

DISEASES OF PULP AND PERI-APICAL TISSUES

**DEPARTMENT OF ORAL AND MAXILLOFACIAL PATHOLOGY &
ORAL MICROBIOLOGY**

DISEASES OF DENTAL PULP

- Dental pulp is **delicate connective tissue** consisting of
 - Tiny blood vessels
 - Lymphatics
 - Myelinated and unmyelinated nerves
 - Undifferentiated connective tissue cells

DISEASES OF DENTAL PULP

- **Etiology**

PHYSICAL INJURY

CHEMICAL INJURY

MICROBIAL FACTOR

Acute Injury

Injury on tooth

Cavity preparation without water spray

Vigorous polishing Root planning in PDL therapy Restoration – improper insulation

Medicaments or materials applied to dentin through dentinal tubules.

Bacterial invasion by:

Dental caries

Fractured tooth where exposed pulp

Anachoretic infection due to presence of bacteria in circulating blood stream.

Chronic Injury

Attrition -abrasive food & bruxism

Abrasion -abnormal tooth brushing

- **Anachoresis:** is a phenomenon by which **blood born bacteria, dye, pigments, metallic substances, foreign proteins, and other materials** are attracted to the site of inflammation.
- **Anachoretic pulpitis:** **bacteria circulating** in the blood stream tend to settle at **sites of pulpal inflammation**, such as that which might follow some chemical or mechanical injury to the pulp
- This phenomenon is due to **increased capillary permeability** in the particular area.

PULPITIS

- Inflammation of the dental pulp

- Like other connective tissue pulp reacts to bacterial infection or other stimuli by an process of inflammation called PULPITIS

- **Types of pulpitis**

- 1). **ACUTE**

- **Reversible:** it refers to instances where the inflammation is mild and the tooth pulp remains healthy enough to save.
 - Irreversible pulpitis Mar**
 - **Irreversible:** it shows irreversible damage to pulp and other symptoms, such as pain, are severe, and the pulp cannot be saved.

2).CHRONIC

- **Closed: whether acute or chronic, may progress to necrosis due to limited ability of pulp to withstand inflammatory edema since it is surrounded by hard tissues**
- **Opened (hyperplastic): pulp Polyp consists of chronically inflamed hyperplastic granulation tissue protruding from pulp cavity.**

Reversible pulpitis

- Mild to moderate pain
- Brief duration
- Response to cold stimuli
- Once stimulus is removed, pain is usually subsides
- Tooth responds to electric pulp tester at lower currents
- Teeth usually show deep caries, metallic restoration with defective margins
- Reversible pulpitis if allowed to progress can led to irreversible pulpitis

Irreversible pulpitis

- Sharp, severe, radiating pain of long duration & varying intensity
- Pain continues even after the stimulus is removed
- Pain may exacerbate with bending over or lying down
- It may progress to more severe pain that is gnawing or throbbing
- Increased by stimulus, like heat and may relieved by cold
- If inflammation/Infection extended to periapical tissue can cause periapical disease

