Why is a tissue radiopaque?

- A tissue is radiopaque because it hinders the unrestricted passage of x-rays.
- On exposed and developed radiographs, they appear as light or white, depending upon the differential absorption of rays. This differential absorption depends upon the thickness or density of the tissue/object.

Classification based on Radiopacity –

A. Completely Radiopaque –

- Unerupted teeth
- Foreign bodies
- Hypercementosis
- Tori, Exostosis, and Peripheral Osteomas
- Root tips
- Mucosal Cyst of the Maxillary sinus
- Sialoliths
- Rhinoliths
- Calcified Lymph nodes
- Phleboliths
- Osteopetrosis / Marble bone disease

B. Mixed Varieties –

- Condensing osteitis
- Periapical idiopathic Osteosclerosis
- Periapical Cemento-ossifying Dysplasia (PCOD) or Focal Cemento-ossifying Dysplasia (FCOD)
- Fibrous Dysplasia
- Focal Sclerosing Osteomyelitis
- Diffuse Sclerosing Osteomyelitis
- Proliferative Osteomyelitis
- (Mature) Complex Odontoma
- Ossifying Subperiosteal Hematoma
- florid Cemento-ossifying Dysplasia (FLCOD)
- Paget's Disease
- Cementoblastoma

Classification based on number –

A. Single Radiopacities –

- Condensing osteitis
- PCOD & FCOD

- Hypercementosis
- Tori, Exostosis, & Peripheral Osteoma
- Mucosal Cyst of the maxillary Sinus
- Sialolith, Rhinolith, and Antrolith
- Fibrous Dysplasia
- Osteomyelitis
- Complex Odontoma

Classification based on Location –

A. Radiopacities of Jaws only –

- Condensing Osteitis
- PCOD & FCOD
- Hypercementosis
- Mucosal cyst of the Maxillary sinus
- Complex Odontoma
- FLCOD

B. Generalized –

- Fibrous Dysplasia

- Paget's Disease
- Osteomyelitis
- Osteopetrosis

CONDENSING OSTEITIS –

- Condensing or sclerosing osteitis is a sclerosis of bone induced by an inflammation or infection that most often occurs as a pulpo-periapical lesion.
- The reaction in this lesion is a proliferation of bone tissue and is produced by extension of inflammation to the periapical area.
- Majority of lesions are found in the mandible in the I molar and premolar region and 50% cases are under 30 years of age.

- Radiographically, the image varies in size, contour, shape, and margins.

- Differential diagnosis includes –

  – Hypercementosis – it is an integral part of the tooth root and is usually completely separated from the periapical bone by the shadow of the PDL.

  – Idiopathic sclerosing osteitis – the pulp is usually vital which is not the case in condensing osteitis.

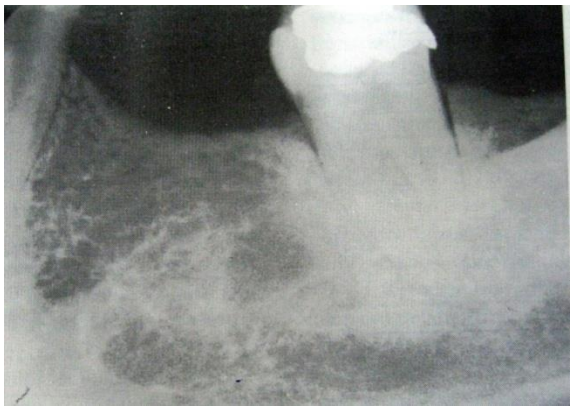
  – PCOD & FCOD – usually has a thin, uniform radiolucent rim in the mature stage. Also it is more common in women over the age of 30 years.

PERIAPICAL IDIOPATHIC OSTEOSCLEROSIS –

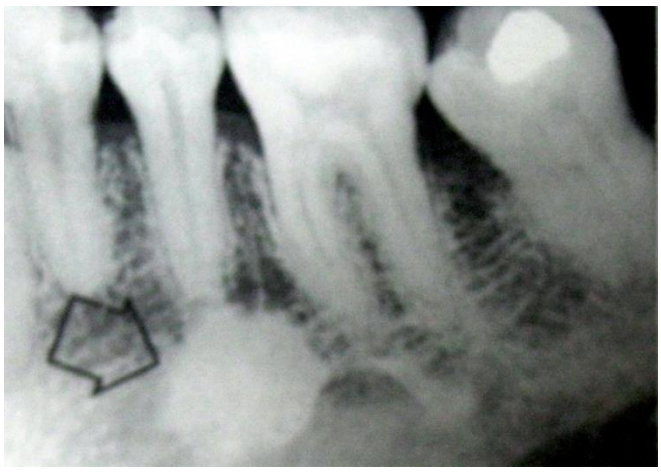
- Also k/a Enostosis, dense bone island, bone whorls, bone eburnation.
- It is second only to condensing osteitis as the most common periapical radiopacity.
- The lesion is most commonly encountered in the periapex of the mandibular premolar and molar teeth.

Radiographic Features –

- Location –
  - More common in the mandible than in the maxilla.
  - Most commonly located in the premolar and molar regions.
- Periphery –
  - Usually well defined but occasionally blends with the trabeculae of the adjacent bone.
  - There is no trace of radiolucent margin or capsule as the radiopaque bone island abuts directly against normal bone.



- Internal Structure –
  - Homogenously radiopaque.
- Effect on surrounding structures –
  - May be associated with root resorption if located around the apex.
  - In extremely rare cases it may inhibit the eruption of a tooth and even displace a tooth.
- Periapical idiopathic osteosclerosis should be differentiated from the dense trabecular pattern produced due to heavy occlusal stresses.
- The basic difference is the location as the dense bone pattern in occlusal stresses is seen around the entire root surface towards which the force is acting where as Periapical idiopathic osteosclerosis is at the apex.



- Differential diagnosis should also include –
  - Hypercementosis
  - PCOD & FCOD – usually are well defined and as previously mentioned would usually have a well defined radiolucent rim surrounding the periphery.
  - Condensing osteitis- it closely resembles Periapical idiopathic osteosclerosis in clinical, radiographic and histologic features. But Periapical idiopathic osteosclerosis is found in healthy teeth with vital pulp where as condensing osteitis is associated with an infected or non-vital pulp.

PERIAPICAL CEMENTO-OSSIFYIND DYSPLASIA (PCOD) –

- PCOD is a localized change in normal bone metabolism resulting in the replacement of normal cancellous bone with fibrous and cementum like material.
- 90% lesions occur in mandible with majority in the anterior region and 80% in females. It has a definite predilection for blacks.
- The involved teeth are vital.

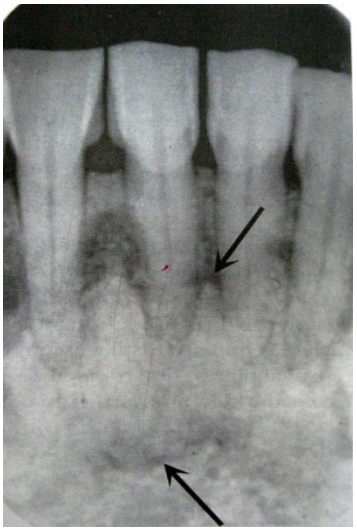
Radiographic features –

- Location –
  - Epicenter usually lies at the apex of a tooth.
  - It has a predilection for the mandibular anterior teeth.

- Most cases the lesion is multiple and bilateral although single lesions may arise as well.
- In some cases, it may be present without the association with a tooth, in cases where an extraction has been done and remnants of the PDL remain – *cemental dysplasia*.

- Periphery and Shape –
  - The periphery is usually well defined having a regular round to oval shape centered over the apex, though irregular shaped varieties are also seen.
- Internal structure –
  - It progresses from an initial radiolucent lesion to a intermediate mixed radiodensity lesion.
  - In the mature stage, the internal aspect may be totally radiopaque without any obvious pattern.

- Usually a thin radiolucent margin can be seen at the periphery (as the lesion matures from its center outwards).



- Effect on surrounding structures –
  - The lamina dura is lost making the PDL space appear wider.
  - Tooth structure is not usually affected though in some cases root resorption may be seen.
  - Larger lesions may cause expansion of the jaw, an area that is always bordered by a thin, intact cortex.
  - Large lesions may cause elevation of the floor of maxillary sinus.
- Differential diagnosis – in the mature stage PCOD must be differentiated from –
  - Hypercementosis – this would show that the radiopaque mass is in a part of the tooth and that it is surrounded by a radiolucent PDL space around the entire root.

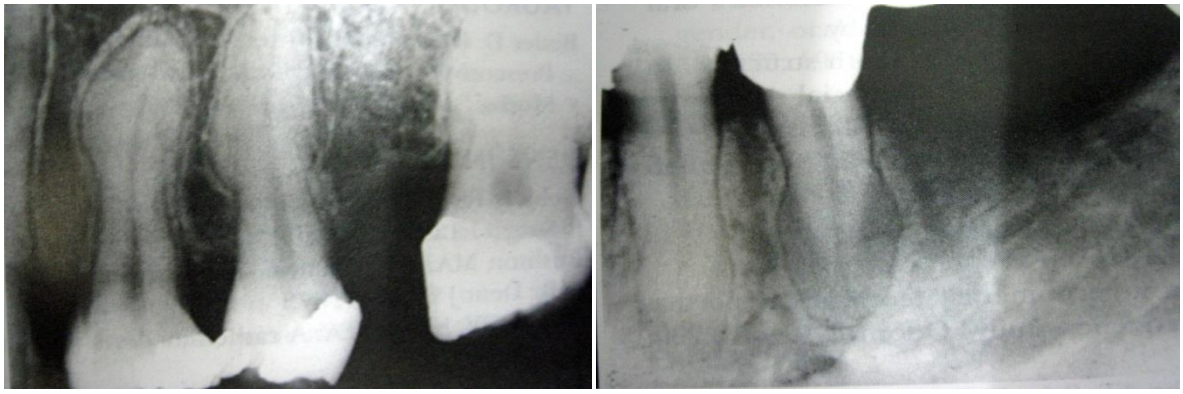
- Condensing osteitis – is associated with a non vital tooth and also does not have a radiolucent rim around it.

