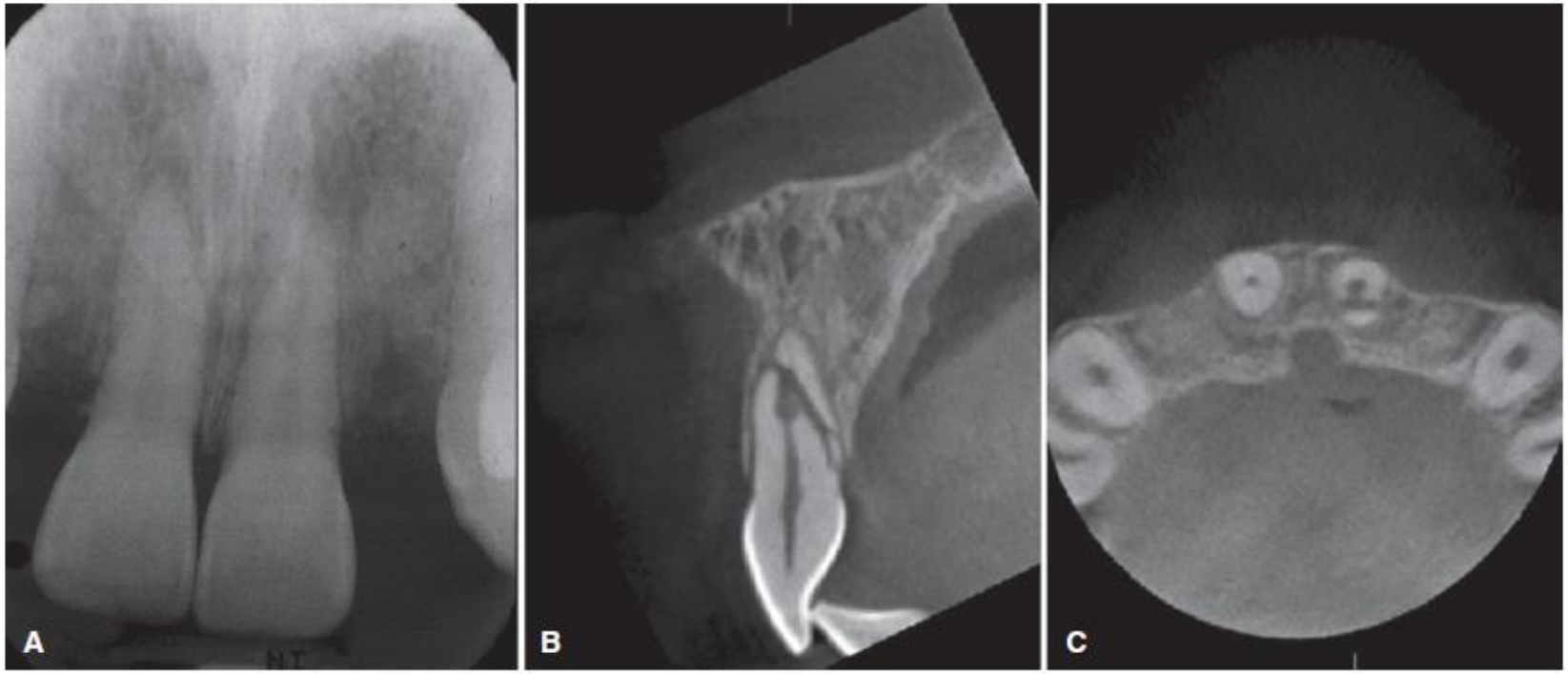


Dental Root Fractures



Dental Root Fractures

Dental Root Fractures
Differential Interpretation

- Superimposition a fracture of the alveolar process
- Superimposition small neurovascular canals
- Superimposition soft tissue structures (the lip, ala of the nose, or nasolabial fold ove)