ACUTE REVERSIBLE PULPITIS

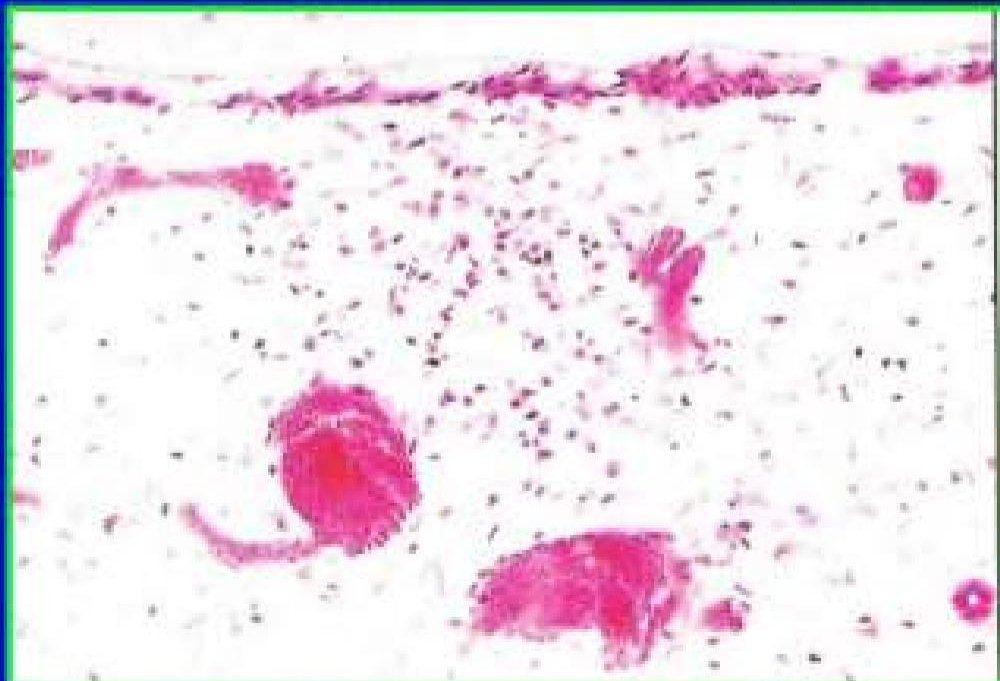
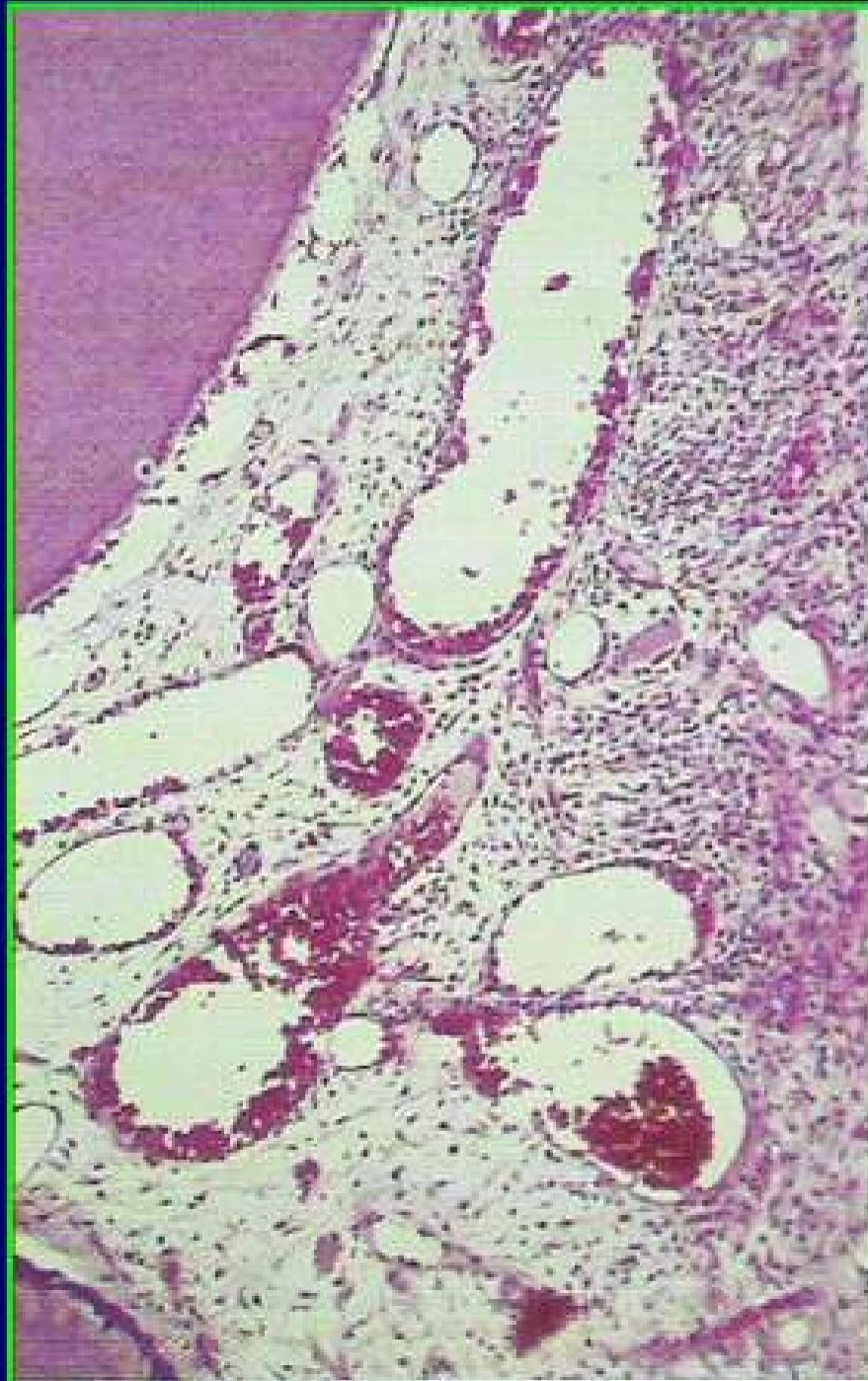
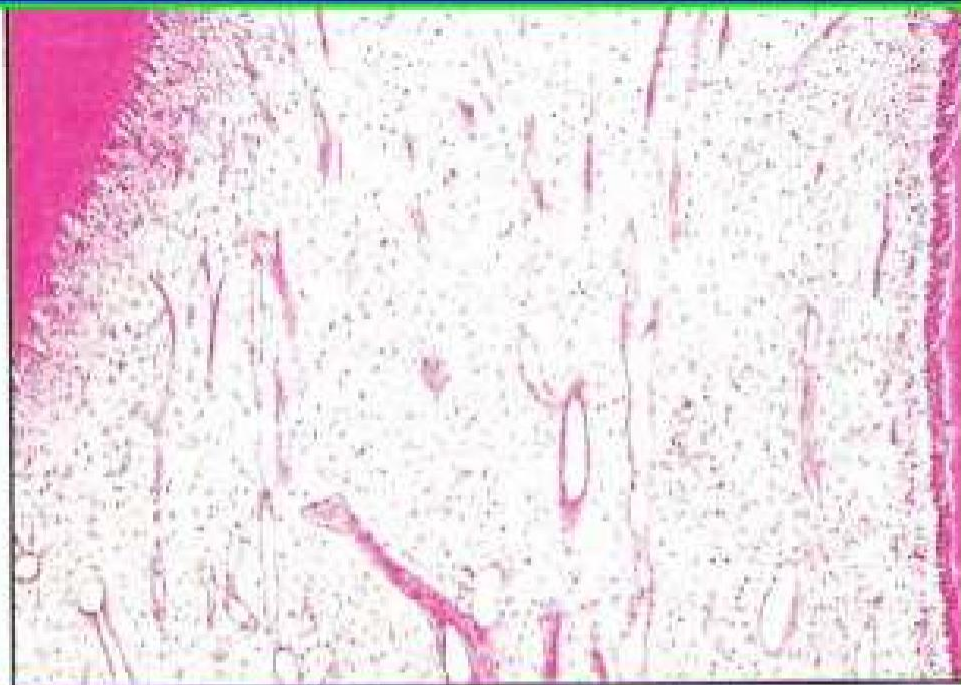
– Etiology

- Dental caries
- Cavity preparation
- Thermal changes in large metallic fillings

- **Clinical features**
- Pain: mild to moderate
- The etiological factor is obvious

- **Histopathological features**
 - Pulp hyperemia (dilation of blood vessels)
 - Exudation
 - Inflammatory cell infiltration (neutrophils)
 - Reactions usually remain localized adjacent to the cause