- Cementoblastoma – almost exclusively occurs in the premolar and molar teeth, whereas PCOD is usually found in the anterior teeth.

- Periapical idiopathic osteosclerosis – as both occur in vital teeth, the differentiation can be quite difficult. Periapical idiopathic osteosclerosis has a irregular shape and is usually seen in the younger age group where as PCOD has a more regular shape and is seen above the ages of 30 years. Also the radiolucent rim surrounding the PCOD is a key differentiating feature.

HYPERCEMENTOSIS –

- Hypercementosis, according to Stafne is *'excessive formation of cementum on the surface of the root of the tooth.'*
- Premolars are most commonly affected teeth.
- Only one root, or multiple roots may be involved.
- Radiographically –
    - The altered shape of the root is apparent and a isolated nodule or characteristic club shaped appearance can be seen.



- Differential diagnosis –
    - It can be easily differentiated from other lesions such as condensing osteitis, PCOD, idiopathic sclerosing osteitis as has been mentioned before.

<u>TORI, EXOSTOSES –</u>

TORUS PALATINUS –

- It is a bony protuberance that occurs in the hard palate.
- It is the most common of all exostoses and occurs in about 20% of the population and is more common in females.

Radiographic Features –

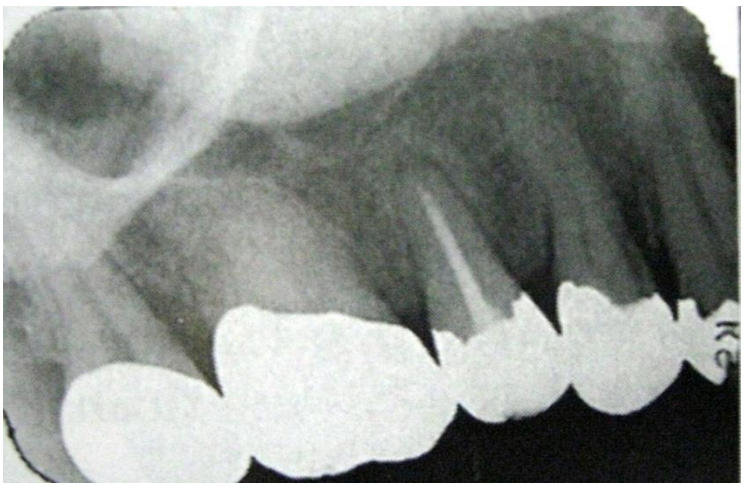
- Location –
    - Seen on the maxillary periapical radiographs or panoramic radiographs, as a dense radiopaque shadow below and attached to the hard palate.
    - It may be superimposed over the apical areas of the maxillary teeth.

- Periphery and Shape –

  – The borders are usually well defined and may have a lobulated appearance.

- Internal Structure –

  – Is homogenously radiopaque.

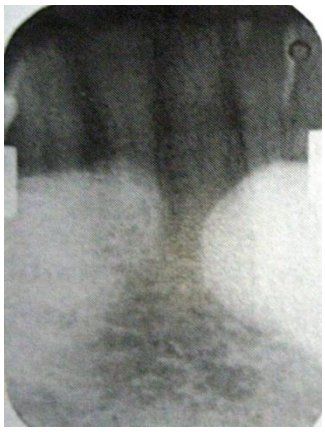


TORUS MANDIBULARIS –

- It is a hyperostosis that protrudes from the lingual aspect of the mandibular alveolar process, usually near the premolar teeth.
- Has an overall incidence of about 8%.
- It has a variable size ranging from one which is just palpable to one which grows large enough to cross the midline.

Radiographic Features –

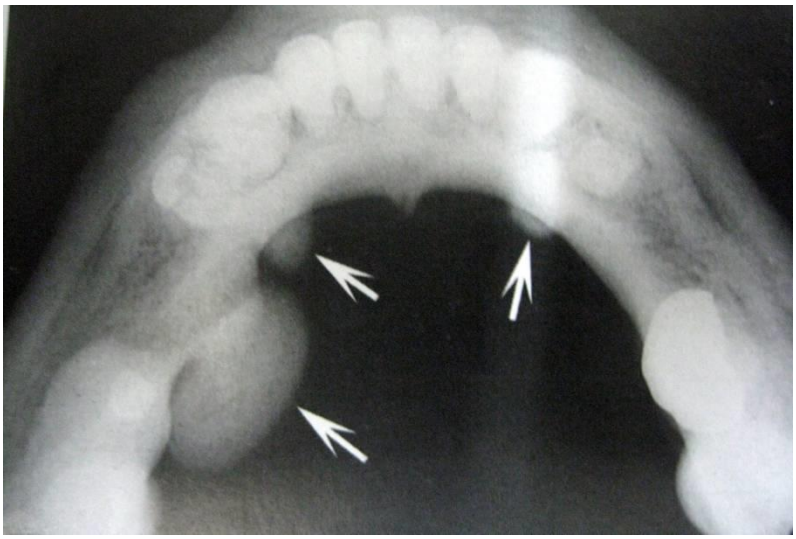
- Location –
  - They may be present unilaterally or bilaterally.
  - On mandibular periapical radiographs, it appears as a radiopaque shadow usually superimposed over the roots of the teeth.
- Periphery –
  - Mandibular tori are sharply demarcated anteriorly and less dense and poorly defined as they extend posteriorly.



- There is no margin between the periphery of the torus and the surface of the mandible as they are continuous with mandibular cortex.

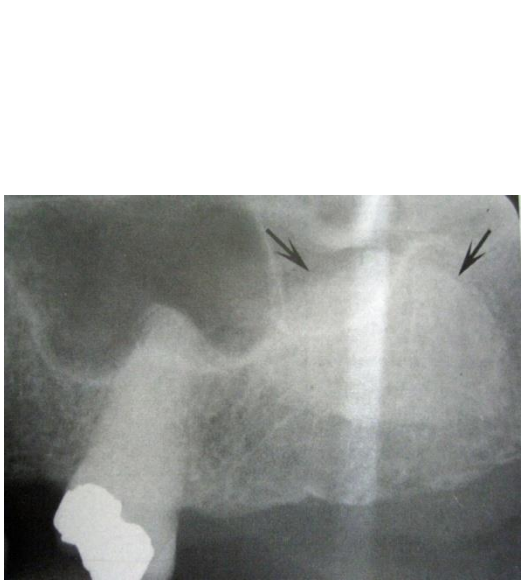
- Internal structure –

  - On occlusal radiographs, they appear as radiopaque and homogenous.



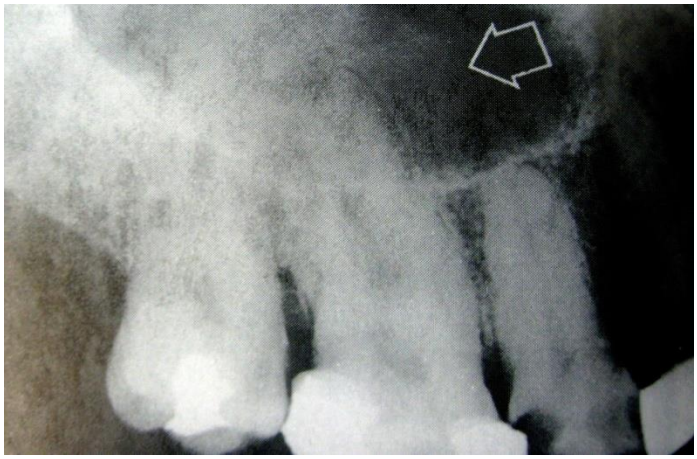
EXOSTOSES – (Hyperostoses)

- They develop most commonly on the buccal surface of the maxillary alveolar process, usually in the canine or molar region.
- Exostoses are less common than the tori previously mentioned and may grow to a large size. They may be single or multiple.
- Radiographic features are similar to that of the tori.



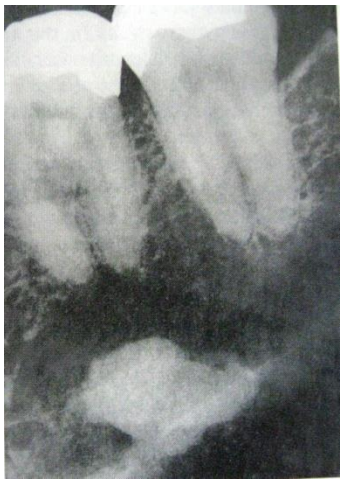
MUCOSAL CYST OF THE MAXILLARY SINUS -

- It is a retention cyst in the lining mucosa of the maxillary sinus.
- It occurs in about 2% of the population.
- The cyst is usually symptomless but sometimes may produce symptoms similar to those seen sinusitis.
- Radiographically it appears a relatively dense, dome shaped mass with its base on the floor of the maxillary sinus.



SIALOLITHS –

- Sialoliths are calcified deposits present in the ducts of salivary glands or within the glands themselves.
- 80% of the sialoliths are found in the submandibular salivary gland and 10-15% in the parotid with the sublingual gland accounting for about 1%.
- Sialoliths of the submandibular salivary gland may be visualized on periapical radiographs, they are best visualized on occlusal, lateral oblique, or panoramic radiographs.



