Periapical pathology

Aetiology of periapical periodontitis

1-Pulpitis and pulp necrosis:

If pulpitis is untreated, bacteria, bacterial toxins and the product of inflammation will extend down the root canal and through the apical foramina to cause periodontitis.

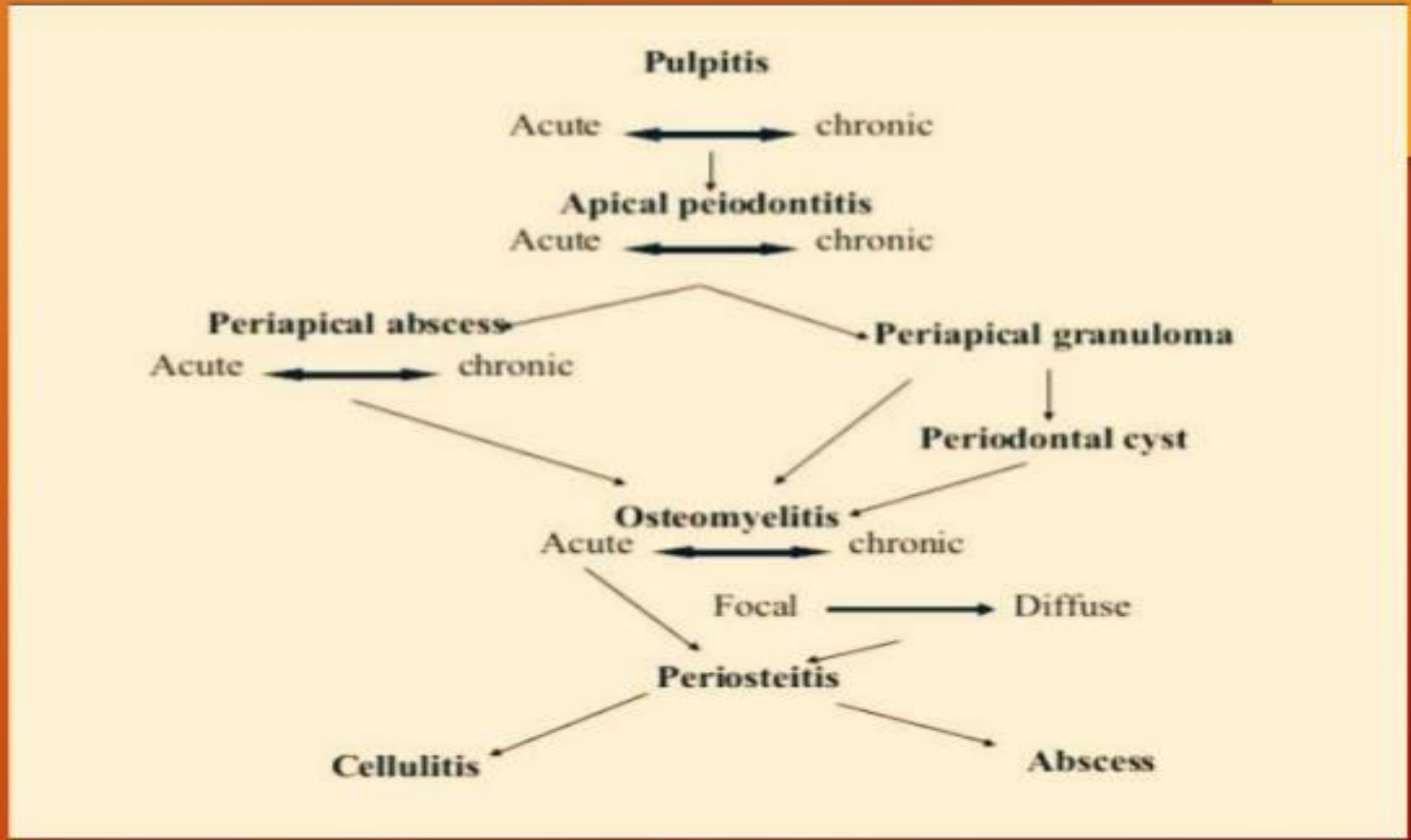
2-Trauma:

Occlusal trauma either from a high restoration or less frequently associated with bruxism, may result in periapical periodontitis under pressure during orthodontic treatment, a direct blow on tooth insufficient to cause pulp necrosis and biting unexpectedly on a hard body in food may all cause minor damage to the periodontal ligament and localized inflammation.

3- Endodontic treatment:

Mechanical instrument through the apex during endodontic treatment as well as chemical irritation from root filling material may result in inflammation in the periapical periodontium. Instrumentation of an infected root canal may be followed by periapical inflammation, due to bacterial proliferation in the root canal or due to bacteria being forced into the periapical tissues.

SEQUELAE OF PULPITIS



Periapical pathology:

1. Chronic apical periodontitis (periapical granuloma).
2. Acute periapical periodontitis.
3. Acute periapical abscess.
4. Cellulitis.
5. Radicular cyst.

1-Chronic apical periodentitis (periapical granuloma)

The term periapical granuloma refers to a mass of chronically or sub acutely inflamed granulation tissue at the apex of a non-vital tooth. The term is not totally accurate because the lesion does not show true granulomatous inflammation microscopically. The formation of the periapical granuloma represent a definitive reaction secondary to the presence of microbial infection in the root canal with spread of related toxic products into the apical zone.