 - **Treatment:** remove the cause



ACUTE IRREVERSIBLE PULPITIS

- **Etiology**

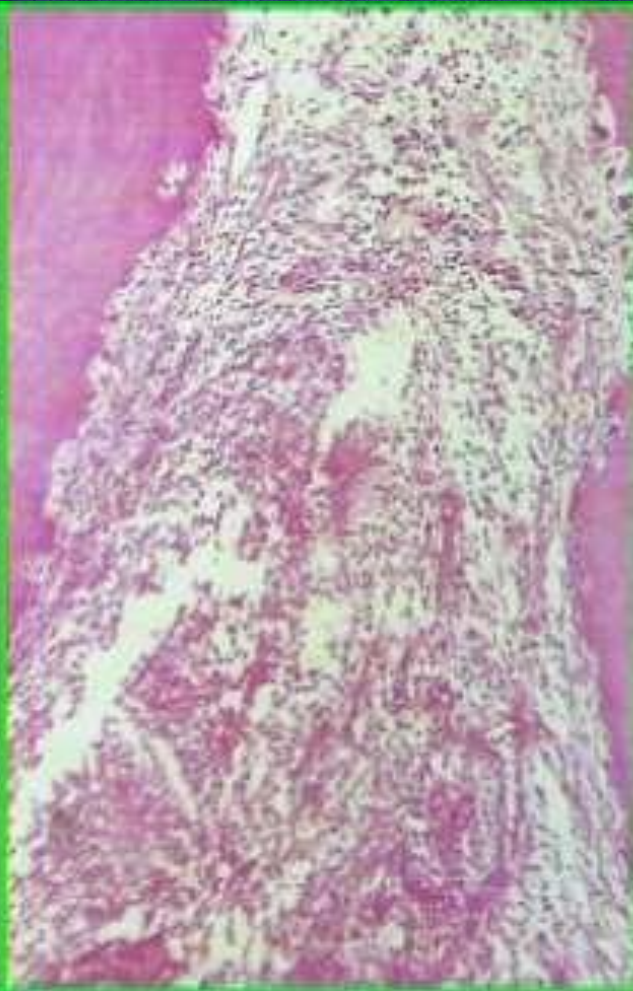
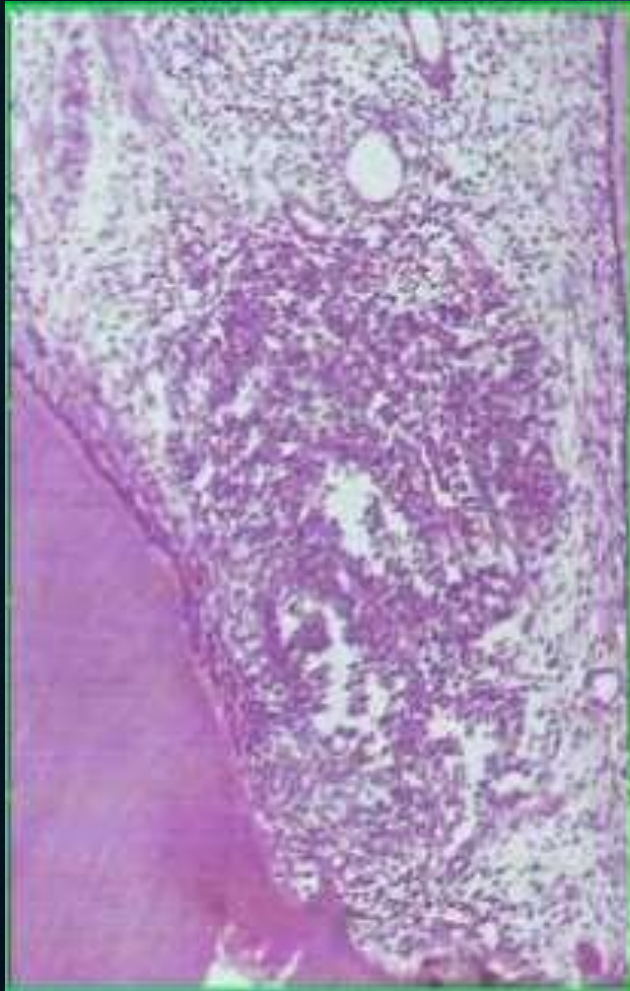
- Acute dental caries
- Pulp exposure
- Severe irritation

- **Clinical features**

- Pain: severe, spontaneous and continuous
- Little response to simple analgesics
- Pain increases when patient lies down

- **Histopathological features**
- **Inflammation involves the whole dental pulp**
- **Vascular dilatation and edema**
- **Inflammatory (granular cells) infiltration**
- **Odontoblasts near to the cause are destroyed**
- **Formation of a minute pulp abscess**
- **In a few days pulp undergoes liquefaction and necrosis**

- **Treatment: RCT**



CHRONIC PULPITIS

- **Etiology**
 - previous acute pulpitis
 - Chronic dental caries
- **Clinical features**
 - Pain: absent or mild to moderate, dull ache and intermittent
 - Reaction to thermal changes is reduced in comparison to acute pulpitis

- **Histopathological features:**
- **Mononuclear cell inflammatory infiltration**
- **Evidence of fibroblastic activity**
- **Minute abscess if exist it is localized by granulation tissue**

- **Treatment: RCT**



CHRONIC HYPERPLASTIC PULPITIS

PULPPOLYP

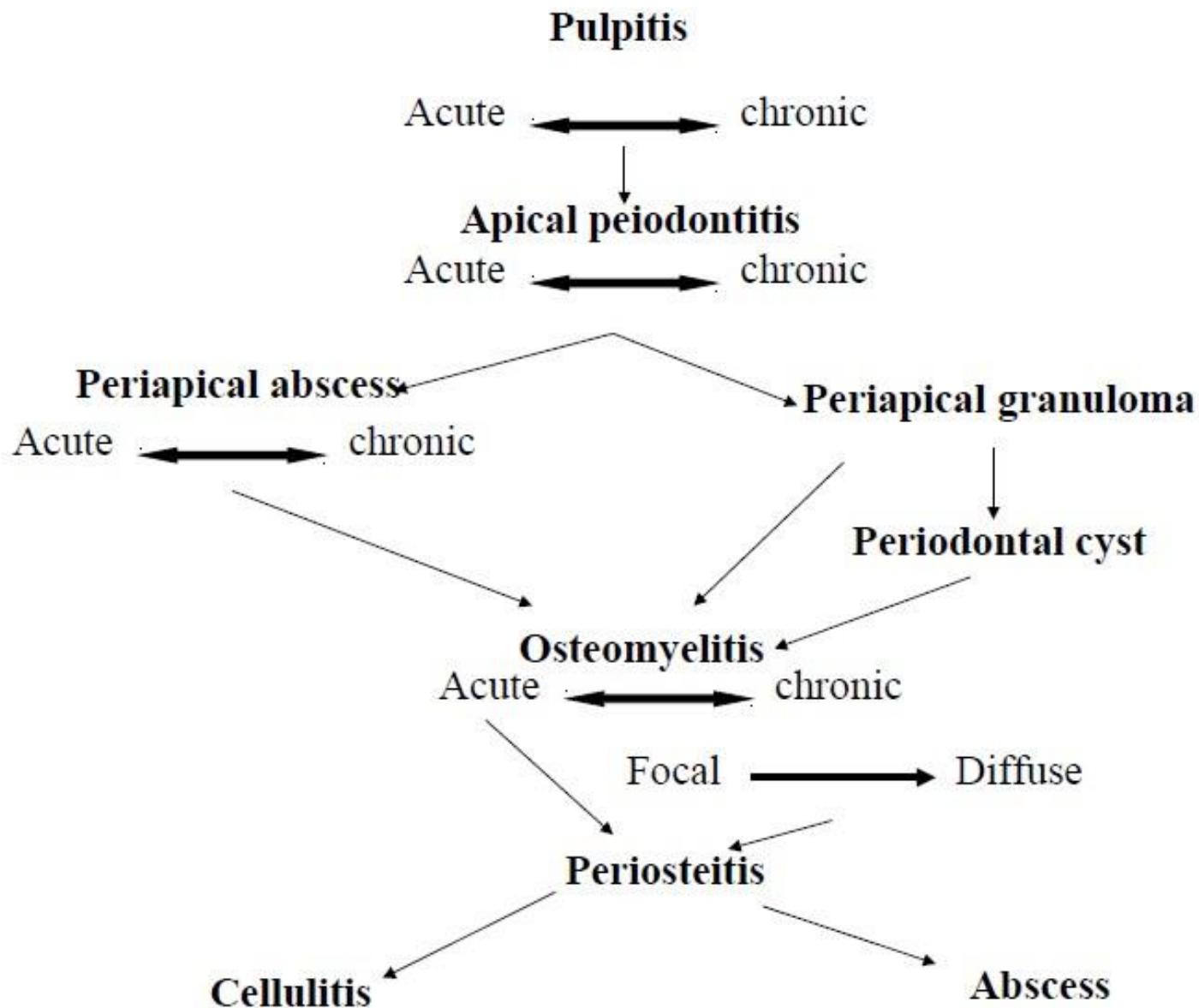
- **Etiolog:**
- Opened cavity
- Starts as chronic or acute
- Wide apical foramen (children)