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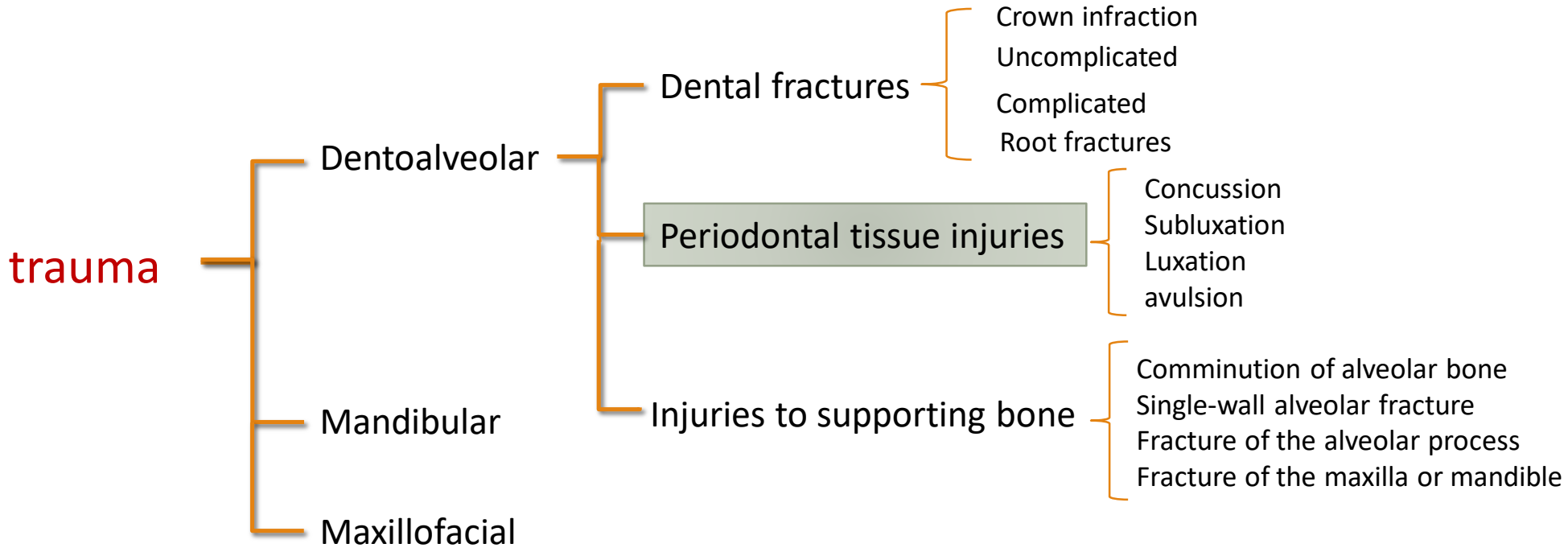
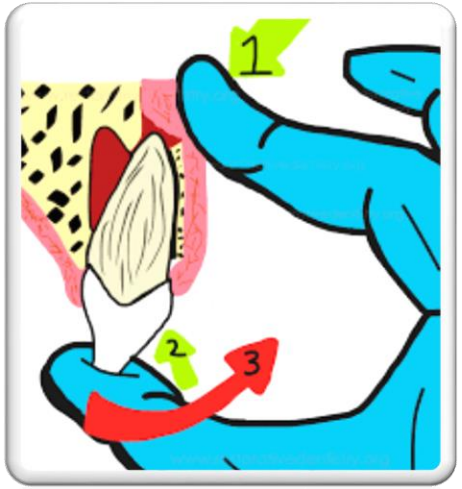
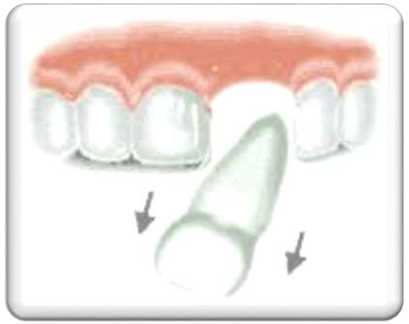


PERIODONTAL TISSUE INJURY





PERIODONTAL TISSUE INJURY
Concussion

- a crush injury to the vascular structures at the tooth root apex and the periodontal ligament, resulting in inflammatory edema
- minimally loosened with no displacement
- may cause mild extrusion, premature contact