Clinical features:

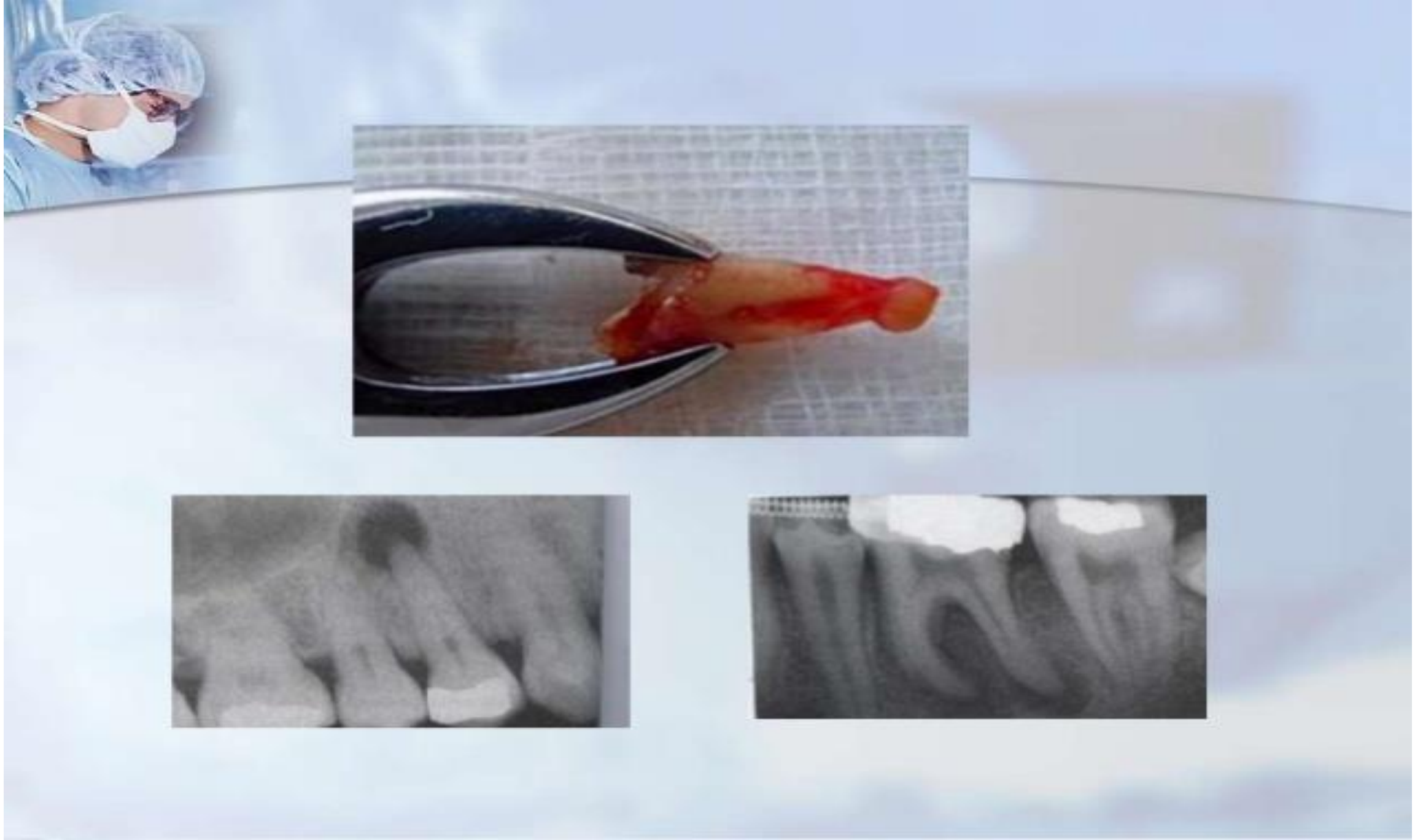
1-most of periapical granulomas are asymptomatic

2-pain may develop if acute exacerbation occurs.

3-typically the involved tooth does not demonstrate mobility or significant sensitivity to percussion.

4-the soft tissue overlying the apex may or may not be tender

5-the tooth does not respond to thermal or electric pulp tests unless the pulp necrosis is limited are limited to a single canal in a multirooted tooth.



Radiographic features

Most lesions are discovered on routine radiographic examination which may show:

1-variable radiolucenies ranging from very small to 2 cm in diameter

2-affected teeth typically reveal loss of the apical lamina dura

3-the lesion may be circumscribed or ill defined and may or may not demonstrate a surrounding radiopaque rim

4- root resporption may be seen

The radiographic features are suggested but not diagnostic

Figure 3-15 · Periapical granulomas. Discrete periapical radiolucencies associated with the apices of the mandibular first molar. (Courtesy of Dr. Garth Bobrowski.)

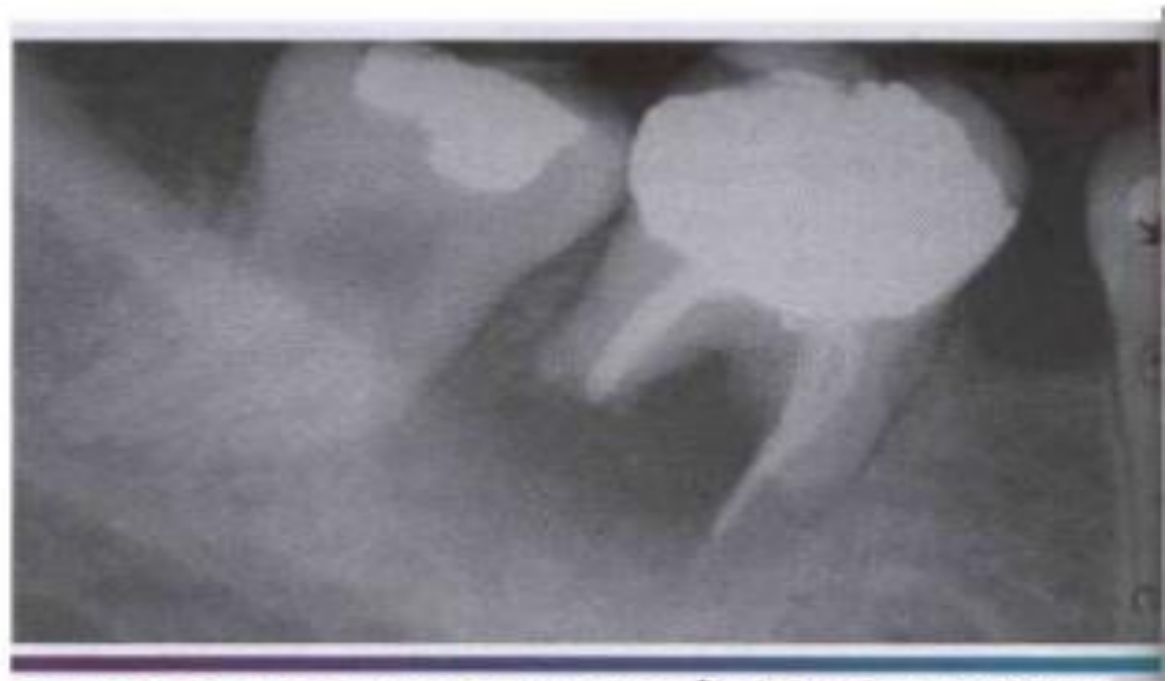


Figure 3-18 · Periapical granuloma. Ill-defined radiolucency associated with the mandibular first molar, which exhibits significant root resorption.