- **Clinical features:**
- Red pinkish soft nodule protruding into the cavity
- Almost in children and young adults
- Relatively insensitive to manipulation
- Most common in deciduous molars
- Must be different from gingival polyp

DISEASES OF PERIAPICAL TISSUES

- Apical periodontitis
 - Acute
 - Chronic (periapical granuloma)
- Periapical abscess
- Periapical cyst
- Osteomyelitis

DISEASES OF PERIAPICAL



APICAL PERIODONTITIS

- Inflammation of **PDL around apical portion of root.**
- Cause: spread of infection following **pulp necrosis, occlusal trauma**, inadvertent endodontic procedures etc.
- Types:
 - 1.Acute Apical Periodontitis
 - 2.Chronic Apical Periodontitis

ACUTE APICAL PERIODONTITIS

- **CLINICAL FEATURES:**
- Thermal changes does not induce pain.
- Slight **extrusion of tooth** from socket.
- Cause **tenderness on mastication** due to inflammatory edema collected in PDL.
- Due to external pressure, forcing of edema fluid against already sensitized nerve endings results in **severe pain**.
- **RADIOGRAPHIC FEATURES:**
- Appear normal except for **widening of PDL space**.



- **HISTOLOGIC FEATURES:**

- PDL shows signs of inflammation - **vascular dilation**
infiltration of PMNs
- Inflammation is **transient**, if caused by acute trauma.
- If irritant not removed, progress into **surrounding bone resorption**.
- **Abscess formation** may occur if it is associated with **bacterial infection** Acute periapical abscess /Alveolar abscess.

- **TREATMENT & PROGNOSIS:**

- **Selective grinding** if inflammation due to occlusal trauma
- RCT

CHRONIC APICAL PERIODONTITIS (PERIAPICAL GRANULOMA)

- Most common sequelae of pulpitis or apical periodontitis.
- If acute (exudative) left untreated turns to chronic (proliferative).
- Periapical granuloma is localized mass of chronic granulation tissue formed in response to infection.
- But term is not accurate since it doesn't show true granulomatous inflammation microscopically.

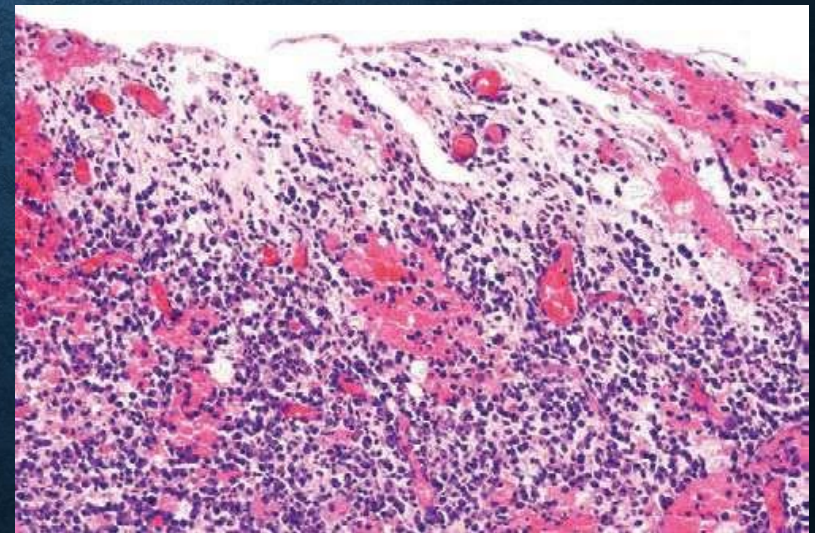
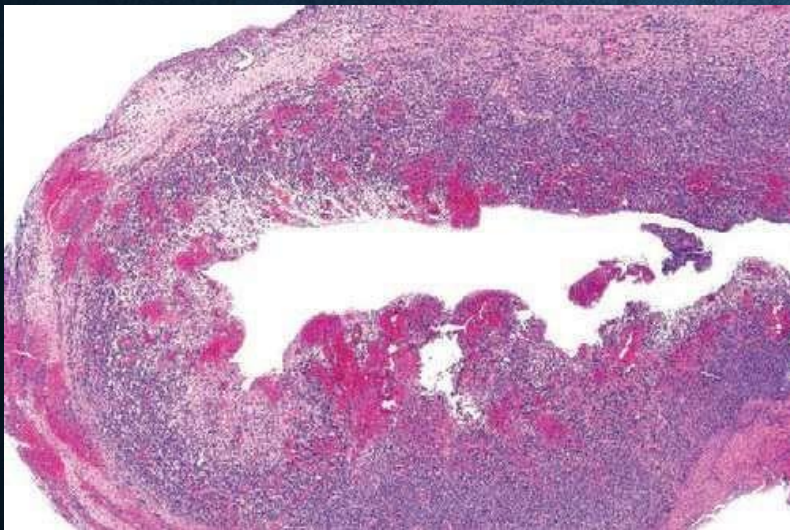
- **CLINICAL FEATURES:**
- Tooth involved is **non vital** / slightly tender on percussion.
- **Percussion** may produce **dull sound instead metallic** due to granulation tissue at apex.
- **Mild pain** on chewing on solid food.
- Tooth may be slightly elongated in socket.
- Sensitivity is due to hyperemia, edema & inflammation of PDL.
- In many cases, **asymptomatic**.
- **No perforation of bone & oral mucosa** forming fistulous tract unless undergoes acute exacerbation.

- **RADIOGRAPHIC FEATURES:**
- **Thickening of PDL** at root apex.
- As concomitant **bone resorption & proliferation of granulation tissue** appears to be **radiolucent area**.
- Thin **radiopaque line or zone of sclerotic bone** sometimes seen outlining lesion.
- Long standing lesion may show **varying degrees of root resorption**.

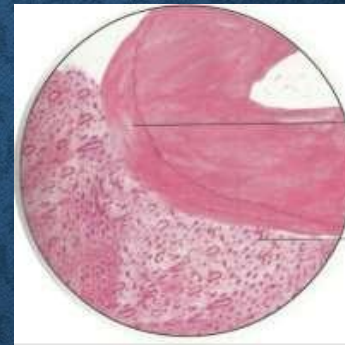
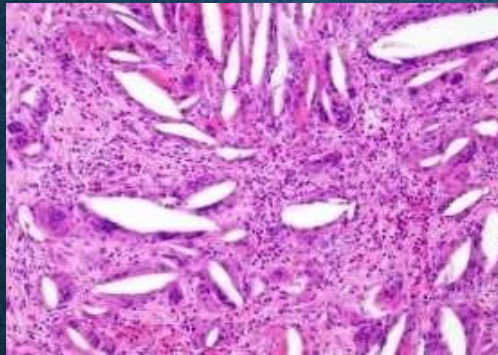


- **HISTOLOGIC FEATURES:**

- Granulation tissue mass consists **proliferating fibroblasts, endothelial cells & numerous immature blood capillaries with bone resorption.**
- Capillaries lined with swollen endothelial cells.
- Its is relatively homogenous lesion composed of **macrophages, lymphocytes & plasma cells.**
- Lymphocytes produces IgG, IgA, IgM & IgE modulators of disease activity.
- Plasma cells containing **Russels body** are found extracellularly.