- In the parotid, they may superimpose over the maxillary molars or the posterior maxillary alveoli.
- Differential diagnosis should include –
    - Phlebolith – may occur in the floor of the mouth and is always accompanied by a clinically discernible varicosity. If no sialoadenitis is present, the diagnosis of phlebolith is favored.

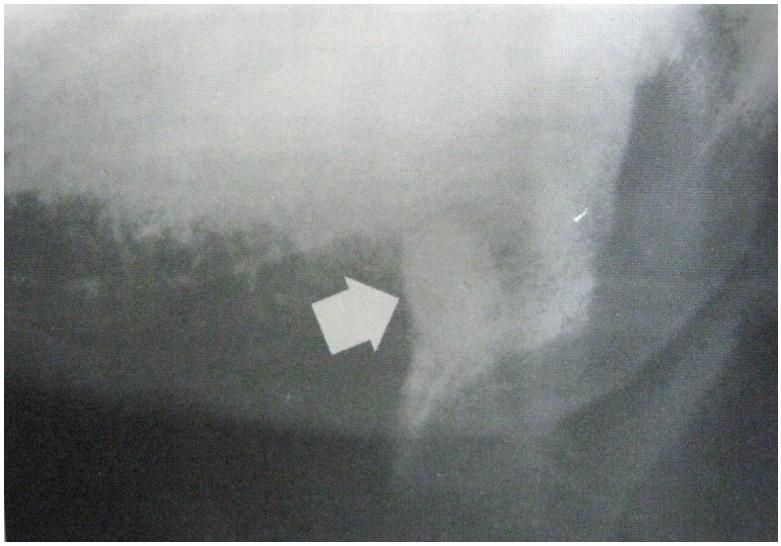
- Foreign body – differentiated by its characteristic shape and history of trauma incident to that region.

- Avulsed tooth – lying in the soft tissue is recognized by its shape and relative density.

- Calcified submandibular lymph node – firstly, the incidence of sialoliths is greater than calcified lymph nodes. Rarely would a calcified lymph node have accompanying symptoms of sialoadenitis as it represents an old, burned out, asymptomatic lesion. Bimanual palpation of the swelling should demarcate wether the firm mass is within the gland or not.

CALCIFIED LYMPH NODES –

- These occur in the cervical and submandibular region.
- Majority are calcified tuberculous lymph nodes.
- On radiographs, a single, round-oval, or linear calcified mass may be seen.
- Frequently the outlines are well contoured and well defined.
- Differential diagnosis needs to be made in respect to a Sialolith which has been discussed earlier.
- Also a history of tuberculosis would push d diagnosis in favor of calcified lymph nodes.



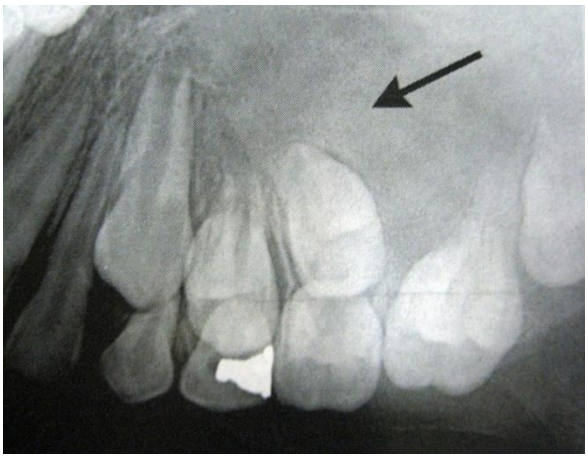
FIBROUS DYSPLASIA –

- Fibrous dysplasia results from a localized change in the normal bone metabolism that leads to the replacement of all the components of cancellous bone by fibrous tissue containing varying amounts of abnormal-appearing bone.
- Fibrous dysplasia may be solitary or multiple (jaffe type) or associated with McCune Albright'syndrome.
- In the jaws, the solitary type is the most common variety encountered.
- It is more common in the maxilla as compared to the mandible with a ratio of 2:1 and is usually unilateral being more common in the posterior regions.
- It usually occurs in children and the younger age group.

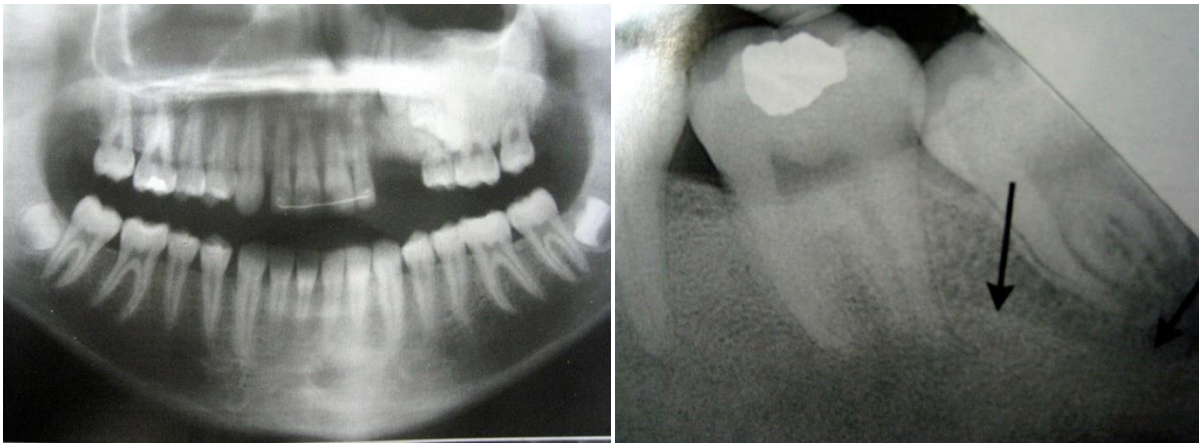
Radiographic Features –

Periphery –

- Most commonly is ill-defined with a gradual blending of normal trabecular pattern bone into abnormal trabecular pattern of fibrous dysplasia.



- Though it may be sharply defined and even well corticated as seen sometimes in young patients.

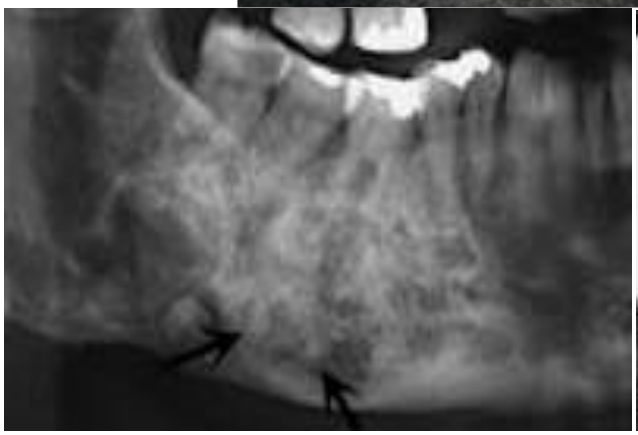


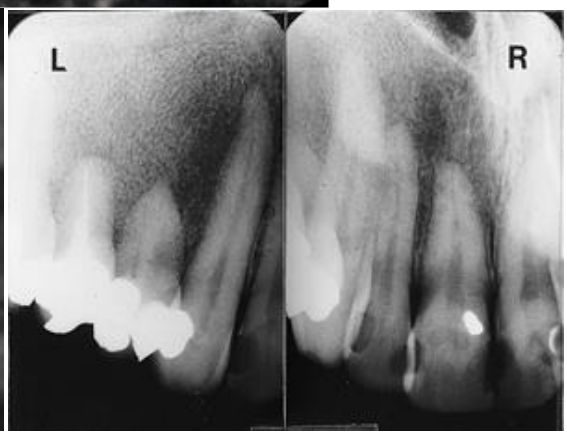
- Internal Structure –
  - The variation of the internal trabecular pattern is more apparent in the mandibular lesions with lesions in the maxilla being more homogenous.
  - Early lesions may be more radiolucent than mature lesions.

– The abnormal trabeculae are usually shorter, thinner, irregularly shaped and more numerous than normal trabeculae.

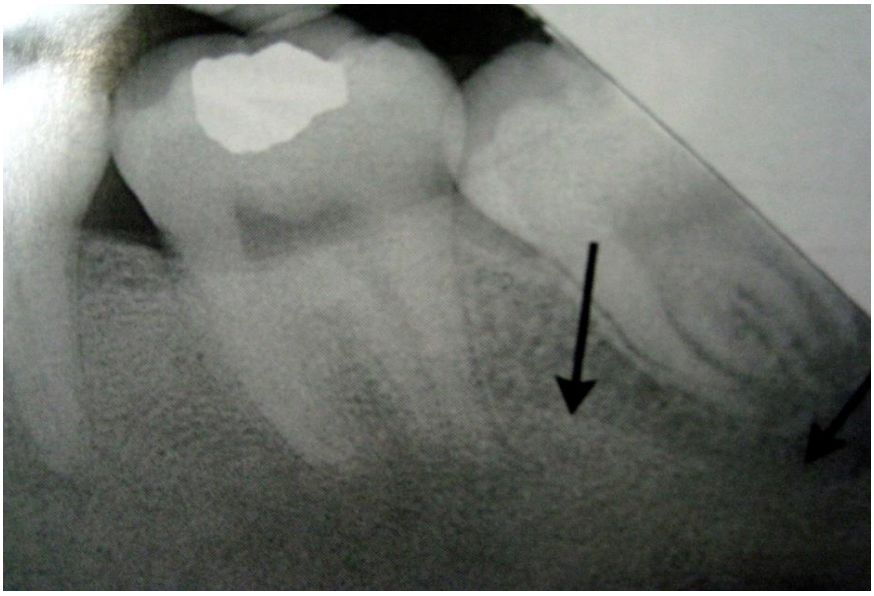
– This creates a radiopaque pattern that can vary:

– It may have a granular, ‘Ground Glass’ appearance resembling the appearance of a shattered car windshield, a pattern resembling the surface of an orange, ‘ Orange peel’ / peau d’orange appearance, a wispy arrangement, ‘cotton wool’ or an amorphous dense pattern.