Histopathological features

Periapical granulomas consist of an inflamed granulation tissue surrounded by fibrous connective tissue wall. The central part of the lesion contains macrophages with foamy cytoplasm caused by the phagocytosis of cholesterol.

Cholesterol crystals may be present surrounded by multinucleated giant cells. A diffuse infiltrate of lymphocytes and plasma cells. When numerous plasma cells are present, scattered eosinophilic globules of gamma globulin (Russell bodies) may be seen. A frequent finding is the presence of irregular islands of epithelium, a result of prolonged, mild stimulation of the rest malassez, which are remnants of the Hertwig root sheath.

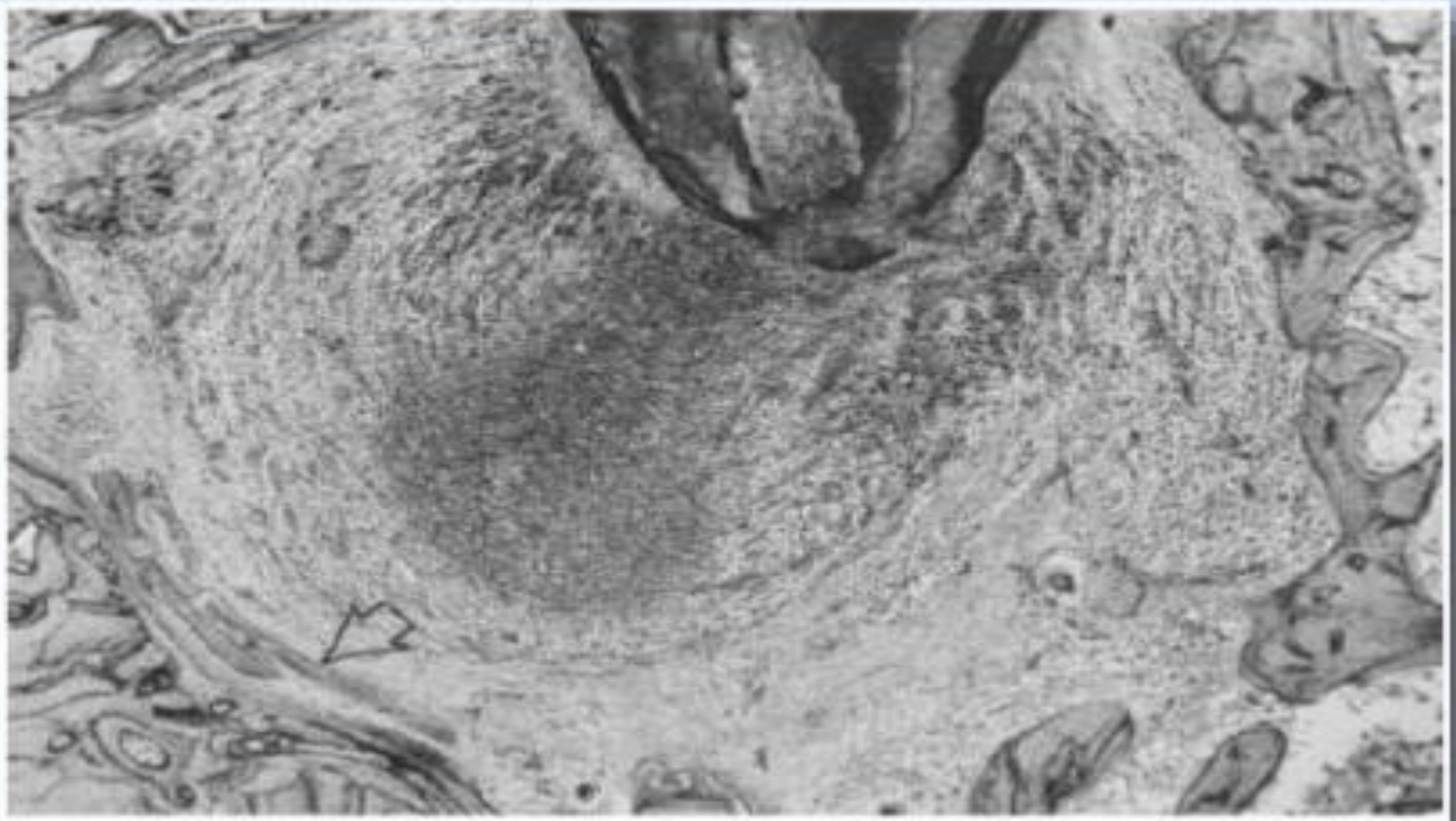
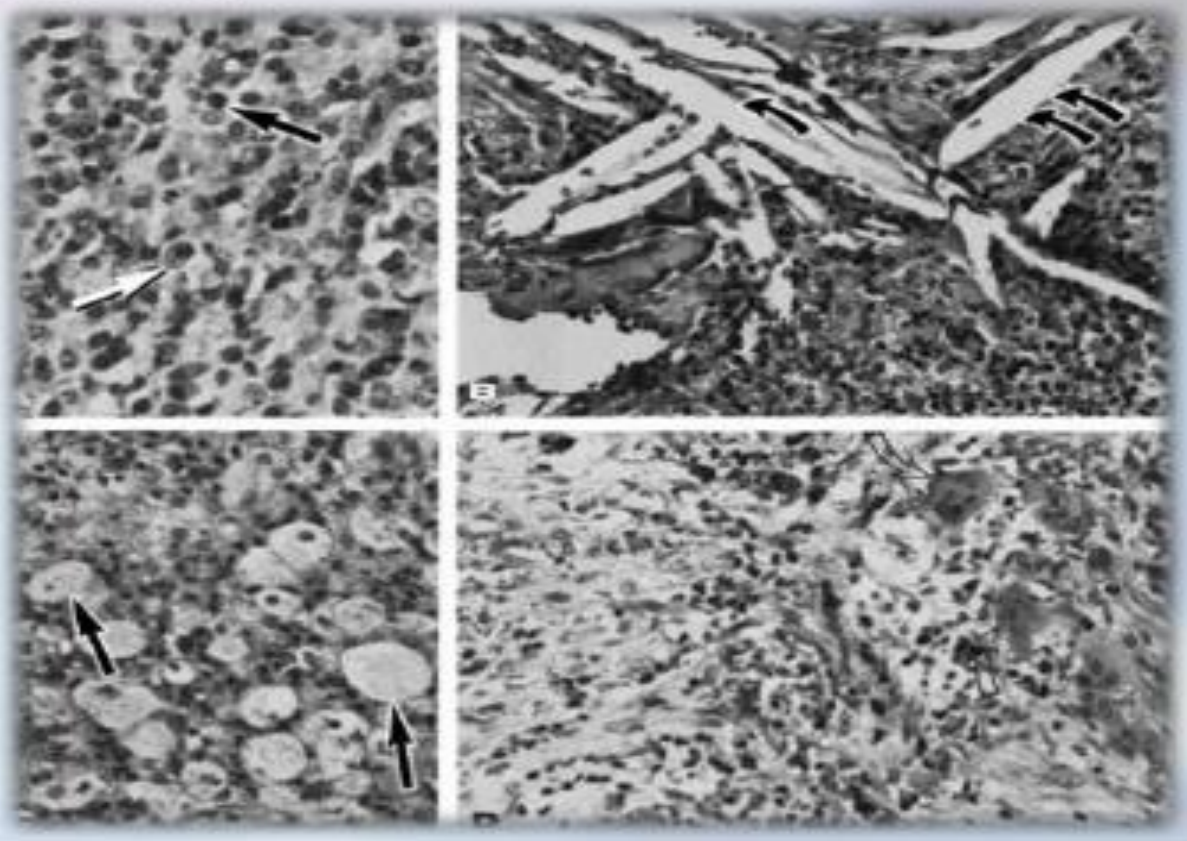