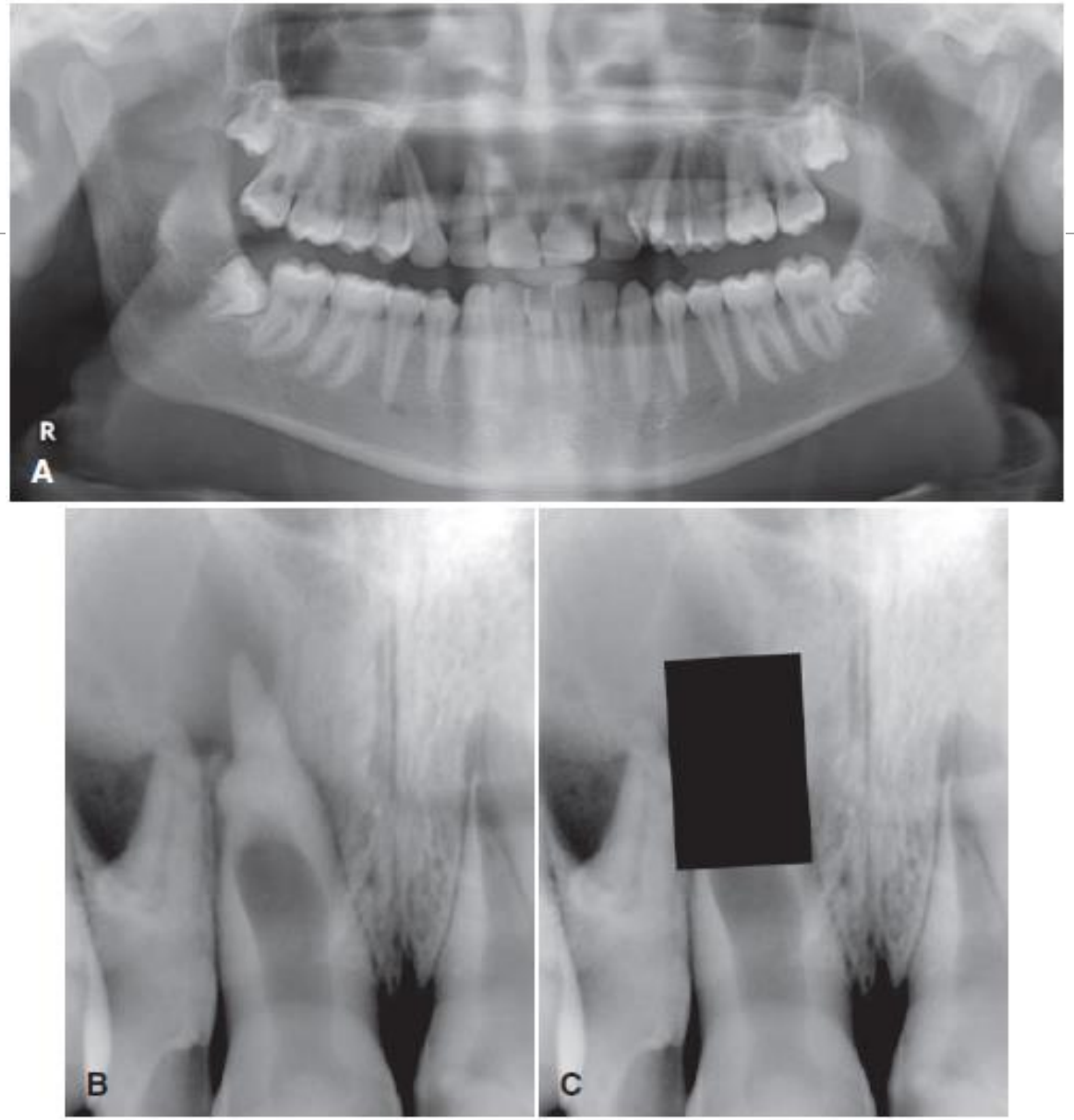
Concussion
Clinical Features

- patient usually complains tender to touch
- can be confirmed by gentle horizontal or vertical percussion of the tooth

Concussion

Imaging Features

- imaging appearance of a dental concussion may be subtle
- Changes to the size of the pulp chamber and root canals may develop in the months and years after traumatic injury
- Teeth with trauma before apical closure may develop a morphologically abnormal apex called an **osteodentin cap**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Subluxation

- periodontal tissue injury that causes abnormal loosening more than concussion but with no displacement
- Clinical feature: tender to horizontal or vertical percussion, sensitive to biting forces
- Bleeding at the gingival crevice is indicative of the damage to the periodontal tissues
- Imaging Features : like concussion, the imaging manifestations are subtle

Luxation

- dislocation of the tooth from its socket after severing of the periodontal attachment. Such teeth are abnormally mobile and displaced.

1. Intrusive luxation
2. Extrusive luxation
3. Lateral luxation

- movement of the apex and disruption of the circulation to can produce either temporary or permanent changes to the dental pulp and these changes may result in pulpal necrosis

Luxation

- If the pulp survives the traumatic incident:
- the rate of dentin formation may accelerate and continue until it obliterates the pulp chamber and root canal.
- This process may occur in both permanent and deciduous teeth.

