Metabolic , endocrine & inherited disorders of bone

Osteoporosis

Bone with a constant turnover. In adult life, bone loss gradually predominate over bone apposition.

Osteoporosis results when bone loss is excessive, or when bone apposition reduced.

It prsesnts commonly in postmenoposal women, cushing syndrome, thyrotoxicosis ,& primary hyperparathyroidism.

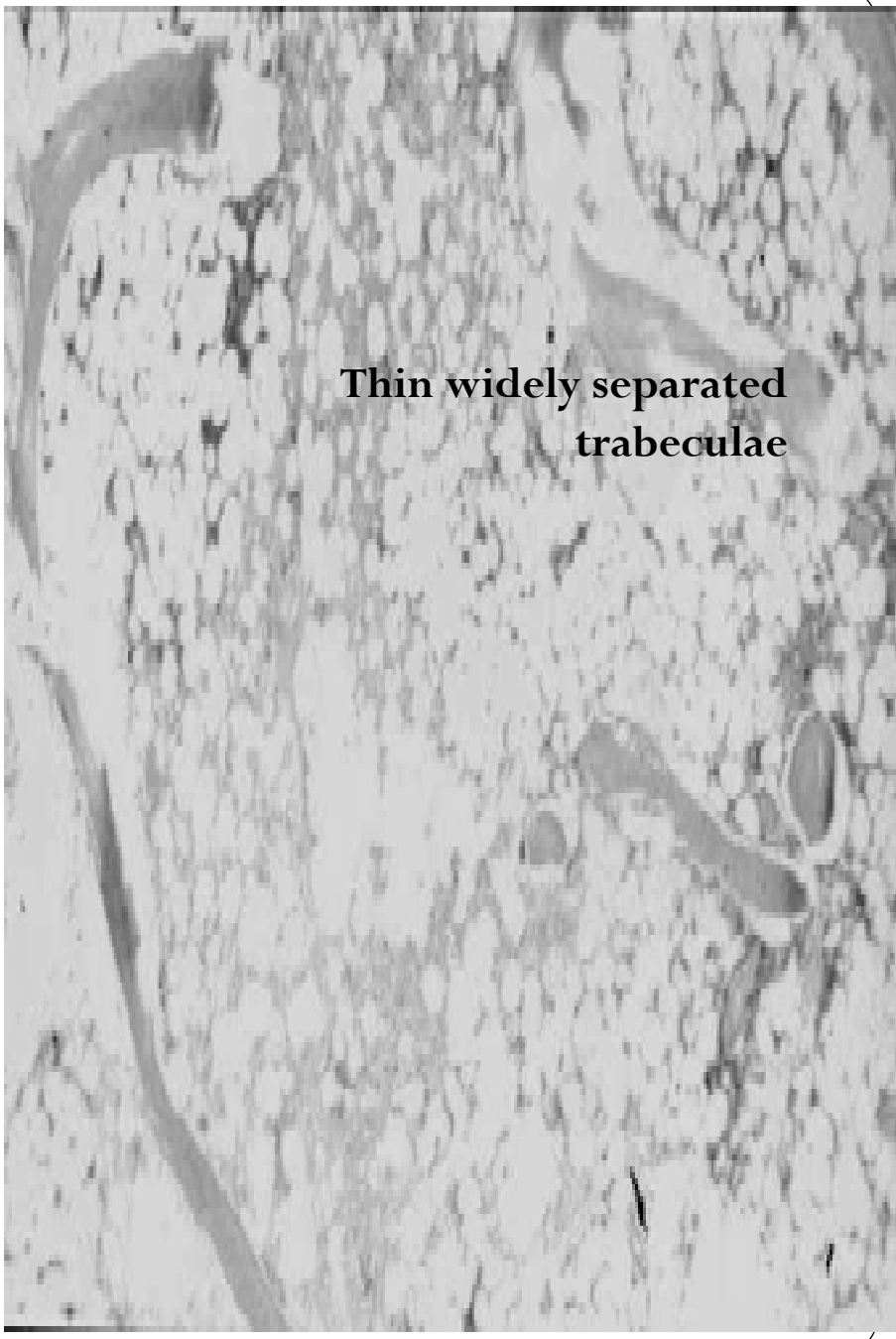
Bone is of a normal composition & structure, but reduced in quantity (skeletal mass).