- A distinct characteristic is the organization of the trabeculae in to a swirling pattern similar to a fingerprint.



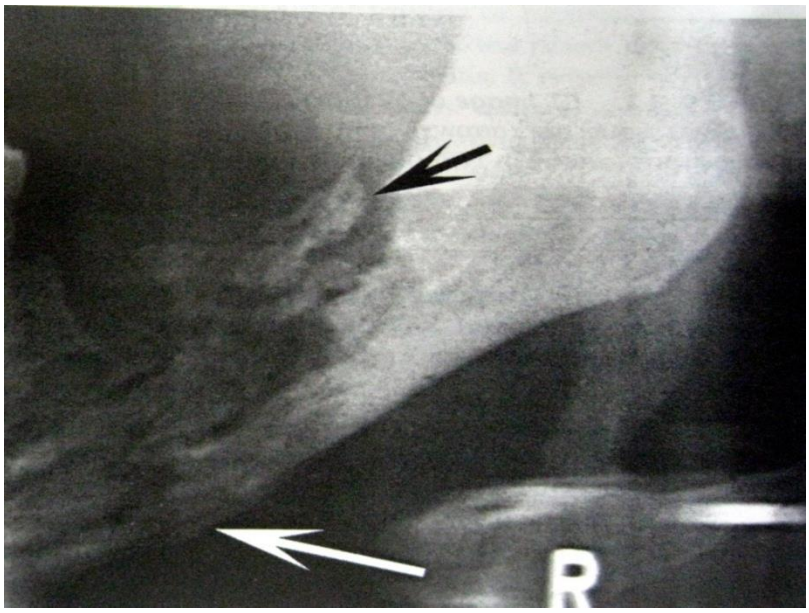
- Effect on surrounding Structures –
  - There is expansion with maintenance of thinned outer cortex.
  - It may expand in to the antrum by displacing its cortical boundary and subsequently occupying part or most of the antral space.
  - Often the bone surrounding the teeth is altered without affecting the dentition, and the lamina dura also disappears as it is also changed to abnormal bone.
  - It may displace the teeth or interfere with normal eruption.
  - Root resorption may occur in rare cases.
  - Fibrous dysplasia may displace the inferior alveolar canal in a superior direction.

- Differential diagnosis –
  - Hyperparathyroidism – similar bone pattern may be produced but will be bilateral and unlike fibrous dysplasia do not cause bone expansion.
  - Paget's Disease – may produce a similar bone pattern with expansion of the bone, but it occurs in a much older age group and is more generalized as compared to the usual unilateral variety of fibrous dysplasia.
  - Osteomyelitis – like fibrous dysplasia it may result in enlargement of the jaws, but the bone laid down in osteomyelitis is because of a periosteal reaction and is laid down on the outer aspect of the cortical bone, thereby consuming the cortical bone within the lesion which can be seen on careful examination.
  - While fibrous dysplasia expands the internal aspect of bone thereby thinning and pushing out the cortical layer. Also the identification of sequestra aids in identification of osteomyelitis.
  - Osteogenic Sarcoma – may produce a similar bone pattern as to fibrous dysplasia but can be readily differentiated by showing the malignant radiologic features.

Radiographic Features –

- Location –
  - The most common site is the posterior mandible.

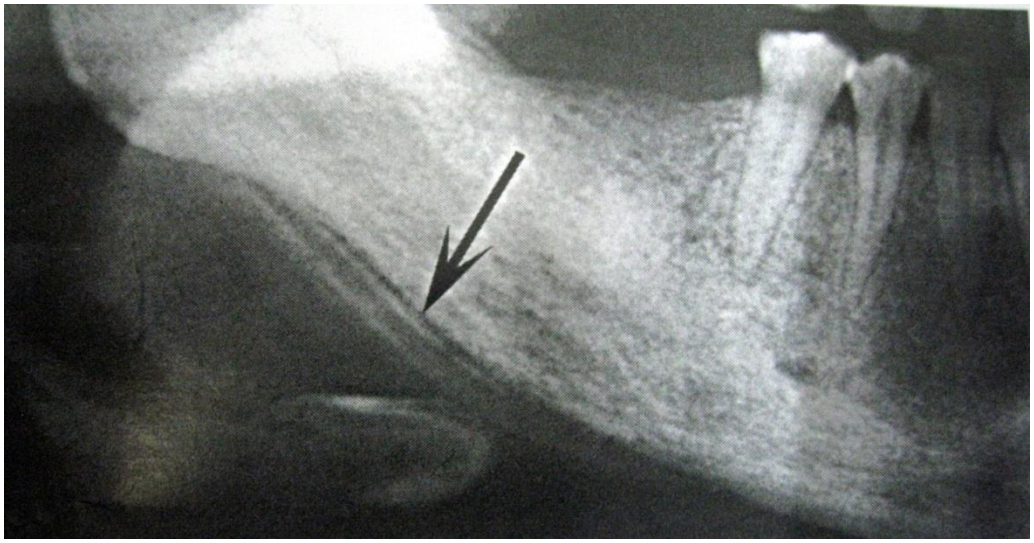
- Periphery –
  - It is poorly defined but better defined than the acute phase, though its still difficult to determine the exact extent of chronic osteomyelitis.
    - A gradual transition is seen between the normal trabecular pattern and the dense granular, characteristic bone pattern of chronic osteomyelitis.
  - Internal Structure –
    - Most of the lesion is usually composed of sclerotic or radiopaque bone pattern.
    - In more chronic cases, the bone density may be exceedingly radiopaque and similar to cortical bone.
  - In some cases, small areas of radioluscency may be scattered throughout the radiopaque bone.



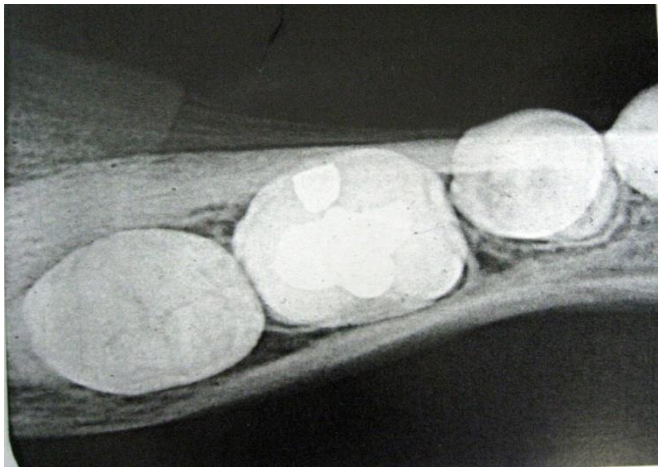
– On close inspection of these radiolucent areas may show the presence of small island or sequestra of bone within them.

– Often the sequestra appear more radiopaque than surrounding bone.

– A periosteal reaction may stimulate new bone formation which takes place on the outer aspect of the cortical bone. This appears as a thin, faint, radiopaque line adjacent to and almost parallel to the surface of the cortical bone.

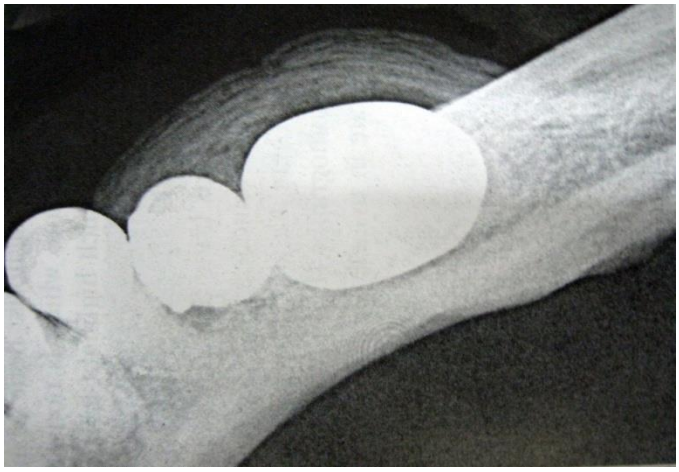


– In the chronic phase, periodic acute exacerbations may produce more inflammatory exudate which again leads to a periosteal reaction and bone formation.

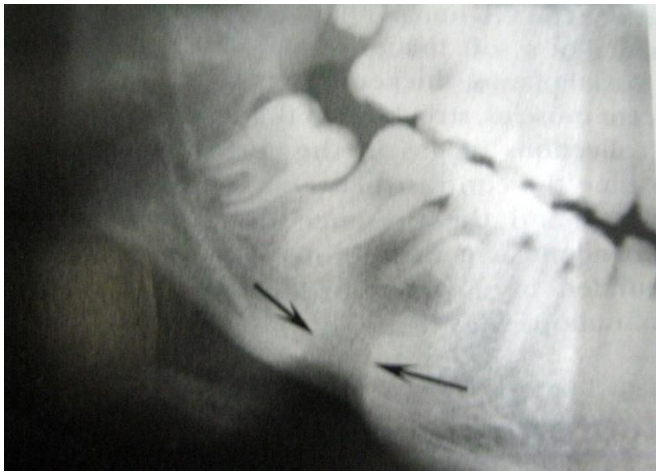


– This is detected radiographically as a radiopaque line separated by a thin parallel radiolucent line. As this process is repeated over again a typical onion peel appearance may form.

– This type is known as proliferative periosteitis.