- T lymphocytes produce cytotoxic lymphokines, collagenase & other enzymes & destructive lymphokines.
- Collection of **cholesterol clefts**, with **multinuclear giant cells**.
- **Epithelial rests of Malassez may proliferate** in response to chronic inflammation & may undergo cystification.



Bacteriologic Features:

Strep. viridans, strep. Hemolyticus, non hemolytic strep, staph. aureus, staph. Albus, E coli & pneumococci are isolated from lesion.

TREATMENT & PROGNOSIS:

Extraction or RCT with / without apicoetomy.

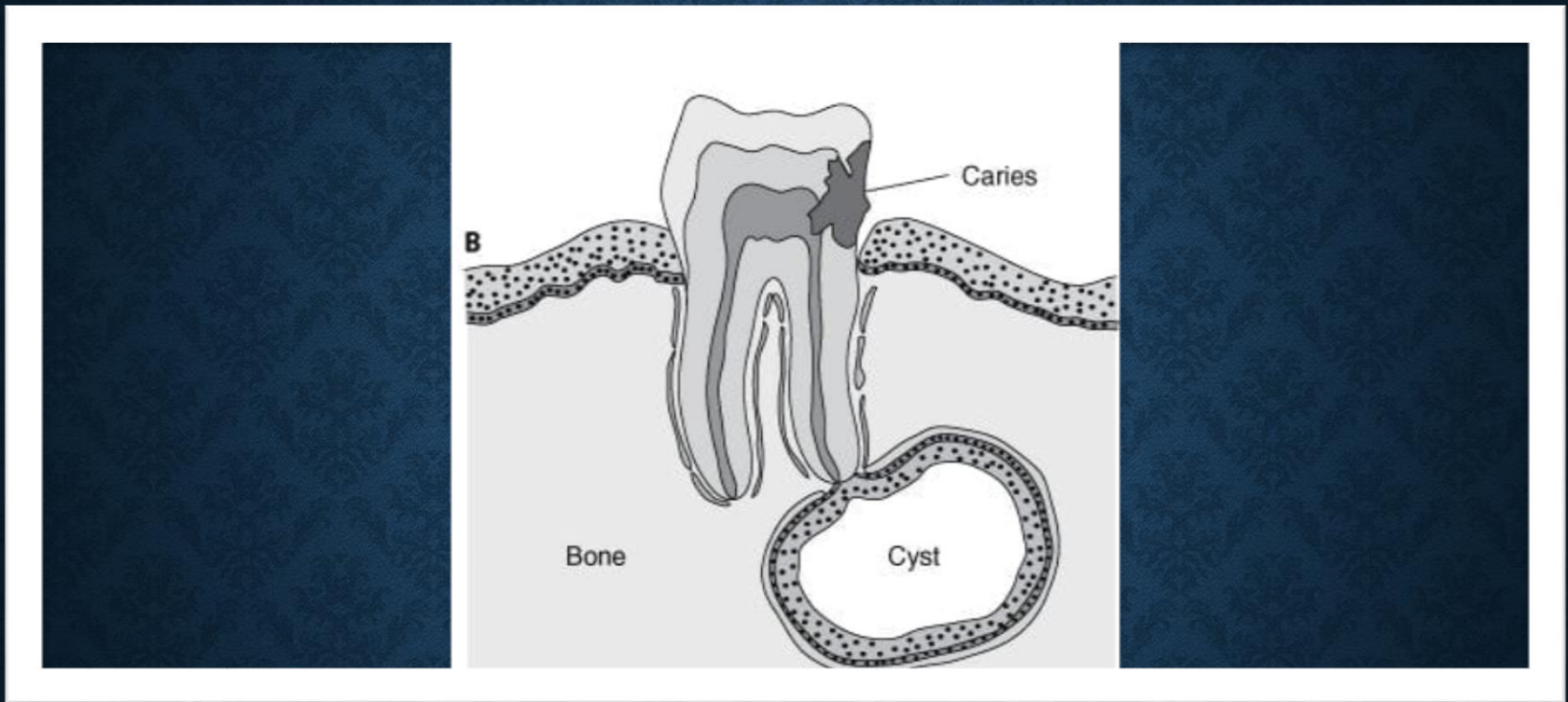
PERAPICAL CYST/ RADICULAR CYST

- These are the most frequent cystic lesion related to teeth
- **Cause:**
- Radicular cysts generally originate after trauma or dental caries
- **Clinical features:**
- 20-60 years of age
- Most commonly in maxillary anteriors followed by mandibular premolars and molars
- Non vital
- asymptomatic

- May turn into abscess due to its acute exacerbation
- Radicular cyst may present as a swelling of the jaw and may be associated with pain/loosening of tooth.
- Root resorption of the affected tooth and displacement of the adjacent teeth have also been observed

Figure 3: Radicular cyst located on the lateral part of palate

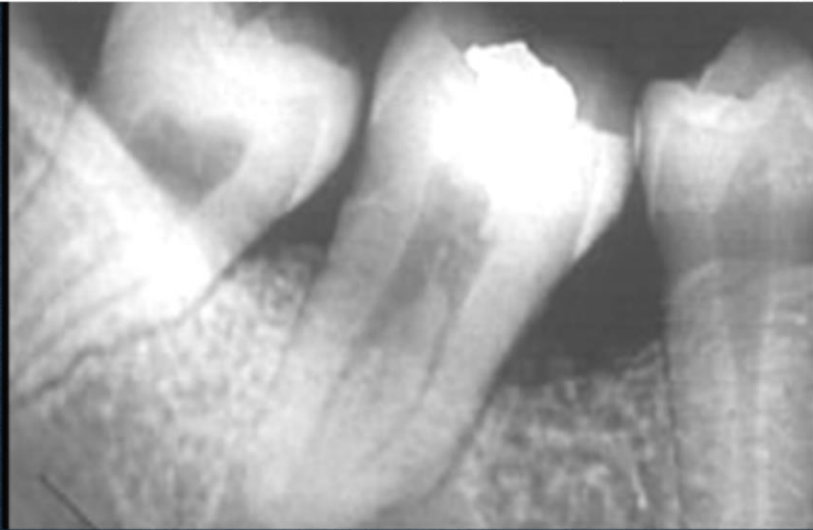




RADICULAR OR PERIAPICAL CYST

•Radiographic features :

- round- or pear-shaped
- unilocular
- lucent lesion in the periapical region
- measuring <1 cm



- **Treatment**

- It involves root canal treatment
- Or extraction followed by periapical curettage
- Does not reoccur if removal is thorough
- May develop residual cyst if incompletely removed

RESIDUAL CYST

- Type of **inflammatory odontogenic cyst** in **edentulous** alveolar ridge.
- Occur due to extraction of tooth, **leaving periapical pathology untreated** or **incomplete removal of periapical granuloma /cyst.**
- **RADIOGRAPHIC FEATURES:**
 - Round /ovoid **radiolucency** in alveolar ridge.
 - Lumen may show radiopacity - dystrophic calcification
- **TREATMENT & PROGNOSIS:**
 - Cyst should **curetted** & lining should be subjected to histopathological examination.