Luxation
Clinical Features

Intruded teeth

Short clinical crown

appear to be completely avulsed or lost

- Depending on the orientation and magnitude of the force and the shape of the root, the tooth may be displaced through the buccal or, less commonly, the lingual cortex of the alveolar process, where it may be seen and palpated.

Vitality test

sensitivity temporarily decreased

may return several weeks or months later

Luxation
Clinical Features

- Usually two or more teeth are involved in luxation injuries
- Most common maxillary incisors
- Deciduous dentition: both intrusions and extrusions
- Permanent dentition: the intrusive type of luxation is less frequent

Luxation
Imaging Features

- Luxation injuries are often accompanied by damage to the bony socket and alveolus.
- Intrusion may result in partial or total obliteration of the apical PDL space.
- extruded teeth may demonstrate varying degrees of apical widening of the PDL space.
- laterally luxated tooth with some degree of extrusion may show a widened PDL space with greater width on the side of impact.

Avulsion

- Complete displacement of a tooth from the alveolar process

Direct force to teeth

Indirect force

Like sudden jaw closure

- fights being responsible for the avulsion of most permanent teeth
- accidental falls for most deciduous teeth

- Avulsion occurs in approximately 15% of traumatic injuries to the teeth

Avulsion
Clinical Features

- Maxillary central incisors
- Most often only a single tooth is lost
- typically occurs in a relatively young age
- when the permanent central incisors are just erupting
- Fractures of the alveolar process and lip lacerations may also be seen with an avulsed tooth.

Avulsion
Imaging Features

- In a recent avulsion, the lamina dura of the empty socket is apparent and usually persists for several months(usually 4 month)
- Missing tooth may be displaced into the adjacent soft tissue.
- Giving the false impression that it lies within the bone.
- (Which is in differentiate with an intruded teeth)

Avulsion

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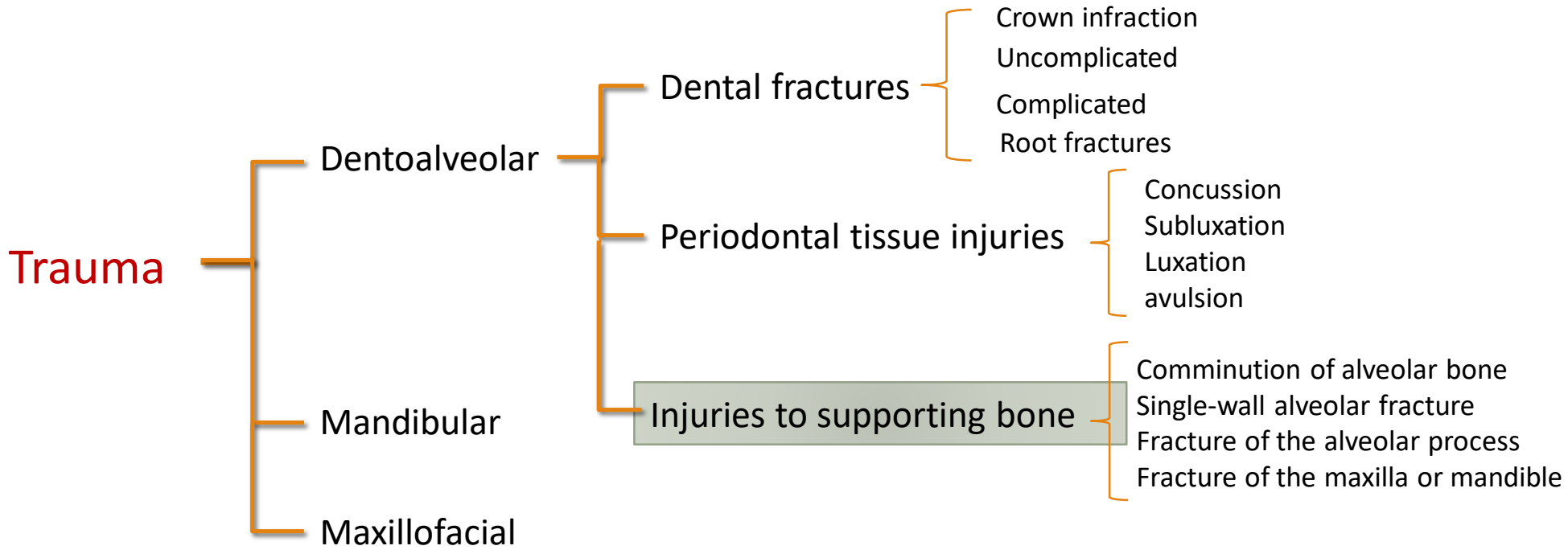