- Effect on Surrounding structure –
  - The roots of teeth may undergo resorption and the lamina dura may become less apparent.
  - In extensive chronic osteomyelitis, the disease may slowly spread to the mandibular condyle and into the joint, resulting in septic arthiritis.
  - Further spread may involve the ear and the mastoid air cells.
  - Chronic lesions may develop a draining fistula which may appear as a well defined break in the outer cortex or the periosteal new bone.

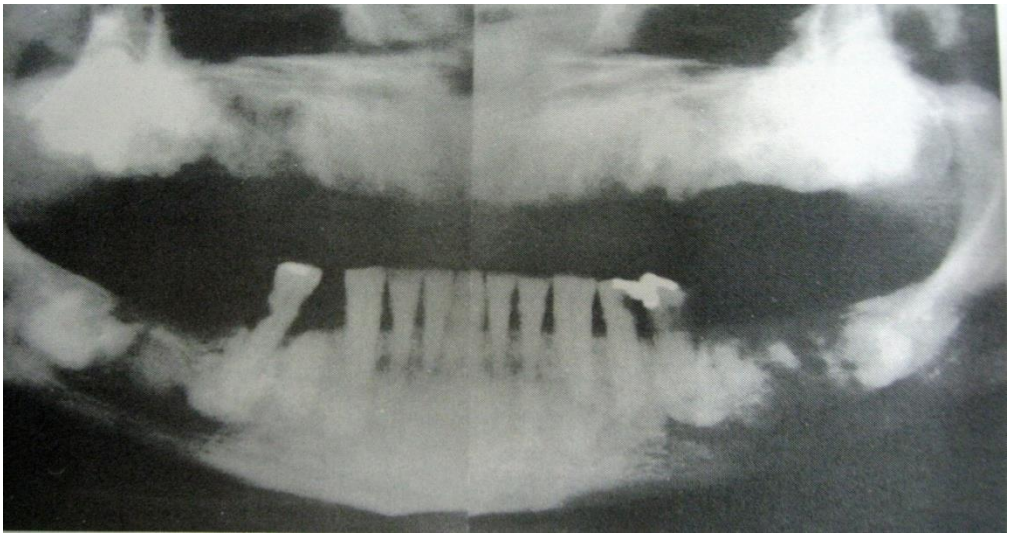


- Differential Diagnosis –
  - Fibrous dysplasia – osteomyelitis in children with a proliferative periosteal reaction or chronic osteomyelitis may mimic fibrous dysplasia. The differentiation has been explained in fibrous dysplasia by examination of the most peripheral portion of the expanded bone.

- Paget's Disease – it affects the entire mandible unlike osteomyelitis and there is no sequestra formation in Paget's disease which are found in chronic osteomyelitis.
- Osteosarcoma – may produce a dense, granular pattern of bone appearance, but like other osseous malignancies, would also demonstrate evidence of bone destruction.

FLORID CEMENTOOSSEOUS DYSPASIA – (FLCOD)

- FLCOD is the most common cause of generalized pathologic radiopacity of the jaws.
- It usually involves multiple quadrants of the jaws.
- The lesions are basically restricted to tooth bearing areas of the jaws and are bilaterally symmetrical.
- Radiographs seem to demonstrate a pagetoid, cotton wool appearance with multiple irregularly shaped areas.



- On closer examination well defined radiolucent rims can be seen surrounding most of the radiopaque areas.
- The radiopaque patterns vary in size but are usually large and may be multiple or diffused and continuous throughout the tooth bearing regions.

- Differential diagnosis –
    - PCOD & FCOD – these are more common and have multiple small lesions, they do not cause any cortical plate expansion.
    - Chronic osteomyelitis – usually involves only one quadrant of the jaw, the radiopaque part is diffuse and the margins blend into normal bone.
    - Paget's Disease & Osteopetrosis – can be ruled out because of involvement of other bones of the skeleton.

PAGET'S DISEASE –

- Paget's Disease usually manifests at an older age group with the peak incidence being above 40 yrs of age.

Radiographic features –

- Location –
  - It occurs infrequently in the jaws as compared to other bones of the skeleton.
  - It affects the maxilla twice as much as the mandible.
  - There is a generalized involvement of the affected bone.
- Internal structure –
  - The internal structure in the third, primarily osteoblastic stage is mostly radiopaque patches of bone with few residual areas of radioluscency.
  - This appearance is k/a cotton wool appearance.

- Effect on surrounding structure –
    - Paget's disease always enlarges an affected bone irrespective of the stage.
    - In enlarged jaws the outer cortex may be thinned out but remains intact.
    - When in the maxilla, the sinus floor is invariably involved.
    - Hypercementosis may develop in few or all of the teeth of the involved jaw.
    - There might be displacement of the teeth in the jaw.
- Differential Diagnosis –
    - Fibrous dysplasia – occurs in a younger age group and is usually unilateral.
    - Metabolic diseases – the bone pattern in both might be similar but there is no bone enlargement in metabolic diseases.

OSTEOPETROSIS –

- Characterized by overgrowth and sclerosis of bone.
- There is a resultant thickening of the bony cortices and thinning of the marrow cavities.
- Radiographically – increased density of the entire skeleton, resulting in diffuse homogenous, symmetrically sclerotic appearance of all bones.
- There is encroachment and narrowing of the cranial foramina and vessels leading to compression.
- Greatly increased thickening of the trabeculae.
- The radiographic appearance of the lamina dura is lost in the overall density.

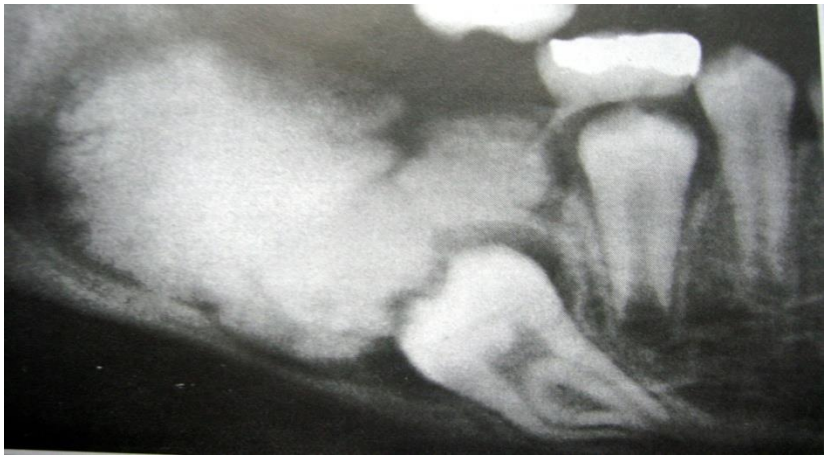
ODONTOMAS –

- The term odontoma is used to identify a tumor that is radiographically and histologically charecterized by the production of mature enamel, dentin, cementum and pulp tissue.
- They are the most common odontogenic tumor.
- Most odontomas are found in the second decade of life.

Radiographic Features –

- Location –
  - 62% of the compound Odontomas occur in the anterior maxilla in association with the crown of an unerupted canine.

- 70% of the complex Odontomas are found in the mandibular first and second molar areas.

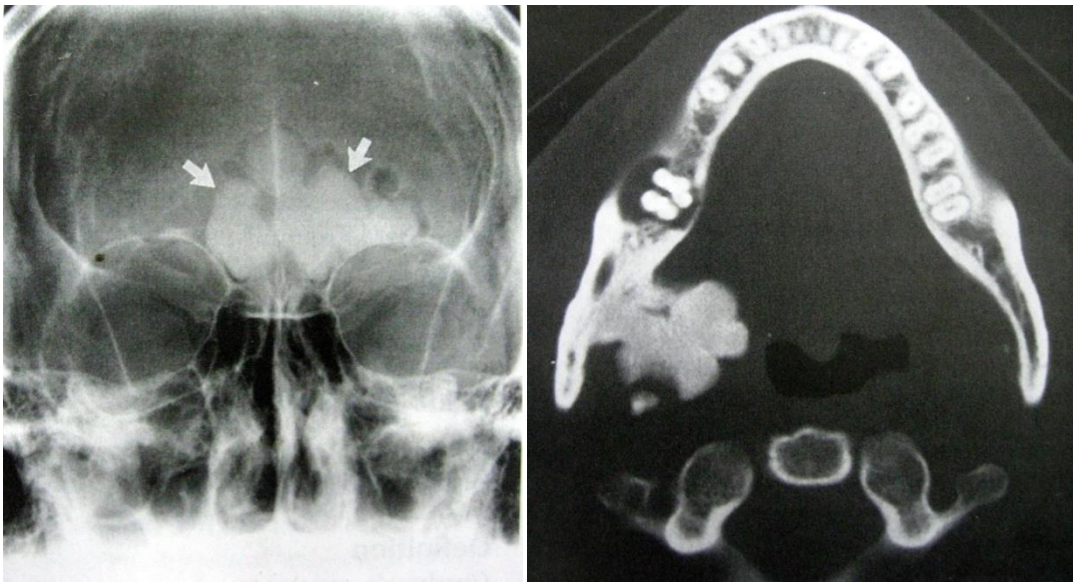


- Periphery –
  - The borders of odontomas are well defined and may be smooth or irregular.
  - These lesions have a cortical border and immediately inside or adjacent to the cortical border is a soft tissue capsule.