PERIAPICAL ABSCESS (DENTO-ALVEOLAR ABSCESS, ALVEOLAR ABSCESS)

- Developed from acute periodontitis / periapical granuloma.
- Acute exacerbation of chronic lesion **Phoenix Abscess**
- Cause due to – pulp infection, traumatic injury pulp necrosis, irritation of periapical tissues (endo procedures).

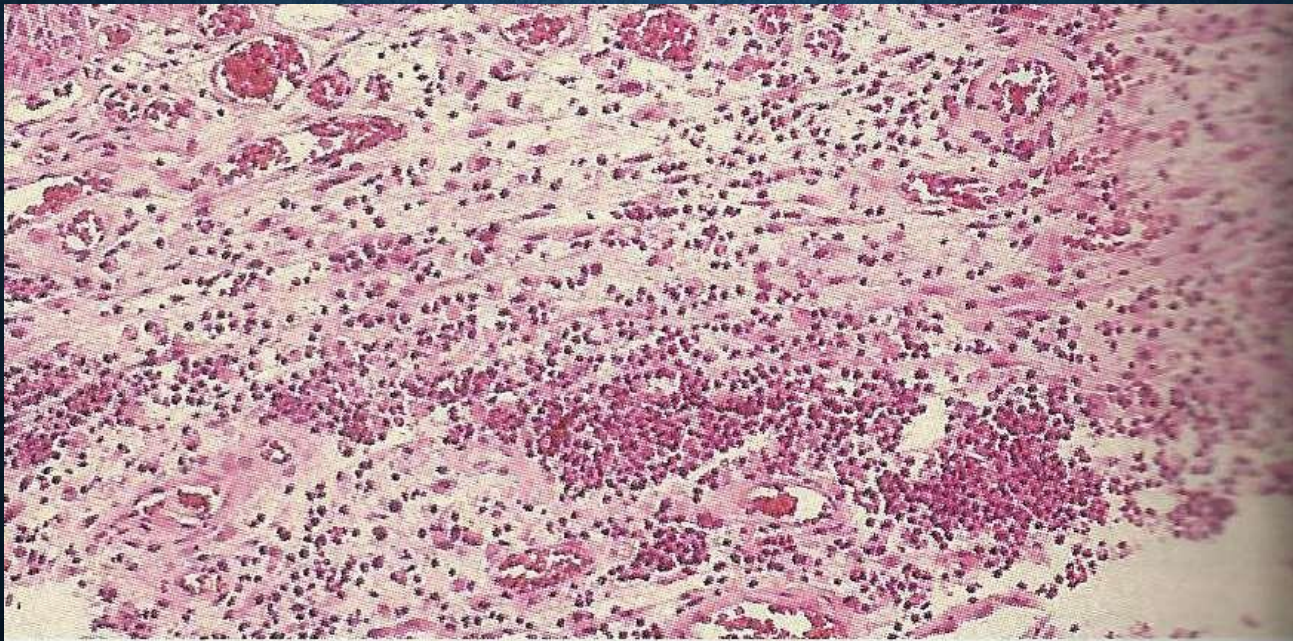
- **CLINICAL FEATURES:**
- Features of acute inflammation.
- **Tenderness of tooth, which relieves after pressure application.**
- **Extreme painful tooth extrude from socket.**
- Extension to **bone marrow spaces** produce **osteomyelitis**, but **clinically** considered as **Dento-Alveolar abscess** – swelling of tissues.
- **Chronic abscess generally presents no features, since it is mild, well circumscribed area of suppuration which spread from local area.**



- **RADIOGRAPHIC FEATURES:**
- Slight thickening of PDL space.
- Radiolucent area at apex of root.



- **HISTOLOGIC FEATURES:**
- Area of suppuration composed of PMN leukocytes, lymphocytes, cellular debris, necrotic materials & bacterial colonies.
- Dilation of blood vessels in PDL & bone marrow space.
- **Marrow space show inflammatory infiltrates.**
- Tissue around area show suppuration containing serous exudate.



- **TREATMENT & PROGNOSIS:**

- Drainage of abscess by opening a pulp chamber
- RCT.
- If untreated, causes **osteomyelitis, cellulites & bacteremia** & formation of fistulous tract opening to oral mucosa.
- Cavernous sinus thrombosis has been reported