Figure 5-3 Apical periodontitis (granuloma) in its more classic form. The central zone is dense with round cells (plasma cells and small lymphocytes). Beyond is a circular layer of fibrous capsule. Limited bone regeneration (**arrow**) can be clearly seen at outer margin of capsule. Human tooth. Reproduced with permission from Matsumiya S. Atlas of oral pathology. Tokyo: Tokyo Dental College Press; 1955.

- Occasionally, needle-like spaces (the remnants of cholesterol crystals), foam cells, and multinucleated foreign body giant cells are seen in these lesions.



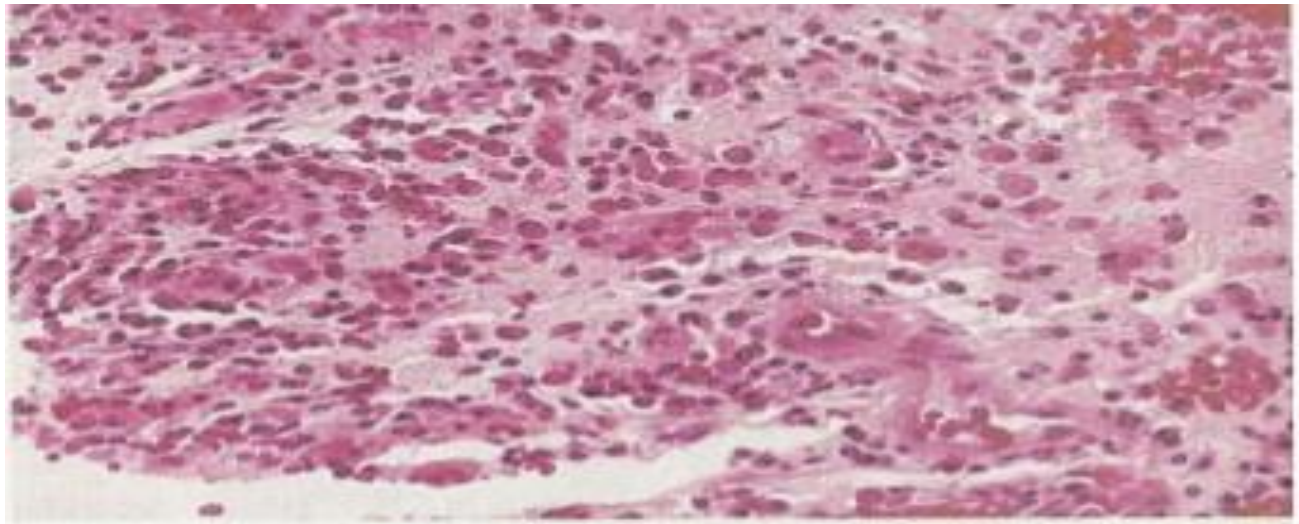
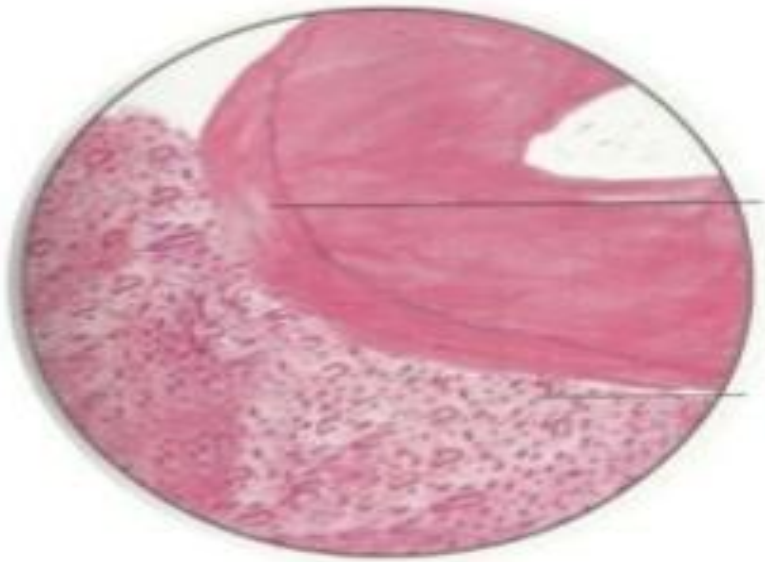


Fig. 3-18 Periapical granuloma. Granulation tissue exhibits mixed inflammatory infiltrate consisting of lymphocytes, plasma cells, and histiocytes.



