ENDODONTICS

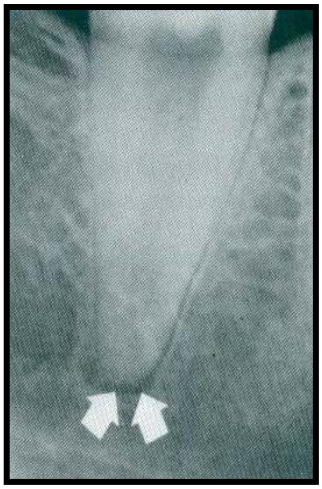
Lecture 2 **Dr. Alaa H Abbas**

Classification of periapical disease

If a pulpal infection is not treated, it will result in complete pulp necrosis. If left untreated, irritants can seep into the periapical area, leading to periapical pathologies. The severity of periapical inflammation depends on both the types of microorganisms present in the root canals and the duration of exposure to these infecting microorganisms. Periapical diseases can be classified into:

1- Symptomatic Apical Periodontitis (Acute Apical Periodontitis)
2- Asymptomatic Apical Periodontitis (chronic Apical Periodontitis)
3- Acute apical abscess
4- Chronic apical abscess
5- Condensing osteitis
6- Acute Exacerbation of Asymptomatic Apical Periodontitis

1- Symptomatic Apical Periodontitis (Acute apical periodontitis)

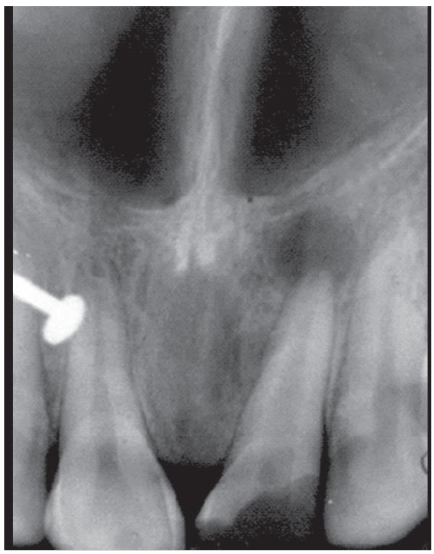


Symptomatic apical periodontitis is characterized by painful inflammation of the periodontium due to trauma, irritation, or infection from the root canal, regardless of whether the pulp is vital or nonvital. The causes of this condition include occlusal trauma, high spots in restorations, complications from pulpal diseases, over-instrumentation, pushing debris and microorganisms beyond the apex, overextended obturation, and root perforations.

Symptoms of symptomatic apical periodontitis include tenderness of the tooth when percussion is applied, mild to severe soreness, dull, throbbing, and constant pain, pain that develops rapidly, and discomfort during mastication. Diagnosis typically shows tenderness on percussion. Radiographic images of a vital tooth may appear normal, while a nonvital tooth may reveal a widening of the apical periodontal ligament space and loss of the lamina dura. Treatment involves occlusion adjustment for vital teeth and root canal therapy for non-vital teeth.

2- Asymptomatic Apical Periodontits (Chronic apical periodontitis)

This condition is a sequela of symptomatic apical periodontitis and results in inflammation and destruction of the periradicular area due to the extension of pulpal infection. It is characterized by asymptomatic periradicular radiolucency observed on radiographs. The etiology is pulp necrosis. The affected tooth is nonvital and usually asymptomatic, though in the acute phase, it may present with dull, throbbing pain. Treatment involves endodontic therapy for the affected tooth. In the acute phase, treatment is similar to that for an acute apical abscess, which includes cleaning and shaping of the canals, followed by analgesics if needed. Extraction may be necessary for non-restorable teeth.



3- Acute apical abscess

An acute apical abscess is a localized collection of pus in the alveolar bone at the root apex of a tooth, resulting from the death of the pulp and the extension of infection through the apical foramen into the periradicular tissue. The most common cause is bacterial invasion from necrotic pulp tissue. Symptoms can range from moderate discomfort or swelling to systemic signs such as elevated temperature and malaise. The affected tooth is typically tender to both palpation and percussion, nonvital, and the pain has a rapid onset, becoming increasingly localized as the tooth grows more sensitive to percussion.

Radiographic findings can vary based on the extent of periradicular destruction, but often include a well-defined radiolucent area. An acute apical abscess frequently represents an acute exacerbation of a chronic condition. Initial treatment focuses on removing the cause as quickly as possible. Drainage should be achieved either by opening the tooth or making an incision into the related swelling. Antibiotics may be prescribed depending on the patient's condition. Once acute symptoms have resolved, root canal therapy or extraction can be considered. If left untreated, the apical abscess may spread to surrounding tissues.