↑ bone RL , more marrow space with thin cortex.

Jaw may be affected. Mandible of edentulous pt presents with a thin fragile strip of bone.

OSTEOPOROSIS

- Asymptomatic
- Present with complications :
- pain, microfractures, deformity
- Fracture (hip,vertebral bodies , radius)



Osteoporotic cancellous bone : the bone, although'structurally' normal, is markedly reduced in amount with thin and widely separated trabeculae.

Hyperparathyroidism

Primary hyperparathyroidism

Secondary hyperparathyroidism

Primary hyperparathyroidism

- Uncontrolled excessive PTH production due to parath. gland adenoma , idiopatheic hyperplasia of parathyroid T , or adenocarcinoma.

- Middle - aged pt (60 yrs). Women more than men.

- ↑PTH → bone resorption.

- ↑PTH → hypercalcaemia, hypophosphataemia , & hypercalciuria.

- Pt present with symptoms of renal stone, bone pain, peptic ulcer , fatique, & headache.

Histologically

- ↑ osteoclastic activity through the skeleton.
- Formation of focal areas of bone resorption " Brown tumours" ,

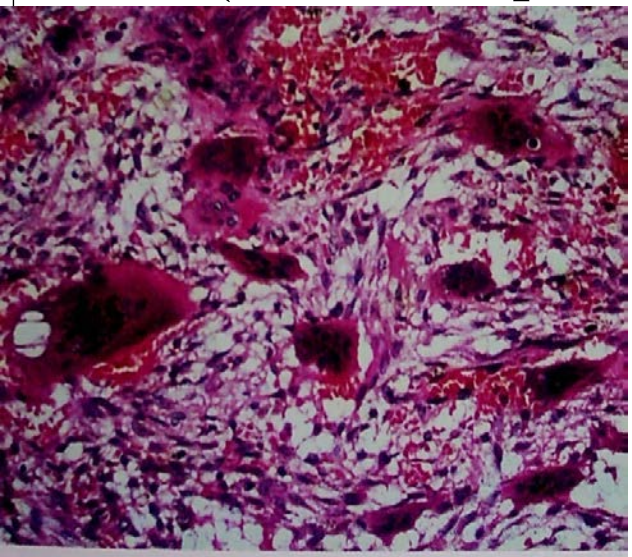
  Consists of:

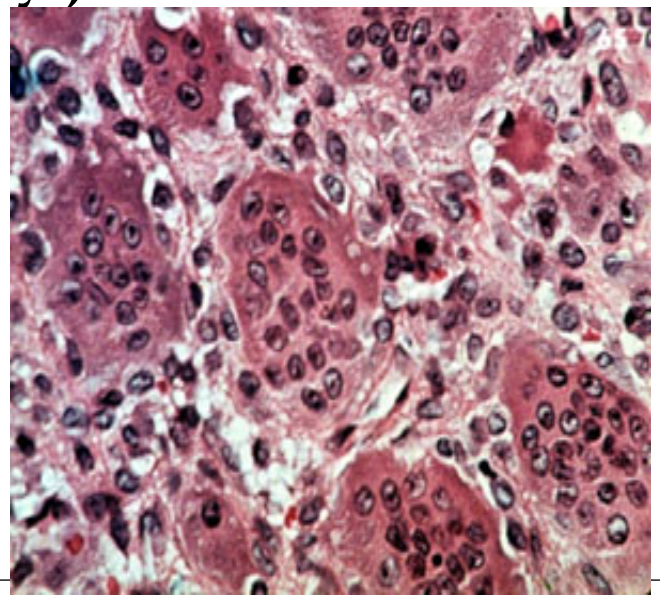
  Large no. of multinucleated ,osteoclast like-giant cells