Sequelae:-

1- Periapical granuloma may continue to enlarge with continued bone resorption

2- Acute exacerbation to an acute periapical periodontitis

3- A suppuration to form an acute periapical abscess

4- Formation of a radicular cyst

5- Low grade irritation may cause osteosclerosis (bone apposition) or cementum apposition (hypercementosis).

Acute periapical periodotitis

Clinically:

Pain is intense when external pressure is applied to the tooth, as the pressure is transmitted through the fluid exudates to the sensory nerve endings. Even light load may be sufficient to induce pain, as the fluid is not compressible; the tooth feels elevated in its socket. Hot and cold stimulation does not cause pain.

The findings are often normal as there is generally insufficient time for bone resorption to occur between the time of injury to the periodontal ligament and the onset of symptoms. If radiological changes are present, they consist of slight widening of periodontal ligament and the lamina dura around the apex.

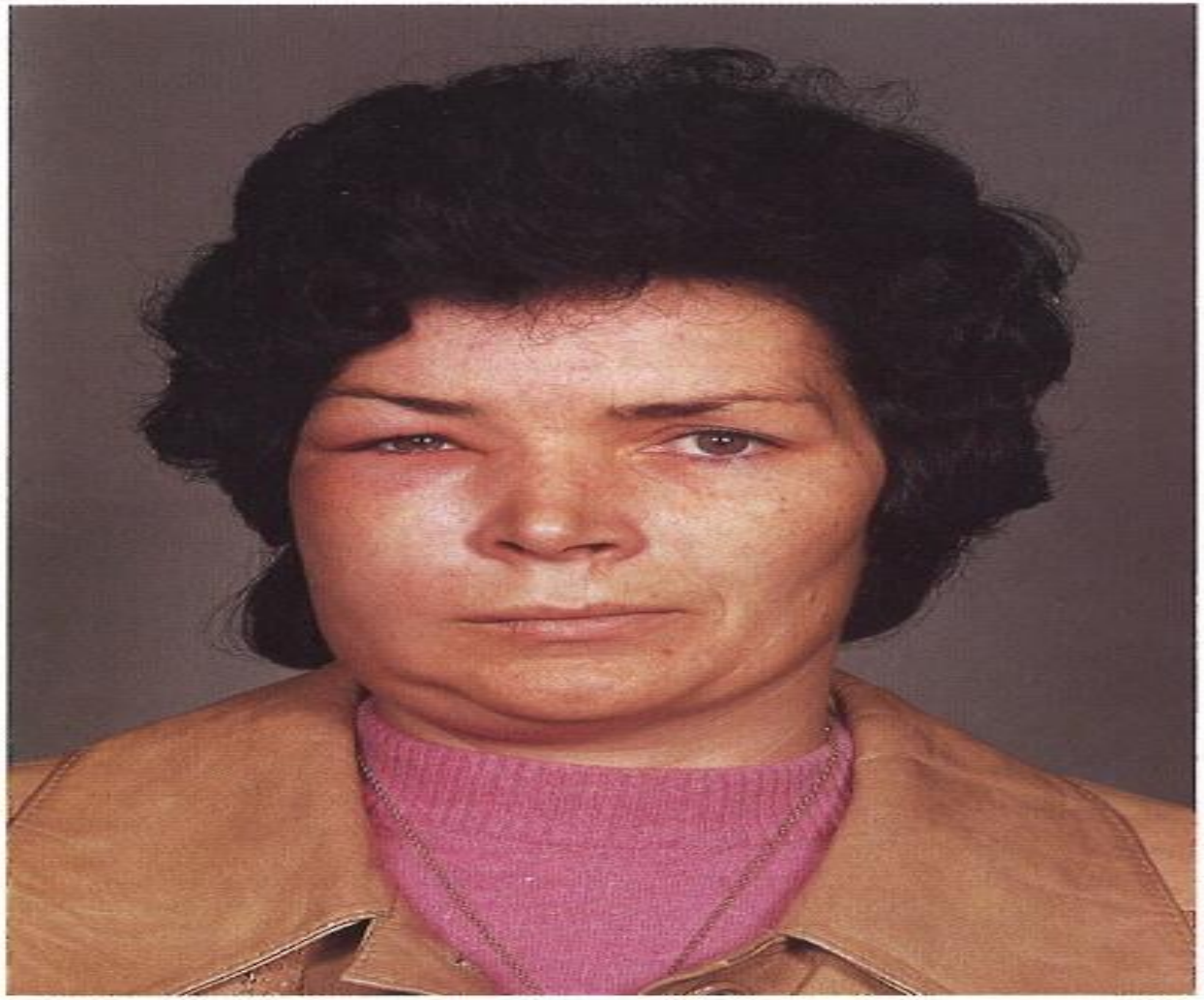


Fig. 4.16 **Oedema due to acute apical periodontitis.** An acute periapical infection of a canine has perforated the buccal plate of bone causing oedema of the face; this quickly subsided when the infection was treated.

Acute periapical periodontitis:

Histopathological findings:

Vascular dilatation, exudates of neutrophils, and oedema, in the periodontal ligament situated in the confined space between the root apex and the alveolar bone