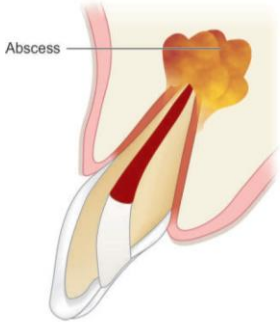
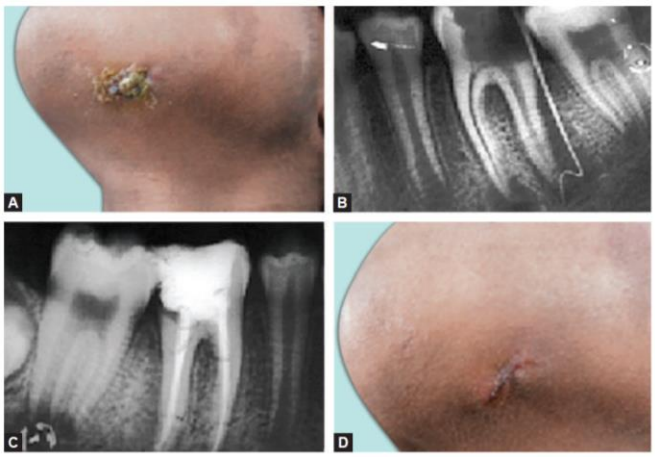


Fig. 3.35 Line diagram showing periapical abscess.


Fig. 3.36 Photograph showing swelling of mandibular area because of apical abscess.

4- Chronic apical abscess

Chronic periapical abscess, also known as suppurative apical periodontitis, is characterized by the gradual release of irritants from the root canal system into the periradicular area, leading to the formation of an exudate. In a chronic apical abscess, the abscess establishes a communication channel through which it discharges. This discharge can occur via an intraoral sinus or, less commonly, through an extraoral route. Alternatively, the discharge may travel along the periodontal ligament, resembling a periodontal pocket. Typically, these communications or tracts heal spontaneously following root canal therapy or extraction.



5- Condensing osteitis

Condensing osteitis is a form of chronic apical periodontitis characterized by a diffuse increase in the trabecular bone as a reaction to irritation. Radiographically, it presents as a concentric radiopaque area surrounding the affected root. Treatment is necessary only if symptoms or pulpal diagnosis suggest a need for intervention.

6- Acute Exacerbation of Asymptomatic Apical Periodontitis

Known as a "Phoenix abscess," this condition is defined as an acute inflammatory reaction that occurs on top of an existing asymptomatic apical periodontitis. The etiology involves the influx of necrotic products from the diseased pulp or bacteria and their toxins into a chronic periapical lesion, which can cause the dormant lesion to react and initiate an acute inflammatory response. Additionally, reduced body defenses can trigger this response. Symptoms are similar to those of an acute apical abscess. Differentiation from an acute apical abscess is made through the patient's history, symptoms, and clinical test results. Radiographs typically reveal a large radiolucent area at the apex, indicating inflammatory connective tissue replacing the alveolar bone at the root apex. Treatment involves drainage and root canal therapy once the symptoms have subsided.

Access Opening

An access opening is a cavity created in the crown of a tooth to provide optimal

and direct access to the apical foramen, ensuring a straight line of sight for the instruments used during pulp extirpation, preparation, and obturation of the root canal. This step is crucial for achieving a thorough three-dimensional filling of the root canal system. The access cavity should be prepared by removing the pulpal roof and all overlying dentin to facilitate effective treatment.

Objectives of Access Opening:

1) To ***facilitate visualization*** of all the root canal orifices by removing the pulp chamber and exposure of pulp horns. Complete deroofing of the pulp chamber. It helps in:

— Complete debridement of the pulp chamber
— Improved visibility
— Locating canal orifices
— Permitting straight line access
— Preventing discoloration of teeth because of remaining pulpal tissue

2) To ***provide direct access (straight-line access)*** to the apical portion of the canal to Improve instrument control because of minimal instrument deflection and ease of instrumentation in the canal, Improved obturation and Decreased incidence of iatrogenic errors during the procedure of root canal treatment.

3) ***Conserve sound tooth structure*** as much as possible to avoid weakening of remaining tooth structure to:

— Proper application of rubber dam
— Stable reference point
— Flooding of the chamber with irrigant
— Support for temporary restoration

4) ***Provide a positive support for temporary filling*** so as to avoid any contamination of the cavity. Walls of cavity should be flared in a shallow funnel shape with the occlusal surface wider than floor.