ALVEOLAR PROCESS INJURY

ALVEOLAR PROCESS INJURY

- Simple fractures of the alveolar process may involve the buccal or lingual cortical plates of the maxillae or mandible
- commonly associated with luxation injuries with or without dislocation
- Several teeth are usually affected
- The fracture plane is most often horizontal
- Alveolar process injuries are commonly associated with luxation injuries, often with tooth fractures.

Clinical Features

- Alveolar fractures are more common in the anterior and premolar regions
- A characteristic feature of an alveolar process fracture is marked malocclusion with displacement and mobility of the fragment, with several teeth moving as a block.
- dull sound when percussed
- attached gingiva may have lacerations
- detached bone may include maxillary sinus floor, so bleeding from the nose on the involved side may occur or ecchymosis of the buccal vestibule
- Occlusion may change

Imaging Features

- Images in patients with limited dentoalveolar injuries: periapical, occlusal → show radiolucent fracture lines located at **any level between the crest of the alveolar process and the periapical region**

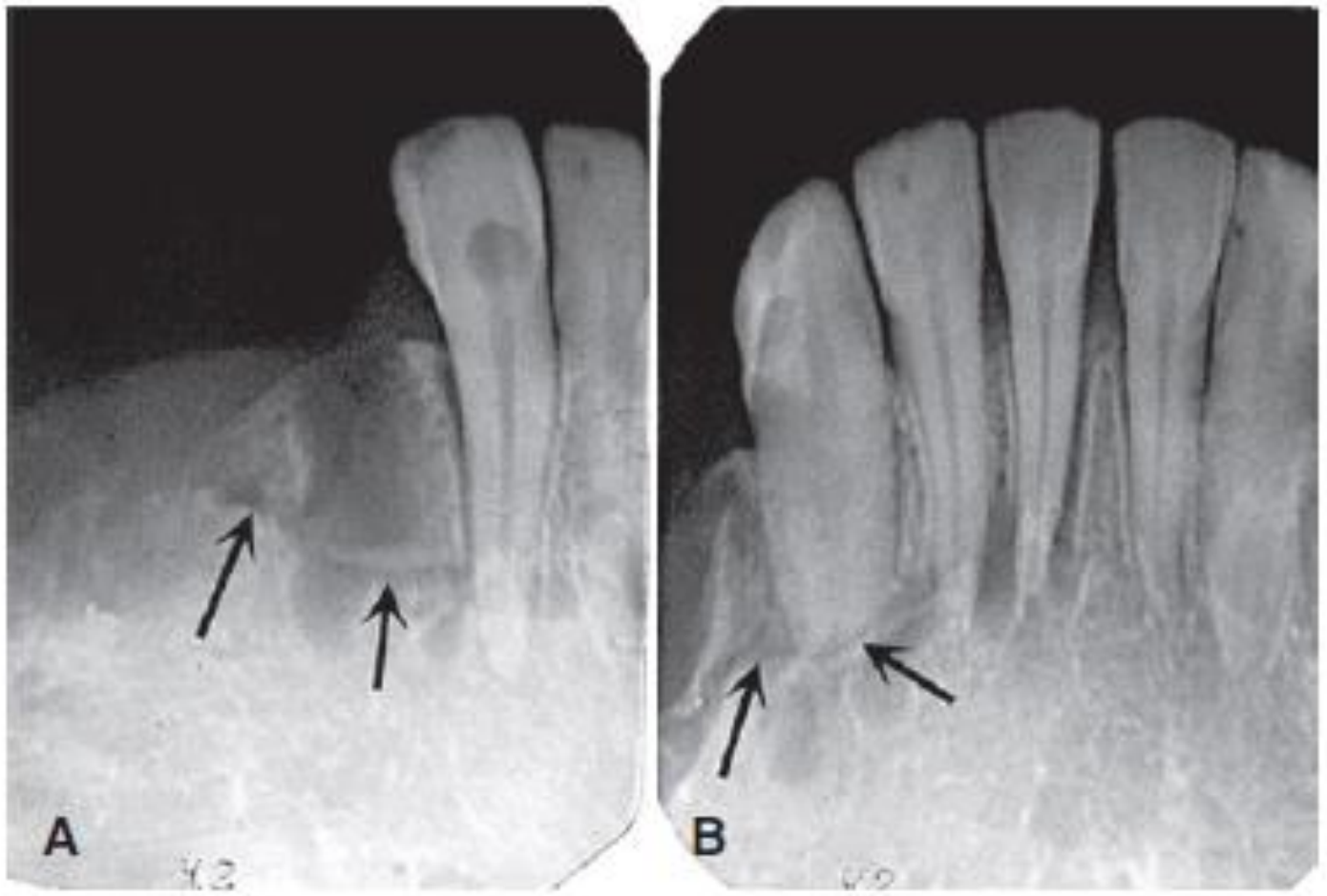
- Fractures of a single cortical plate are difficult to detect, esp when segments are nondisplaced.