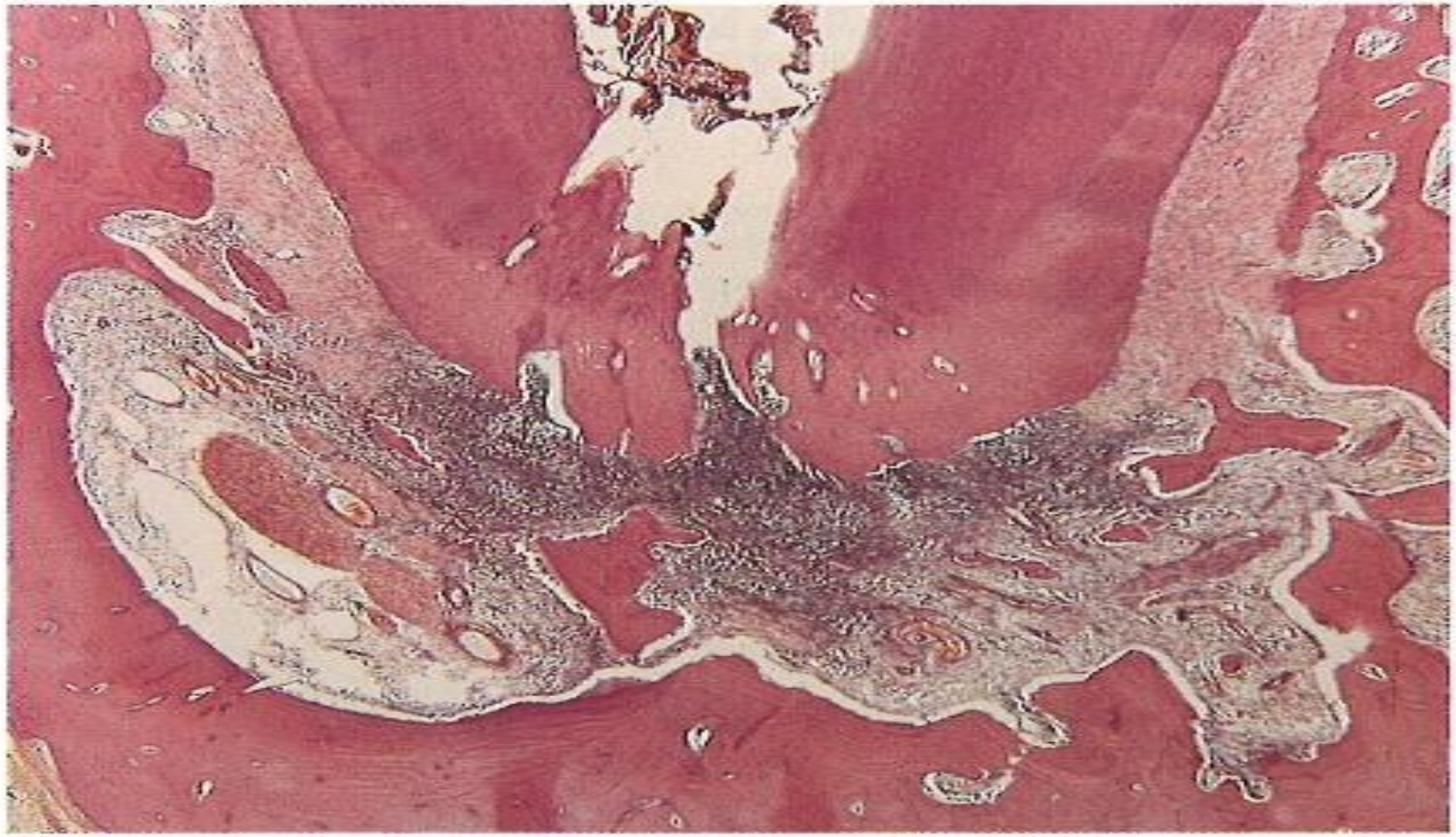


Fig. 4.17 Acute apical periodontitis. In this early acute lesion, inflammatory cells, mainly neutrophil polymorphonuclear leucocytes, are seen clustered around the apex of a non-vital tooth. The inflammatory cells are spreading around and into bone and there has not yet been time for significant bone resorption to develop.

Sequela and prognosis

The inflammation may transient if it is due to acute trauma rather than infection and the condition seen resolves. If the irritant persist the inflammation becomes chronic and may be associated with resorption of the surrounding bone. Suppuration may occur associated with necrosis and bacterial infection with continued exudation of neutrophils leading to abscess formation, called acute periapical abscess.

Acute periapical abscess

The accumulation of acute inflammatory cells at the apex of a nonvital tooth is termed a periapical abscess. It is a progression of an acute pulpitis in which exudates extend into the adjacent soft and hard tissue. Because it often contains one or more strains of virulent bacterial organisms, the exudates usually contains potent exotoxins and lytic enzymes capable of rapidly breaking down tissue barriers. Another cause is the acute exacerbation of a chronic periapical granuloma.

Clinical features

Patients have severe pain in the area of the nonvital tooth because of pressure and the effects of inflammatory chemical mediators on nerve tissue. The exudates and neutrophilic infiltrate of an abscess cause pressure on the surrounding tissue, often resulting in slight extrusion of the tooth from its socket.

Pus associated with a lesion, if not focally drained from the tooth ((e.g. by endodontic treatment)), seeks the path of least resistance and spread into contagious structures. The affected area of the jaw may be tender to palpation, and the patient may be hypersensitive to tooth percussion. The tooth is not responding to electric pulp tester, or thermal stimuli, headache, malaise, fever and chills may be present

FIGURE 13-4 Palatal abscess representing extension of a periapical abscess.