The outline form of the access cavity must be correctly shaped and positioned according to:

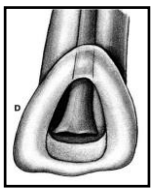
I. **The size of the pulp chamber.**
II. **The shape of the pulp chamber.**

III. **The number of individual root canals and their direction of curvature.**

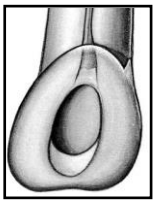
The outline form of the access opening is influenced by the size of the pulp chamber. In younger patients, the pulp chamber is larger, so the access opening will be correspondingly larger, while in older patients, the pulp chamber is smaller. The finished outline should accurately reflect the shape of the pulp chamber. For example, in premolars, which have an oval pulp chamber in cross-section, the access opening should be oval, elongated buccolingually rather than mesiodistally, to match the shape of the pulp chamber. Modifications to the access opening may be necessary to achieve the desired results.

Access is considered satisfactory when all the orifices can be visualized without needing to move the mouth mirror. Ideally, the access cavities should adhere to the restorative dentistry principle where the axial walls of the preparation taper. The number of individual root canals and their curvature can influence the outline of the access opening. Occasionally, removing a part of a cusp or incisal ridge is necessary to improve visualization and access to the root canals. The dentist must ensure they can see, locate, and reach each root canal with their instruments.

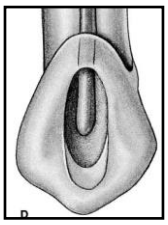
The shape of the access opening for each anterior tooth



1- **Maxillary Central Incisor:** The access opening is triangular. The root is straight, single, large, oval at the beginning, then tapered till it becomes rounded apically. **Average tooth length=22.5mm**

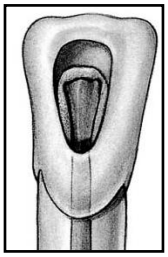


2- **Maxillary Lateral Incisor:** Similar in shape to the max. central incisor, but smaller in size with disto-palatal curvature at the apex of the root. **Average tooth length= 21mm**



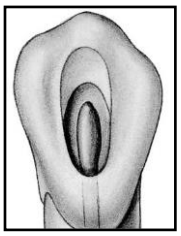
3- **Maxillary Canine:** The canal is big and it is wider buccoingually than mesiodistally. At the cervical third, the orifice is oval, at the middle third: it is oval., and in the apical third it is rounded. **Average length=26.5mm**

4- <u>Mandibular Incisors</u>: If we take an X-ray from a buccal direction we will find a small, tiny root canal, but if we take an X-ray film from the mesial or distal direction, we will find large, wide pulp “labio-lingually” with a possibility of two canals one labially and the second one is located lingually, so we have to widen the root canal orifice “Labiolingually”. **Average length=21mm**



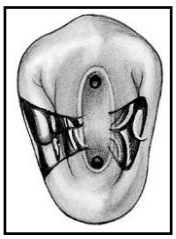
Also, in the lower incisor, some times we have slight curvature in the root apex “to the lingual side” so, there is a possibility of perforation during instrumentation.

5- <u>Mandibular Canine</u>: There is one canal which is big and oval in shape. Another root canal may be present lingually to the major root canal but this rarely happens. **Average length=22.5mm**



The shape of the access openings of each posterior tooth

1- <u>Maxillary First Premolar</u>



- Access opening: ovoid and elongated buccopalatally. **Average length=21mm**

- The canal shape is wide in buccopalatal direction at the cervical portion, slightly ovoid at mid-root, and rounded at the apical third.

- Canal Orifices: below and slightly central to cusps tips.

- Multiple canal possibilities:

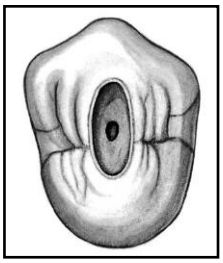
(i) 20% single canal in single root, elliptical or figure (8) in shape, wider buccopalatally than mesiodistally. It may be mistaken as two canals.

(ii) 80%: two canals, either single root with either one or two apical foramen, or two canals with two separated roots “and the palatal one is longer”.

(iii) Rarely there are (3) roots with (3) root canals.

Type (ii)or (iii), usually have two roots.

2- <u>Maxillary Second Premolar</u>

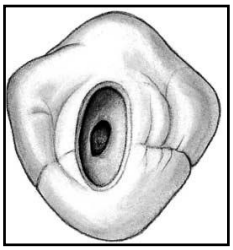


- Mostly it has a single root and the canal shape is ovoid and very wide in buccopalatal direction, ovoid in the mid root, and rounded in the apical area. **Average length=21.5mm**

- Canal orifice is centrally located and often appears as a slot than as a single ovoid opening.