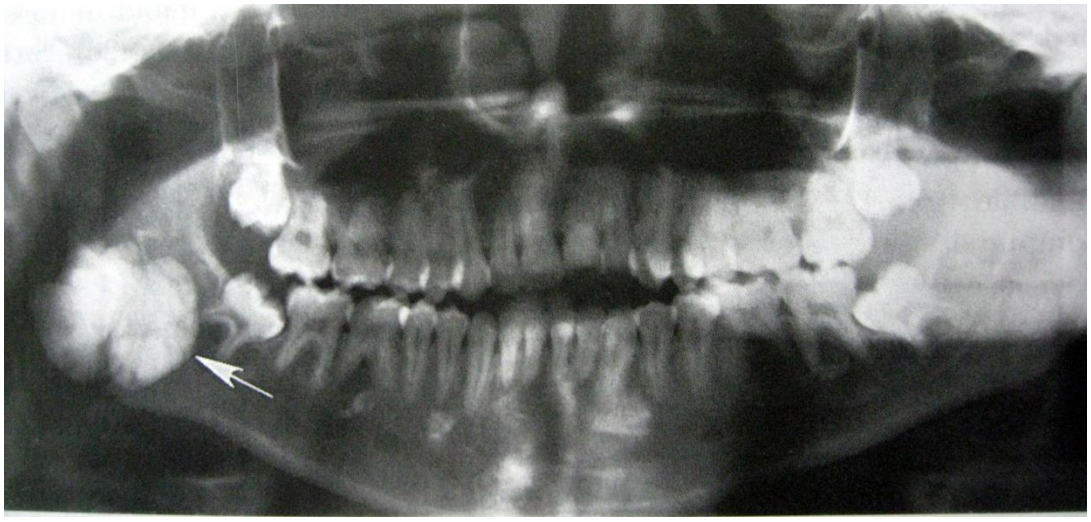
- Internal Structure –
  - Contents of these lesions are largely radiopaque.
  - Compound odontomas have a number of tooth like structures and look like deformed teeth.
  - Complex odontomas look like an irregular calcified mass.
  - The degree of radiopacity is similar to that of adjacent teeth.
- Effect on surrounding Structures –
  - They may interfere with the normal eruption of teeth.
  - Most odontomas are associated with abnormalities such as impactions, malpositioning, diastema, aplasia, malformation, and devitalization of adjacent teeth.
  - Large complex odontomas cause expansion of the jaw with maintenance of the cortical boundary.
- Differential diagnosis –
  - Cemento-ossifying fibroma – odontomas are associated with unerupted teeth and also the odontomas are more radiopaque than cemento-ossifying fibromas.
  - PCOD – usually are multiple and associated with the apical region. Also are more common in the mandibular anterior region.

OSTEOMAS –

- Osteomas can form from the membranous bones of the skull and face.
- This lesion may be solitary or multiple occurring in a single or multiple bones.



- Osteomas originate from the periosteum and may occur externally or within the paranasal sinuses though it is less common in the maxillary sinus.
- Osteomas most commonly occur in individuals older than 40 years of age.



Radiographic Features –

- Location –
  - The mandible is more commonly involved than the maxilla.
  - Osteomas are found most frequently on the posterior aspect of the mandible on the lingual side of the ramus or on the inferior mandibular border below the molars.
- Periphery –
  - Osteomas have well defined borders.
- Internal Structure –
  - Osteomas composed solely of compact bone are uniformly radiopaque, those containing cancellous bone show internal trabeculae.
- Effects on surrounding structure –
  - Large lesions can displace adjacent soft tissues such as muscles.
  - May cause expansion of the bone with an intact cortex.
- Differential diagnosis –
  - Small osteomas may be similar in appearance to a torus.
  - Osteomas involving the condylar head can be difficult to differentiate from osteochonromas, or condylar hyperplasia.

CEMENTOBLASTOMA –

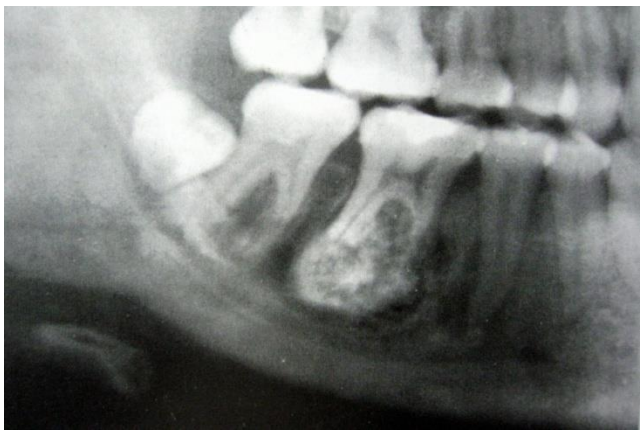
- These are slow growing mesenchymal neoplasms composed principally of cementum.
- It manifests as a bulbous growth at or attached to the apex.
- Most commonly occurs in permanent teeth and rarely in primary teeth.
- The lesion is more common in males than in females.
- Most patients are relatively young.
- The tumor is usually a solitary lesion which is slow growing and may eventually displace teeth.

Radiographic Features –

- Location –
    - More common in the mandible (78%) and more on a premolar or molar (90%).

- Periphery –
  - The lesion is a well defined radiopacity with a cortical border and then a well defined radiolucent band just inside the cortical border.

- Internal Structure –
  - These are mixed lesions in which the majority of the internal structure is radiopaque.
  - The resulting pattern may have a ‘wheel spoke’ pattern.
  - The radiolucent band on the periphery indicates that the lesion matures from the central aspect to the periphery.



- Effect on surrounding structure –
  - In most cases various amounts of external resorption can be seen.
  - If large enough, may cause expansion of the mandible but with an intact cortex.
- Differential Diagnosis –
  - PCOD – the radiolucent band around the cementoblastoma is usually better defined and more uniform. Also in the first molar region, cementoblastoma has a more rounded shape. The PCOD has a predilection for the mandibular anterior teeth as compared to the cementoblastoma which usually is found on the mandibular posterior teeth.
  - Condensing Osteitis & Enostosis – absence of soft tissue capsule surrounding the radiopacity.
  - Hypercementosis – surrounded by PDL space which is usually thinner than the soft tissue capsule surrounding the cementoblastoma. Also there is no root resorption or jaw expansion with hypercementosis.

PULP CALCIFICATIONS –

Pulp Stones –

- Pulp stones are foci of calcifications in the dental pulp.
- Microscopically they are apparent in more than half the teeth of young people and in almost all teeth of older individuals.
- Some may be as large as 2-3 mm, filling the entire pulp chamber.
- These are the ones which are most apparent radiographically.

Radiographic Features –

- There appearance is quite variable.
- They may be seen as radiopaque structures within pulp chambers or root canals or extending from the pulp chamber into the root canals.

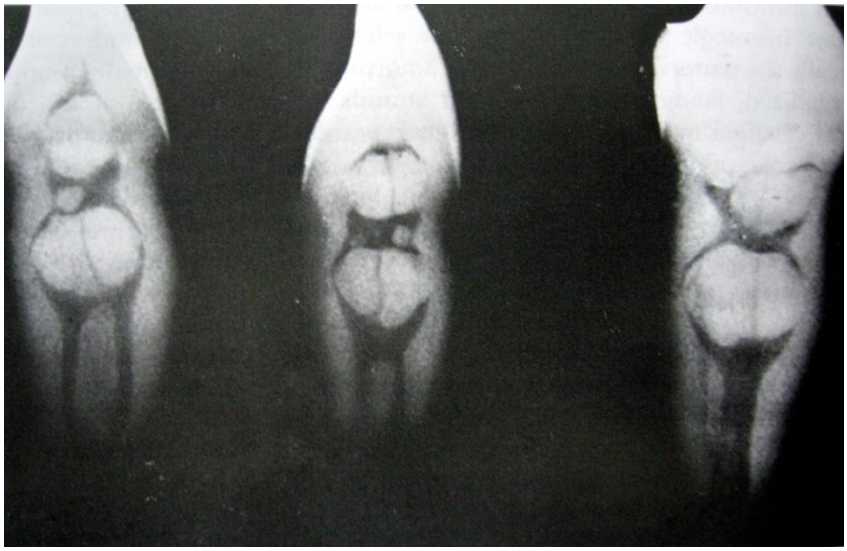
- They may appear as single dense masses or several small radiopacities.
- They occur in all teeth but are most common in the molars.

Differential Diagnosis –

- Pulp stones need to be

  differentiated from

  pulpal scerosis.