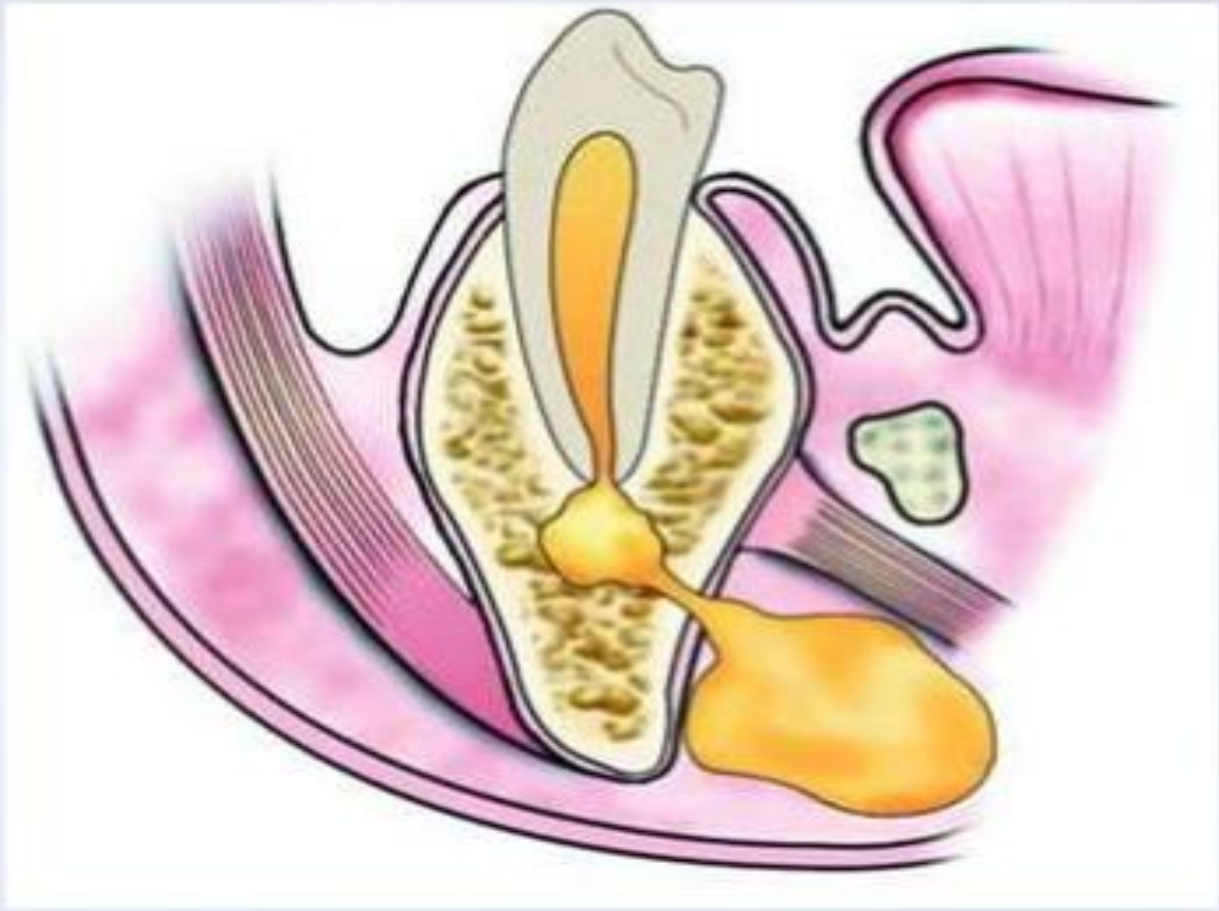
TREATMENT:

- Drainage of abscess by opening pulp chamber or extraction.
- Root canal treatment.
- If untreated, causes osteomyelitis, cellulites & bacteremia & formation of fistulous tract opening to oral mucosa.

Fig. 4.23 A persistent skin sinus from a lower incisor rendered non-vital by a blow some time previously. This young woman was seen and treated unsuccessfully for 2 years by her doctor, surgeons and dermatologists before anyone looked at her teeth.

CELLULITIS

- It is a rapidly spreading inflammation of the soft tissues characterized by diffuse pus formation.
- This happens if an abscess is not able to establish drainage through the skin surface or into oral cavity.
- Cellulitis arising from dental infection and spreading through soft tissues of head and neck can take various forms.
- Mostly, infection spreads through tissue spaces like canine space, infratemporal space, pharyngeal space, buccal space, submental and submandibular space etc.
- Two dangerous forms of cellulitis are –
  - Ludwig's angina
  - Cavernous sinus thrombosis



Radicular cyst

Clinical and radiographical features

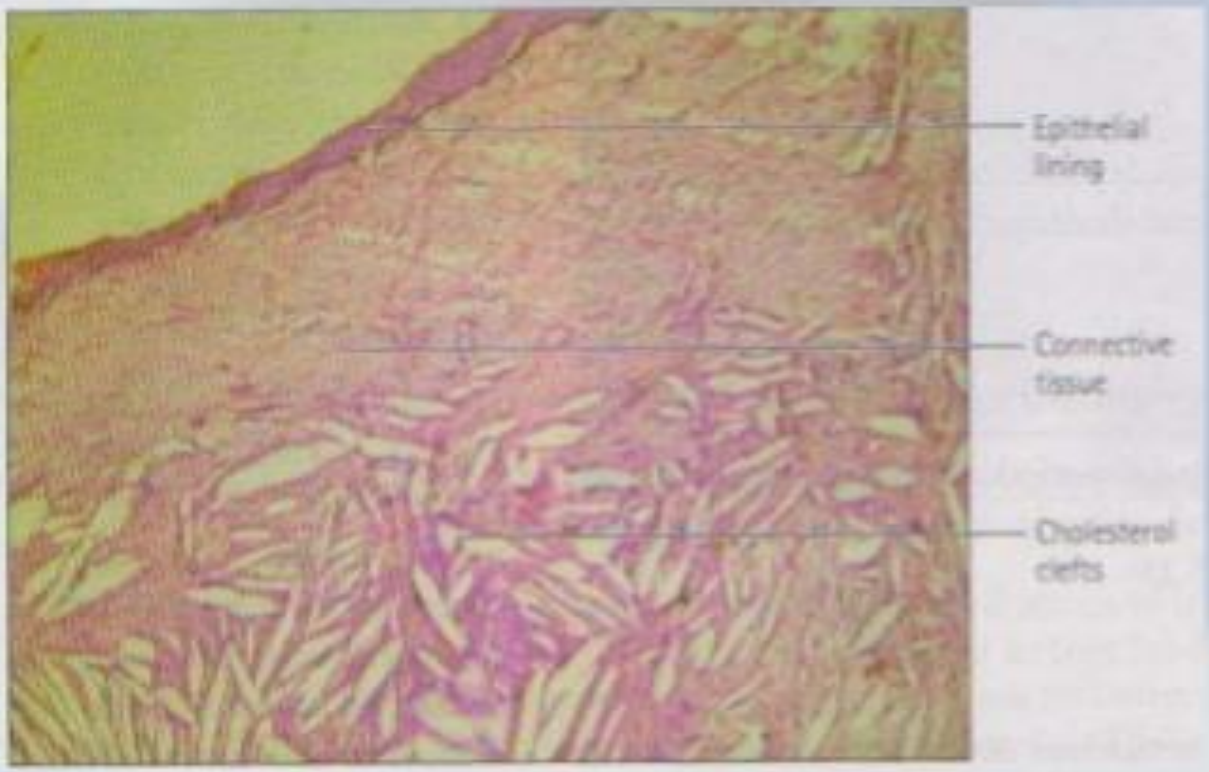
Apical radicular cyst are the most common cystic lesions in the jaws and are always associated with apex of non vital teeth , they account for about 75% of all radicular cyst. When small they are frequently symptomless and are usually discovered during routine radiographical examination as they enlarge, they produce expansion of alveolar bone and ultimately may discharge through sinus. However the majority of radicular cyst does not grow to large dimension.