- **Small-FOV CBCT imaging**

- AAOMR-AAE imaging guidelines

Imaging Features

- Closer fracture to alveolar crest, greater possibility of root fracture
- involve the floor of the maxillary sinus
  - may result in abnormal thickening of the sinus mucosa
  - air-fluid level (blood)
- When the fracture plane is in contact with the root apices, the risk for internal or external resorption is high.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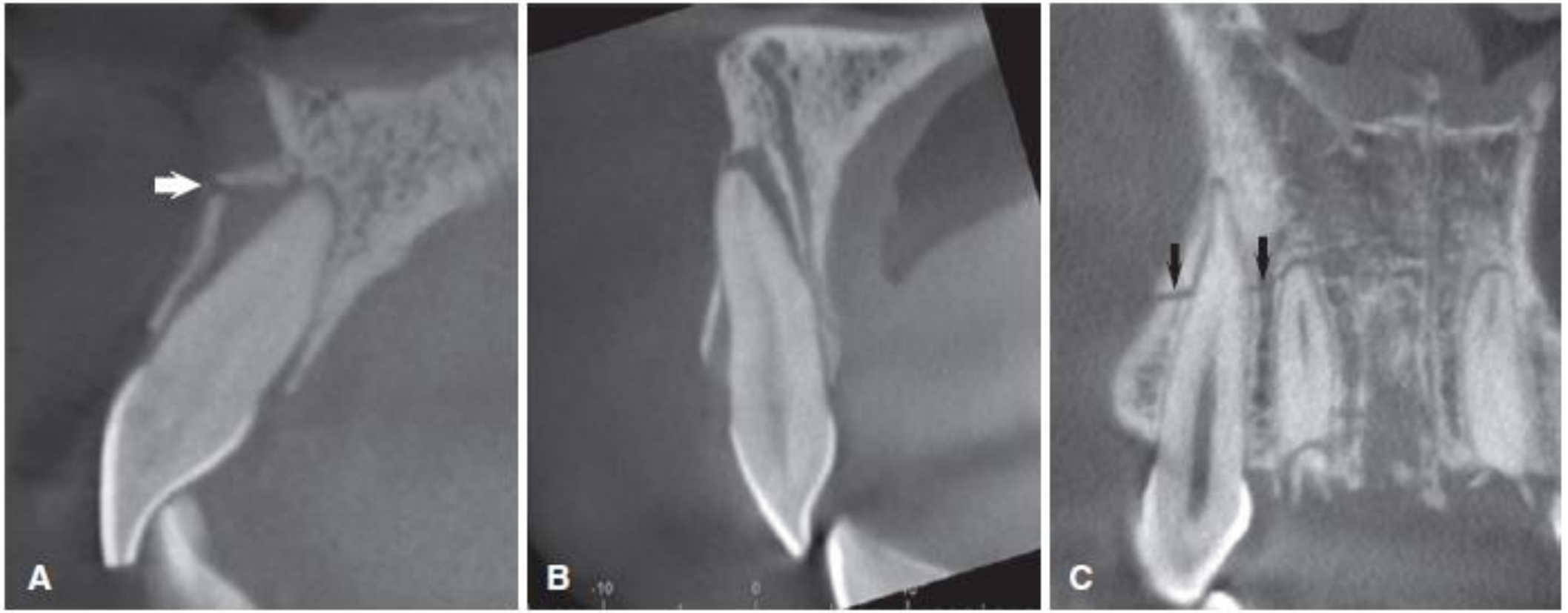
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References:

Oral Radiology(White&Pharoah)

Thanks for your attention