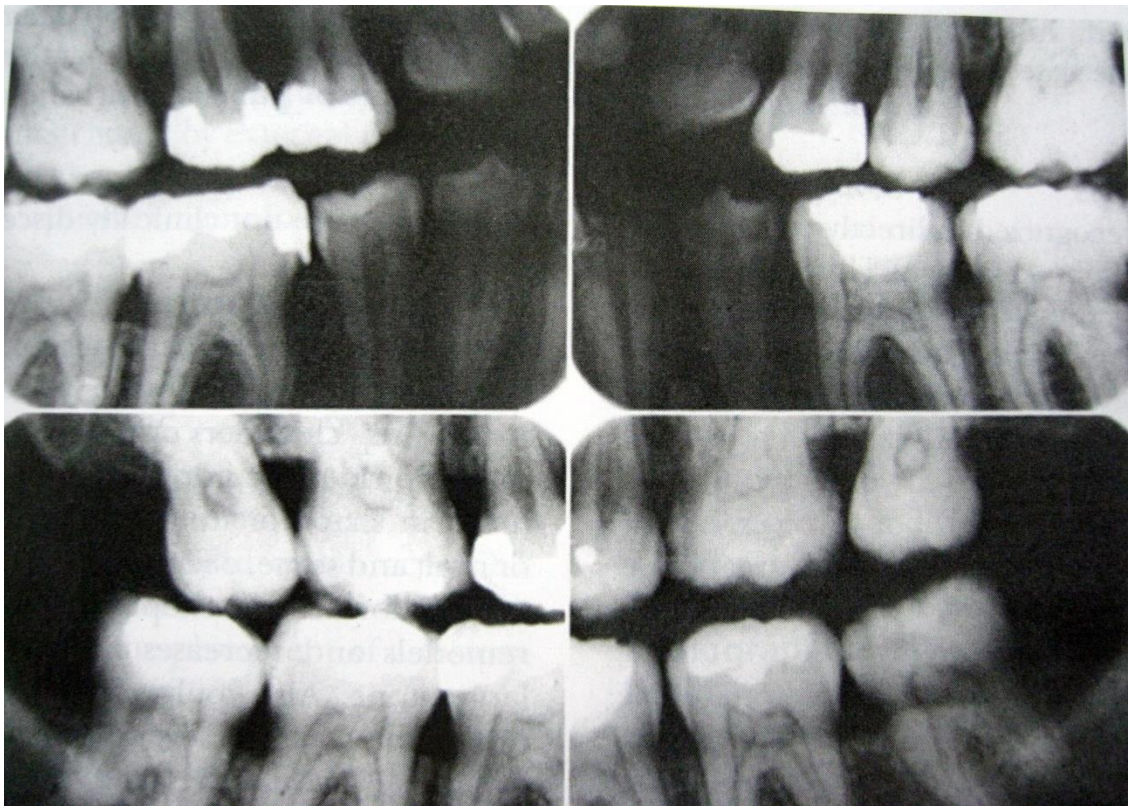


Pulpal Sclerosis –

- It is another form of calcification in the pulp chamber and canals of the teeth.
- In contrast to the pulp stones, it is a diffuse process with an unknown cause.
- 90% of all teeth of individuals between 50 and 70 years show histological evidence of pulpal sclerosis.

Radiographic features –

- Early pulpal sclerosis is a degenerative process not radiographically demonstrable.
- Diffuse pulpal sclerosis produces a generalized, ill-defined collection of fine radiopacities throughout large areas of the pulp chamber and pulp canals.



HETEROTOPIC CALCIFICATIONS –

- The deposition of calcium salts, particularly calcium phosphate in an unorganized fashion in the soft tissues is known as *heterotopic calcifications.*
- They can be divided into three categories –
  - Dystrophic calcification
  - Idiopathic calcifications
  - Metastatic calcifications
- Dystrophic calcifications – these are calcifications that develop in degenerating, diseased, and dead tissue despite normal serum levels of calcium and phosphates.
  - Calcified lymph nodes
  - Tonsiloliths
  - Cysticercosis
  - Monckeberg's Medial Calcinosis (Arteriosclerosis)
- Idiopathic Calcifications – results from deposition of calcium in normal tissue despite normal serum levels of calcium and phosphorus.
  - Sialoliths
  - Phleboliths
  - Rhinolith / Antrolith

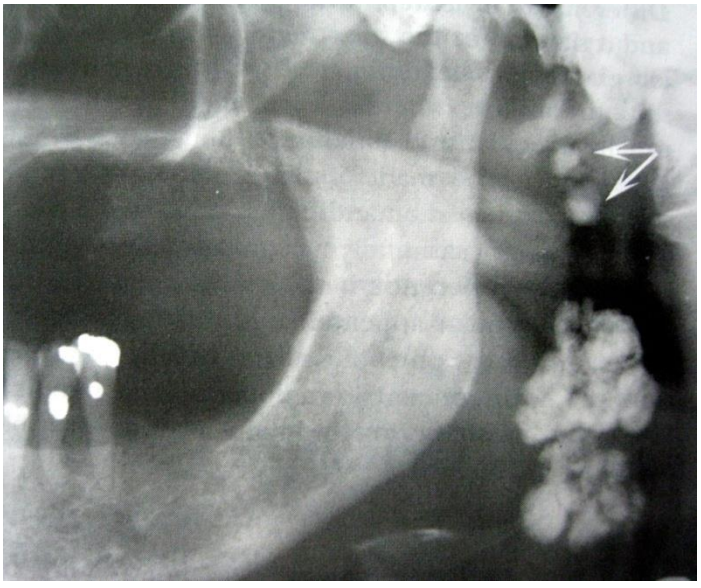
- Metastatic Calcifications – these result when minerals precipitate into normal tissue as a result of higher than normal serum levels of calcium and phosphates. These are usually bilateral and symmetrical.
  - Osteoma cutis
  - Myositis ossificans

TONSILOLITH –

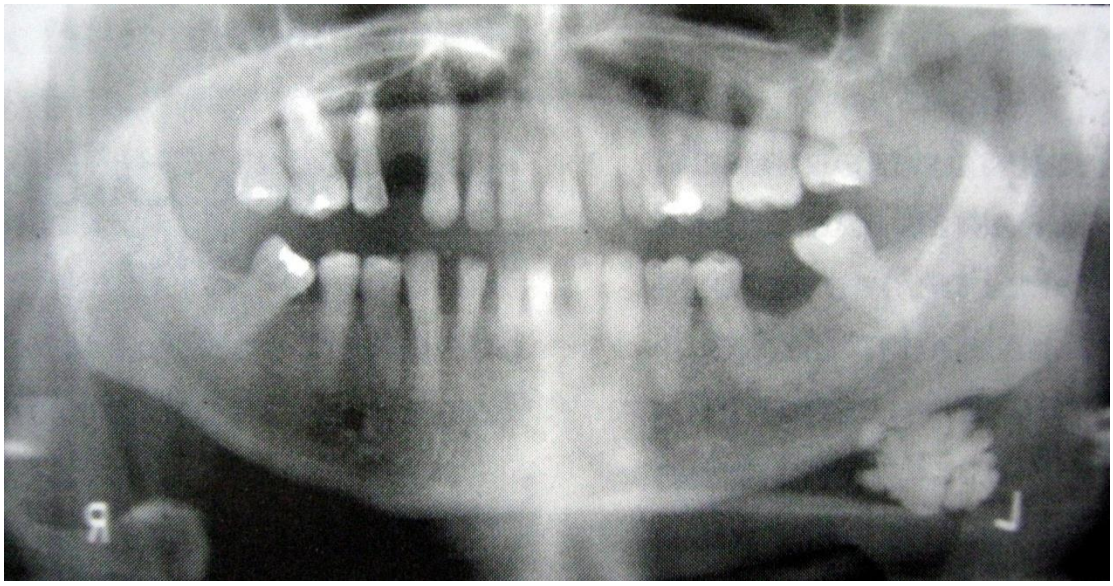
- These are formed when repeated bouts of inflammation enlarge the tonsillar crypts.
- Incomplete resolution of dead bacteria and pus serve as the nidus for dystrophic calcification.
- More common in the older age group.

Radiographic Features –

- Location –
  - On panoramic radiographs, they appear as single or multiple radiopacities that overlap the mid portions of the ramus where the image of the dorsal surface of the tongue crosses the ramus in the palatoglossal or glossopharyngeal air spaces.
- Periphery –
  - Most common appearance is a cluster of multiple small, ill-defined radiopacities.



- Internal Structure –
    - The radiopacity is slightly more than cancellous bone and similar to that of cortical bone.



- Differential Diagnosis –
    - The radiographic differential diagnosis is a radiopaque lesion within the mandibular ramus, such as a dense bone island.
    - To differentiate, a right angle view such as PA skull view or a open mouth Towne's view may show the calcification lying medial to the ramus.

CYSTICEROSIS –

- When the eggs from Taenia Solium (pork tapeworm) are ingested, the covering of the eggs is digested and the larval form of the parasite is hatched.
- The larva penetrate the mucosa and enter the blood vessels and lymphatics and are distributed in the tissues all over the body.

Radiographic Features –

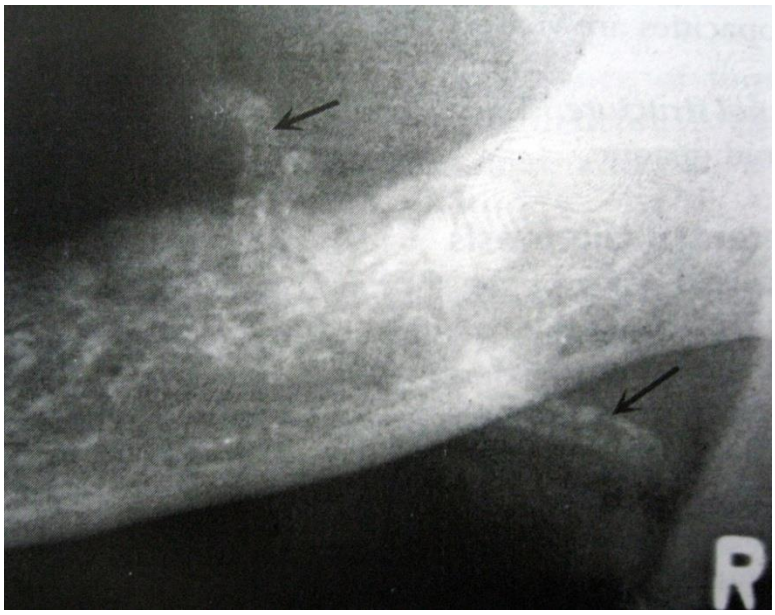
- Location –
  - The location of the calcified larva include the muscles of mastication and facial expression.
- Periphery –
  - Multiple, well defined elliptical radiopacities are viewed, resembling grains of rice.
- Internal Structure –
  - The internal structure is homogenous and radiopaque.
- Differential Diagnosis –
  - They appear similar to sialolith but the small size of the calcified nodular larva and the widespread dissemination are suggestive of a diagnosis of Cysticerosis.

MONCKENBERG'S MEDIAL CALCINOSIS –

- Is also k/a Arteriosclerosis.