Pulpitis

Acute ↔ chronic



Apical peiodontitis

Acute ↔ chronic

Periapical abscess

Acute ↔ chronic

Periapical granuloma

Periodontal cyst

Osteomyelitis

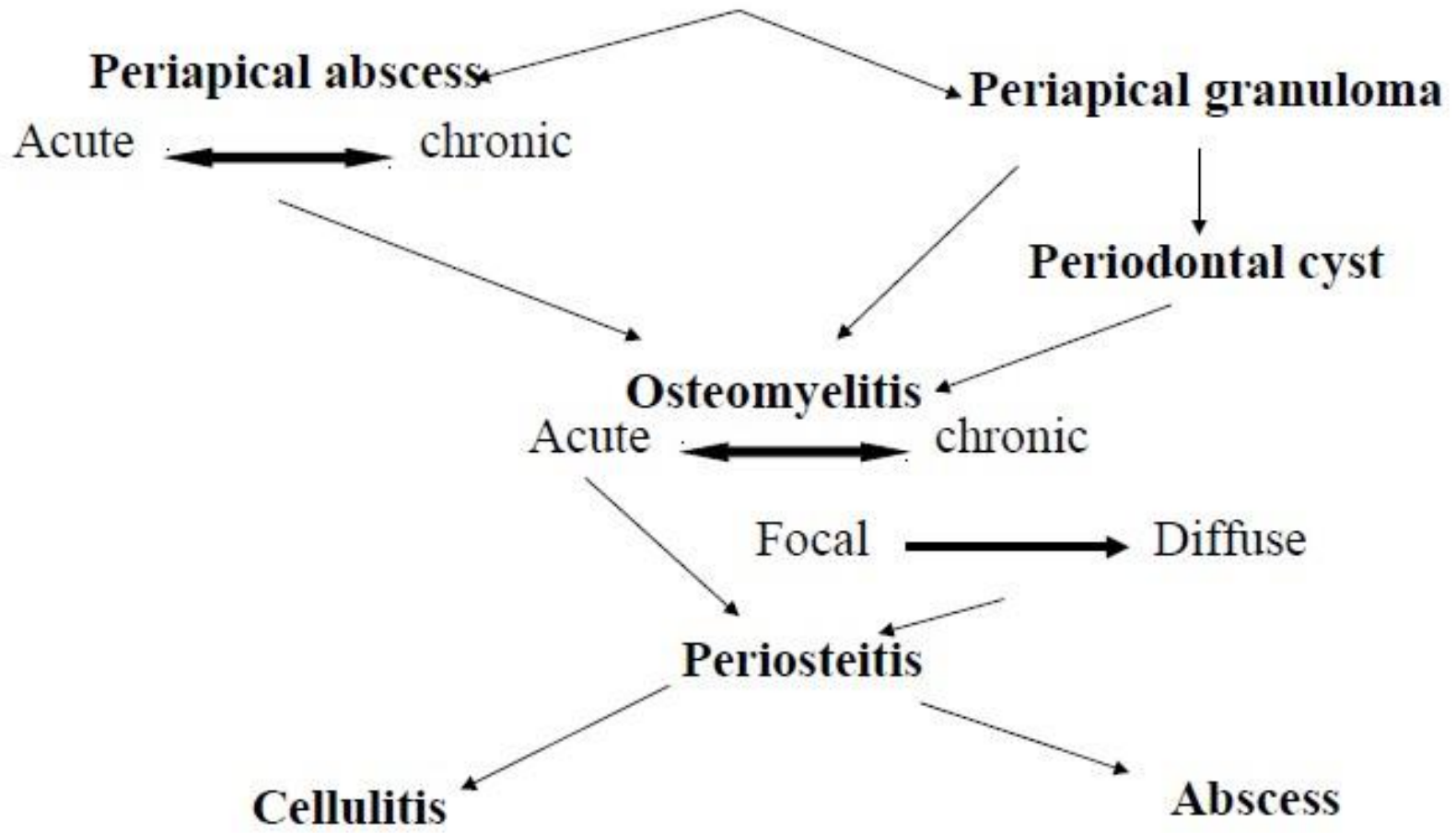
Acute ↔ chronic

Focal → Diffuse

Periosteitis

Cellulitis

Abscess



OSTEOMYELITIS

- The word “osteomyelitis” originates from the ancient Greek words **osteon (bone)** and **muelinos (marrow)** and literally means infection of medullary portion of the bone.
- **Inflammation process of the entire bone including the cortex and the periosteum.**

- **Predisposing factors**
- **Local factors (decreased vascularity/ vitality of bone)**
 - Trauma
 - Radiotherapy
 - Pagets disease
 - Osteoporosis
 - Major vessel disease
- **Systemic factors (impaired host defence)**
 - Immune deficiency
 - Immunosuppression
 - Diabetes mellitus
 - Malnutrition
 - Extremes of age

CLASSIFICATION

- **Based on the duration**
 - **Acute**
 - **Chronic**
 - **Suppurative osteomyelitis**
 - **Acute suppurative osteomyelitis**
 - **Chronic suppurative osteomyelitis**
 - **Non suppurative osteomyelitis**
 - **Chronic focal sclerosing osteomyelitis**
 - **Chronic diffuse sclerosing osteomyelitis**
 - **Garres chronic sclerosing osteomyelitis**
 - **Proliferative periostitis**
- (proliferative)

ACUTE SUPPURATIVE OSTEOMYELITIS

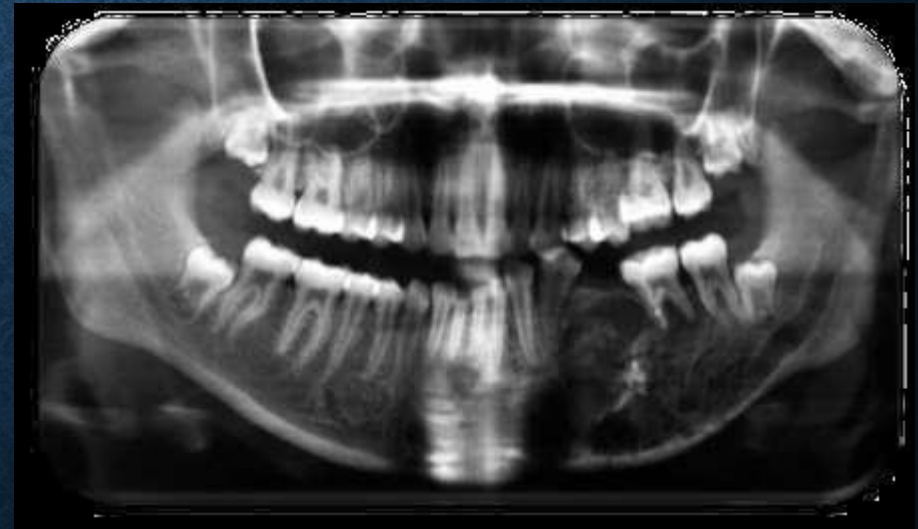
- Serious **sequela of periapical infection** that often results in diffuse spread of infection throughout the medullary spaces, with subsequent necrosis of variable amount of bone.
- Poly microbial
- Most common cause : **Dental infection**
- Other causes : Infection due to fracture of jaw, gun shot, or hematogenous spread

- **Clinical features**
- **Maxilla : localized ; Mandible : Diffuse and widespread**
- **Sever pain**
- **Trismus**
- **Parasthesia of lips** in case of mandibular involvement
- **Elevation of temperature**
- **Regional lymphadenopathy**
- **Loosening of teeth and exudation of pus from gingiva**
- **No swelling and redness till periostitis develops**

- **Radiographic features**
- No Radiographic evidence of its presence until the disease has developed for at least one to **two weeks**
- Trabeculae becomes **fuzzy and indistinct**



Ill defined margins



Moth Eaten Appearance

**Acute
inflammation
of marrow
tissues**

**Spread of
exudate
along the
marrow
spaces**

**Thrombosis
of vessels
due to
compression**

**Necrosis
of bone**

**Liquefaction
of necrotic
tissues**

**Lifting of
periosteum
causing
further
necrosis**

- **Histologic features**
- The inflammatory cells are chiefly **neutrophilic polymorphonuclear leukocytes** but may show occasional lymphocytes and plasma cells
- **Osteoblasts bordering** the bony trabeculae are **destroyed**
- Trabeculae may lose their viability and begin to undergo slow resorption



- **Treatment and prognosis (Essential measures)**
- **Bacterial sampling and culture**
- **Emperical antibiotic treatment**
- **Drinage**
- **Analgesics**
- **Specific antibiotic based on culture and sensitivity**
- **Debridement**
- **Remove source of infection, if possible**

- **Adjunctive treatment**
- **Sequestrum - If small, exfoliates through mucosa, If large, surgical removal – sequestrectomy, decortication**
- **Involucrum : When Sequestrum is surrounded by new living bone**
- **Hyperbaric oxygen**