RADIOLOGICAL FEATURES:

- ✓ Classically presents as round / ovoid radiolucency with sclerotic borders and associated with pulpally affected tooth / teeth.
- ✓ If infection supervenes, the margins become indistinct, making it impossible to distinguish it from a periapical granuloma.

HISTOPATHOLOGY

- Cavity is lined by stratified squamous epithelium.
- Surrounded by connective tissue that is infiltrated by lymphocytes, plasma cells, and polymorphonuclear neutrophils.
- Contains debris and eosinophilic material.
- Cholestrol clefts, macrophages, & giant cells also present in CT.



Cyst contents

The cyst contents vary from a watery straw color fluid through to semi solid brownish material of paste like consistency. Cholesterol crystals impart a shimmering appearance the composition of cyst fluid is a complex of variable it is hypertonic compared with serum and contents

1-breakdown products of degenerating epithelial cell and inflammatory cell and connective tissue components

2-serum proteins all groups of serum proteins are present in cyst fluid and the soluble proteins level is 5-11 g/dl most are derived as inflammatory exudates.

3- water and electrolytes

4- cholesterol crystals

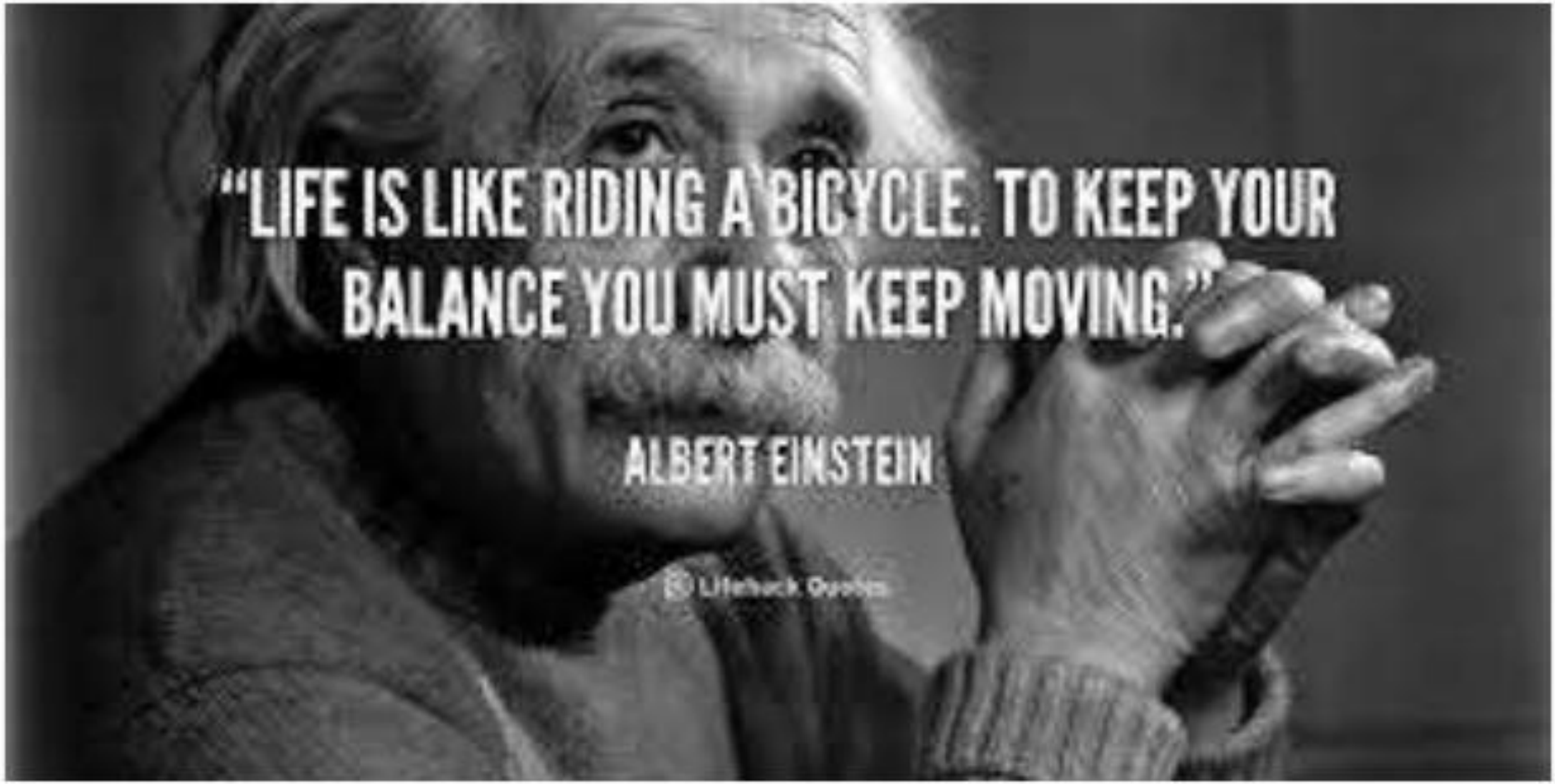
Cyst expansion

- Cysts expansion is dependent on osteoclastic resorption of surrounding bone. Osteoclasts are derived from haematopoietic precursors and are transported via the blood.

- Bone resorption is followed by cyst expansion which may involve hydrostatic pressure.
- Cyst contents are hypertonic. The wall acts as a semi permeable membrane and retains the osmotically active molecules in the lumen creating an osmotic gradient. Water moves into the lumen along the gradient increasing the hydrostatic pressure in the cyst leading to enlargement.

Treatment of radicular cyst:

The treatment of periapical radicular cyst depend on the condition of the tooth as whole, if the tooth is restorable, the root canals can be filled, if the root canals cannot be filled and the apical area is in a location accessible for surgery, an apicoectomy with complete surgical enuculation may be performed to remove the cystic lesion, followed by histopathological examination; otherwise, the tooth is extracted and the periapical cyst is curreted through the tooth socket.


"LIFE IS LIKE RIDING A BICYCLE. TO KEEP YOUR BALANCE YOU MUST KEEP MOVING."
ALBERT EINSTEIN