Radiographic Features –

- Location –
  - The medial calcinosis involving the facial artery or less commonly the carotid artery may be viewed on panoramic radiographs.
- Periphery and shape –
  - The calcified deposits outline an image of the artery.
  - From the side, the calcified vessel appears as a pair of thin parallel radiopaque lines, that may have a straight or tortuous course.
  - This is described as a *pipe stem or tram track* / *tram line appearance.*
- This particular appearance of arteriosclerosis is pathognomic of the condition.



- The appearance of the tram tracks can be understood by understanding the pathogenesis leading to the arteriosclerosis.
- The hallmark of arteriosclerosis is the fragmentation, degeneration, and eventual loss of elastic fibers followed by the deposition of calcium within the medial coat of the vessel.
- As a result the radiographic appearance of the tram tracks appears because of the calcification of both the medial walls of the vessel.

PHLEBOLITHS –

- Phleboliths are intravascular thrombi, which arise secondary to stagnation, sometimes become organized or even mineralized.
- Phleboliths are usually found associated with hemangiomas.

Radiographic Features –

- Periphery and Shape –
  - In cross section the shape is round or oval.
  - They may be upto 6mm with a smooth periphery.

- Internal structure –
  - May be homogenously radiopaque.

- More commonly it has the appearance of laminations, giving a ‘bulls eye’ or ‘target appearance’.
- A centre which is radiolucent may be seen representing the patent portion of the vessel.

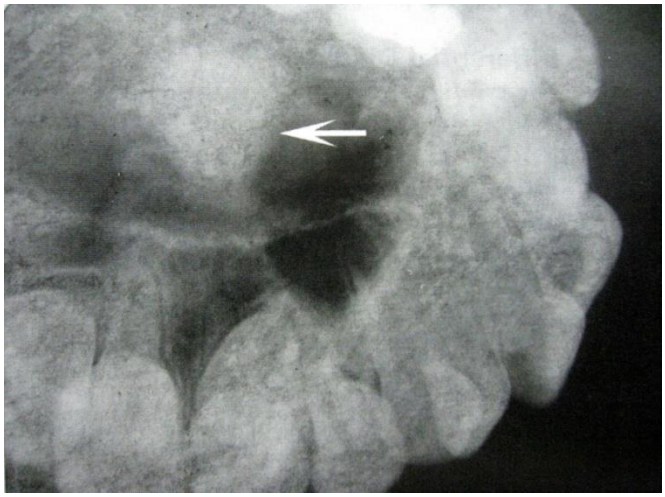
- Differential diagnosis –
  - Sialoliths- sialoliths are usually single and even if they are multiple they are arranged in a straight line unlike phleboliths which have a more random, clustered distribution.

RHINOLITH & ANTROLITH –

- Rhinoliths – hard calcified bodies or stones in the nose.
- Similar structures in the antrum of the maxillary sinus are the antroliths.
- These arise from the deposition of mineral salts around a nidus.

Radiographic Feature –

  - These stones can have a variety of shapes and sizes.
  - They may present as a homogenous or heterogenous radiopacity.
  - Sometimes it may have laminations as well.



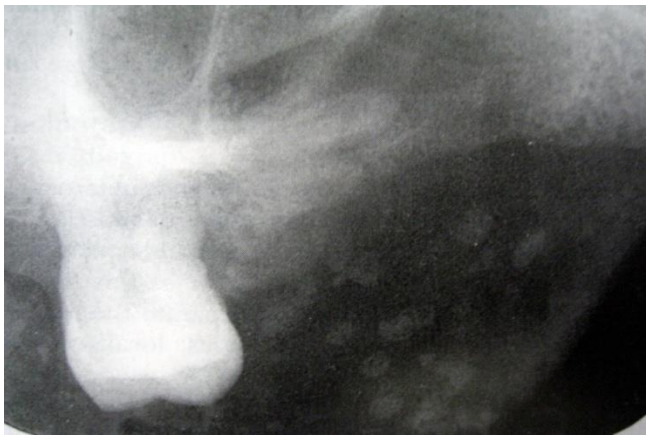
- Differential Diagnosis –
  - D/D includes Osteoma and healing odontogenic cyst.

OSTEOMA CUTIS –

- It is a rare soft tissue ossification in the skin.
- 85% of the cases occur secondary to long standing acne developing in a scar or chronic inflammatory dermatosis.
- They are most commonly found on the face.

Radiographic Features –

- Location –
  - Most commonly in the lip and cheek regions.
  - The image may be superimposed over the tooth root or alveolar process.
  - A PA view of the skull with the cheek blown out, using a soft tissue technique at reduced KVp helps localize the osteoma.
- Periphery and Shape –
  - Osteoma cutis appears as smoothly outlined, radiopaque, washer-shaped images.
  - These multiple radiopacities are usually small ranging from the usual 0.1 cm to the rare 5 cm diameter.



- Internal Structure –
  - May be homogenously radiopaque and may have a central radioluscency representing normal fatty bone marrow.
  - This gives this lesion a '*donut type*' appearance.
- Differential Diagnosis –
  - Myositis Ossificans – is a lesion of greater proportion and in some cases causes noticeable deformity of the facial contour.

MYOSITIS OSSIFICANS –

- In myositis ossificans fibrous tissue and heterotopic bone form within the interstitial tissue of muscle and associated tendons and ligaments.
- It results from acute or chronic trauma or from heavy muscular strain.
- Muscle injury leads to hemorrhage within the muscle which undergoes progressive scarring which may sometimes form bone or cartilage.

Radiographic Features –

- Location –
  - Most commonly involved muscles of the head and neck are the masseter and sternocleidomastoid.
  - Usually a radiolucent band can be seen between the area of ossification and adjacent bone.
- Periphery and shape –
  - The periphery is usually more radiopaque than the interior.
  - The shape can be variable ranging from irregular to oval to linear streaks.
  - These linear streaks are known as pseudo-trabeculae and run in the same direction as the normal muscle fibers.
- Internal structure –

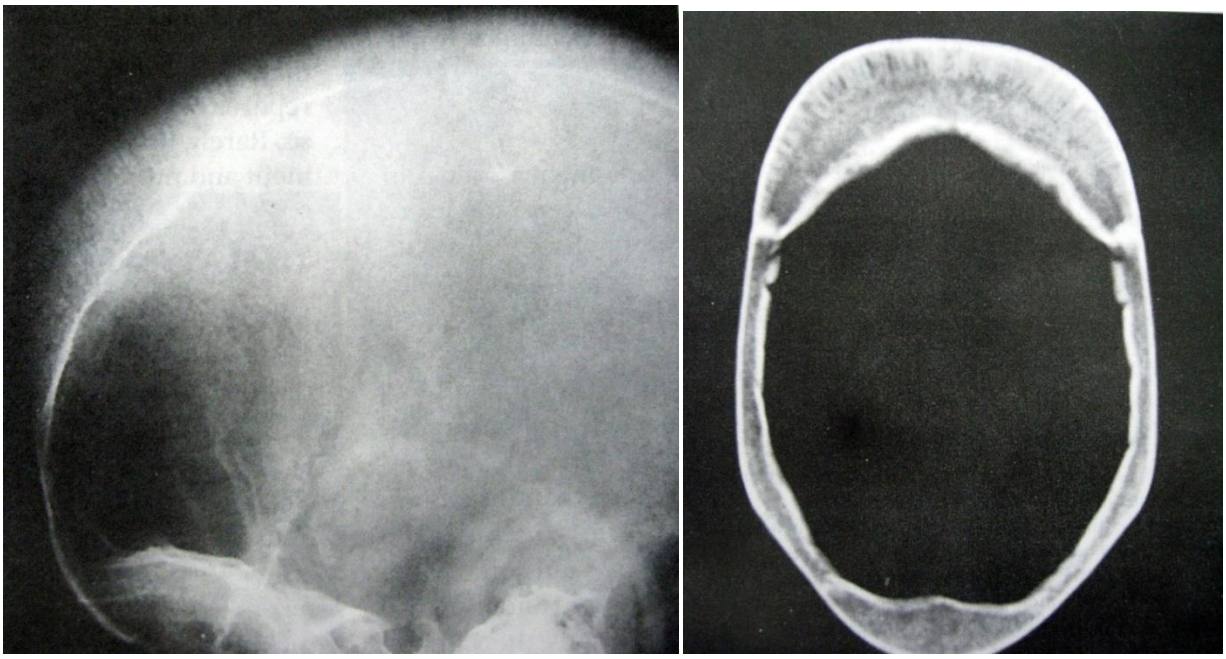
- Within the first 3-4 weeks after the injury, the lesion is a faintly homogenous radiopacity.
- After about another 2 months this turns to a feathery or lacy radiopacity signifying maturation and formation of bone.
- As the lesion becomes older, the radiopacity becomes denser and better defined.

SICKLE CELL ANEMIA –

- Sickle cell anemia is an autosomal recessive, chronic hemolytic blood disorder.
- patients have abnormal hemoglobin which under low oxygen tension results in sickelling of the RBC's.
- The spleen readily snaps up these cells and in an attempt to compensate for the resultant anemia there is increased production of RBC's resulting in compensatory hyperplasia of bone marrow.
- Radiographic Features –
    - The hyperplasia of the bone marrow at the expense of cancellous bone is the primary reason for the radiographic manifestations of sickle cell anemia.

    - The thinning of the individual cancellous trabeculae and cortices is most common in the vertebral bodies, long bones, jaws, and skull.

- The skull may have widening of the diploic space and thinning of the inner and outer tables.
- In extreme cases the outer table may not be apparent at all and a ‘hair-on end’ appearance may occur.



- In the jaws there is generalized osteoporosis, with a decrease in the volume of trabecular bone and thinning of the cortical plates.

NOTE – THALASSEMIA

- The radiographic appearance is similar to sickle cell anemia, except the effects are more severe in thalassemia.
- The skull may show a granular appearance along with the ‘hair-on end’ appearance.