- **Complication**
- **Pathological fracture – extensive bone destruction**
- **Chronic osteomyelitis – inadequate treatment**
- **Cellulitis – spread of virulent bacteria**
- **Septicemia – immuno-compromised patient**

CHRONIC OSTEOMYELITIS

- Chronic suppurative
- Chronic diffuse sclerosing
- Chronic focal sclerosing

CHRONIC SUPPURATIVE OSTEOMYELITIS

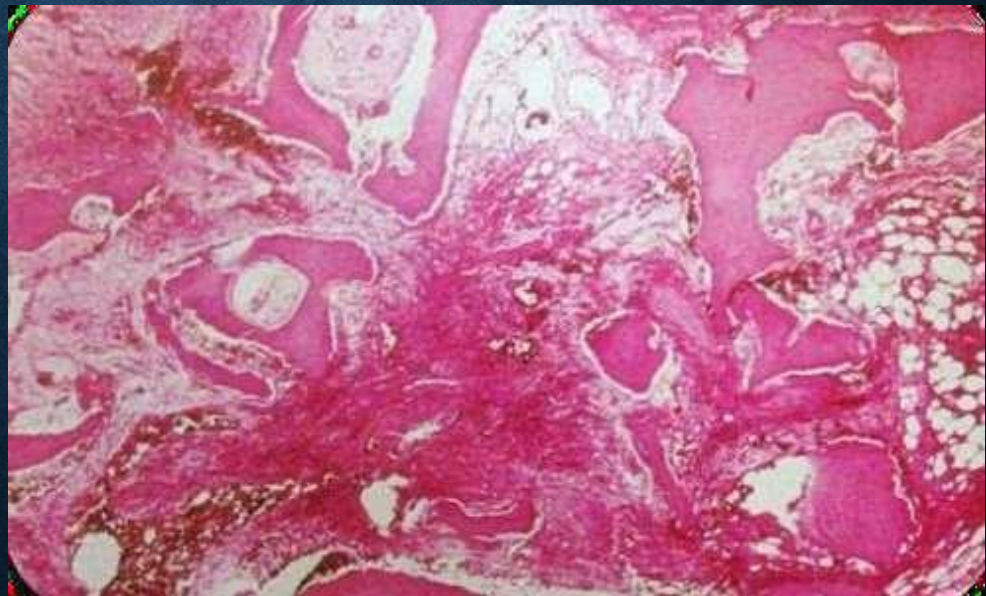
- Inadequately treated acute osteomyelitis
- Clinical features **similar to acute** forms but **milder**
- Acute exacerbations of chronic stage may occur
- **Fistulous tract** may form which open to surface



- **Radiological features**
- **Patchy, ragged** and ill defined **radiololucency**
- Often contain **radiopaque sequestrum**



- **Histologic features**
- **Inflammed connective tissue filling inter-trabacular areas of bone**
- **Scattered sequestra**
- **Pockets of abscess**



- **Treatment**
- **Difficulty to manage medically**
- **Surgical intervention is mandatory**
- **Antibiotics are same** as in acute condition but are given through **IV in high doses**

CHRONIC FOCAL SCLEROSING OSTEOMYELITIS (CONDENSING OSTEITIS)

- Unusual reaction of bone to infection
- Bony reaction to **low grade peri-apical infection** or unusually strong host defensive response
- High degree of tissue reaction and tissue reactivity



- **Clinical features**
- Commonly affects **young adults and children**
 - **Mandibular molar** is affected commonly
 - Symptoms : **mild pain** due to infected pulp
 - Tissues reacts to the infection by proliferation rather than destruction , since the infection **acts as a stimulus rather than a irritant**

- **Radiographic features**
- Pathognomonic , **well circumscribed radiopaque** mass of sclerotic bone surrounding and extending below the apex of one or both roots
- **PDL space widening** (distinguishes from cementoblastoma)



- **Histologic features**
- Dense bony trabeculae with little interstitial marrow tissue
- Many reversal and resting lines giving pagetoid appearance
- If interstitial soft tissue is present , it is generally fibrotic and infiltrated with small amount of lymphocytes
- Osteocystic lacunae appears empty

- **Treatment**
- **Elimination of the source** of inflammation by extraction or endodontic treatment.
- If lesion persists and periodontal membrane remains wide, reevaluation of endodontic therapy is considered.
- After resolution of lesion, inflammatory focus is termed as bone scar.

CHRONIC DIFFUSE SCLEROSING OSTEOMYELITIS

- In contrast to focal type , it may occur at **any age group** , **no gender predominance**
- **Common in edentulous mandible**
- Insidious in nature, no clinical indications of its presence
- Acute exacerbation can result in : vague pain , unpleasant taste , mild suppuration , many times drainage through fistulous tract

- **Radiographic features**
- **Cotton wool appearance**
- **Indistinct borders because of its diffuse nature**
- **Mimic Paget's disease or fibro osseous proliferation**



- Dense, irregular trabeculae of bone bordered by active Layer of Osteoblasts; focal Osteoclastic area may be present
- **Mosaic pattern** appearance
- Interstitial soft tissue is fibrotic
- **Proliferating fibroblasts** and occasional small capillaries as well as small focal collection of lymphocytes and plasma cells



- **Treatment and prognosis**
- Lesion is too extensive to be removed surgically
- Sclerotic bone is hypovascular and **resistant to antibiotics**
- Extraction of tooth as a last option utilizing a surgical approach with *removal of liberal amounts of bone to facilitate extraction and increase bleeding.*
- Antibiotic administration during acute exacerbation may help

CHRONIC OSTEOMYELITIS WITH PROLIFERATIVE PERIOSTITIS (GARRES OSTEOMYELITIS)

- Distinctive type of chronic osteomyelitis in which there is **focal gross thickening of the periosteum**, with peripheral reactive bone formation resulting from mild reaction or infection

- **Clinical features**
- **Common : Children and young adults; Mandible ; especially in bicuspids and molars**
- **Toothache or pain in the jaws**
- **Bony hard swelling on the outer surface of jaw , which may last for several weeks**
- **May develop only due to dental infection but also from soft tissue infection or cellulitis**

- **Radiographic features**
- **ONION PEEL APPEARANCE** : Focal overgrowth of bone on the outer surface of cortex ,which may be described as duplication of the cortical layer of bone
- IOPA often reveals a carious tooth opposite to bony hard mass
- This mass of bone is smooth rather well calcified which itself shows a thin but definite cortical layer



Garre's osteomyelitis

- **Histologic features**

- Supracortical but subperiosteal mass is composed of much reactive new bone and osteoid tissue, with Osteoblasts bordering many of trabeculae
- Trabeculae is perpendicular to cortex and parallel to each other
- Connective tissue is fibrous and shows sprinkling of lymphocytes and plasma cells



- **Treatment and prognosis**
- **Extraction or endodontic treatment** of the teeth
- **No surgical intervention** except biopsy to confirm diagnosis
- **After extraction the jaws undergo remodeling and facial symmetry is restored**
- **Neoperiostitis or new periosteum formation may occur in certain conditions.**