- Multiple canals possibilities: 40% → 2 canals, 60% → one canal.

3- <u>Mandiblular First Premolar</u>:



The mandibular first premolar has a well-developed buccal cusp and a small lingual cusp, the root is more rounded than the mandibular second premolar and shorter. The pulp chamber is ovoid and the buccal pulp horn is higher. **Average length=21.5mm**

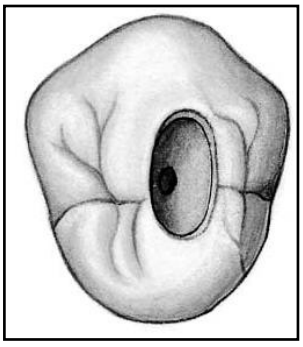
- Canal shape: At cervical level is wide in buccolingual dimension. At the mid-root area, it is ovoid and at the apical third, it is rounded.

- Canal configuration possibilities: Type I = 73.5%, Type II = 6.5%, Type III =19.5%

We may also see Type IV.

- Access opening: ovoid and made slightly buccally to the central groove and the final preparation should have a slightly lingual inclination.

4- <u>Mandibular Second Premolar:</u>



It has a well-developed buccal cusp and a much less formed lingual cusp. There is one root canal, and the pulp chamber gradually merges with the root canal. **Average length=22.5mm**

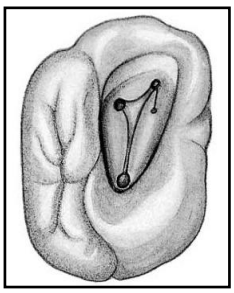
- Canal orifice:

a- At cervical third, wide in buccolingual dimension.

b- Mid-root level → elongated ovoid.

c- Apical third level → generally round.

5- <u>Maxillary First Molar</u>



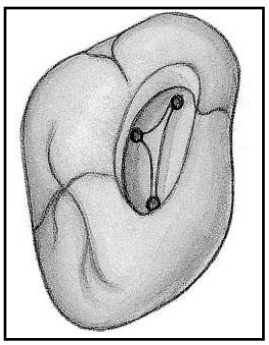
- There are three roots, with three to four root canals mesiobuccal (+ mesiobuccal 2), distobuccal, and palatal canal which is the biggest one. **Average length=21mm**
- The access opening is in the mesial part of the tooth and we may leave the oblique ridge as it is if it is caries-free.
- The final preparation of the access opening is rhomboid in shape and there are three to four canals:

  a- Mesiobuccal canal: It is a tiny canal, difficult to find. It is possible to find another mesiobuccal canal (70%) lingual to the main one.

  b- Distobuccal canal: It is toward the distopalatal side.

  c- The palatal canal: It is in between.

6- <u>Maxillary Second Molar</u>

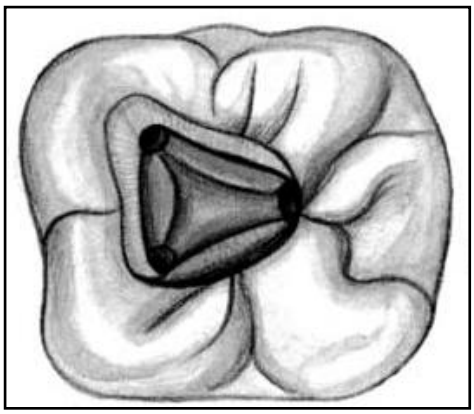


- Similar to Max. 1st molar but the distobuccal canal is located in between the mesiobuccal canal and palatal canal and slightly distally. **Average length=20mm**
- Variations: We may have 2 canals: one buccally and one palatally instead of 3 canals, in this case, the two canals are large and opposite to each other.

7- <u>Mandibular First Molar</u>

- There are 3 canals, 2 mesial “mesiobuccal and mesiolingual” and one located distally. **Average length=21mm**
- We start preparation in the mesial part of the tooth and the access opening is triangular-trapezoid in shape.

- There is a possibility of 2 canals located distally (33%) “and they may end with separate orifices or joined orifices so if the distal canal is tiny and more toward the buccal side then the possibility of 2 canals is high but if it is in the center buccolingually then the possibility of one canal is high.



8- <u>Mandibular Second Molar</u>

- The access opening resembles that of the mand. 1st molar with 3 root canals, 2 mesially and 1 distally. **Average length=20mm**
- There is a possibility of 2 canals: mesial canal and distal canal with each canal opposite to other.