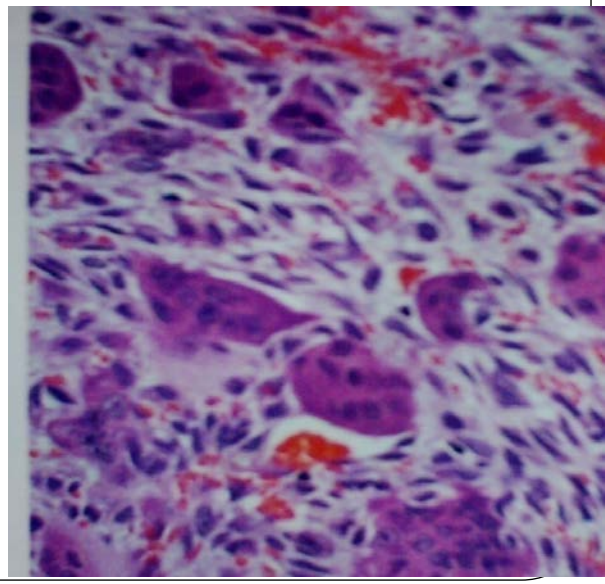
  scatterd in highly, cellular fibro-vascular CT stroma.

  Much haemosiderin pigment → brown color of the lesion

  (Macroscopically)







Giant cell lesions of bone (including jaw bones)

Impossible (histologically) to distinguish this tu from other giant cell lesions of the bone as:

- Giant cell granuloma (Central & Peripheral)
- Cherubism
- Aneurysmal bone cyst
- Giant cell tumor (Osteoclastoma)

Biochemical investigation as:

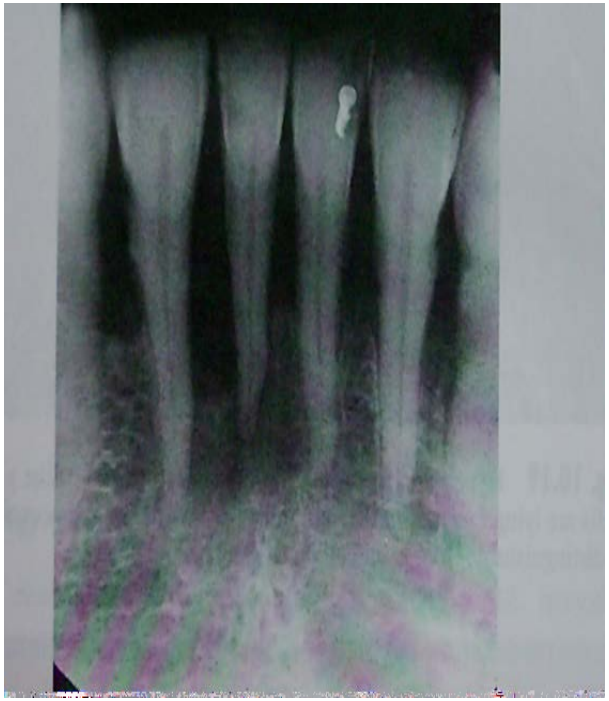
(S.Ca , PTH, Alk.Phosph)

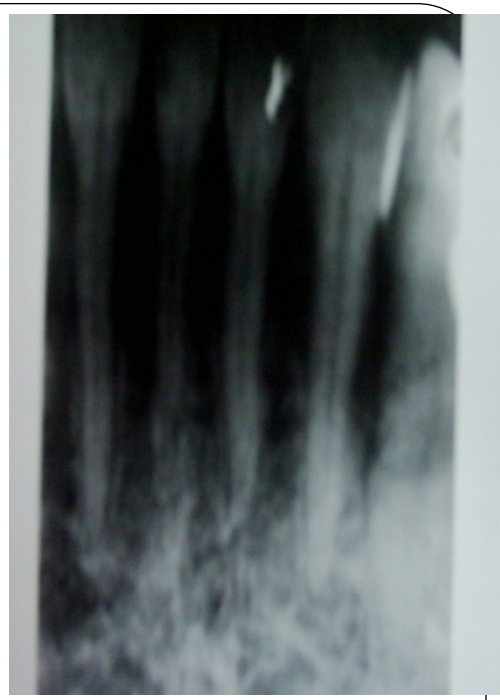
X-Ray

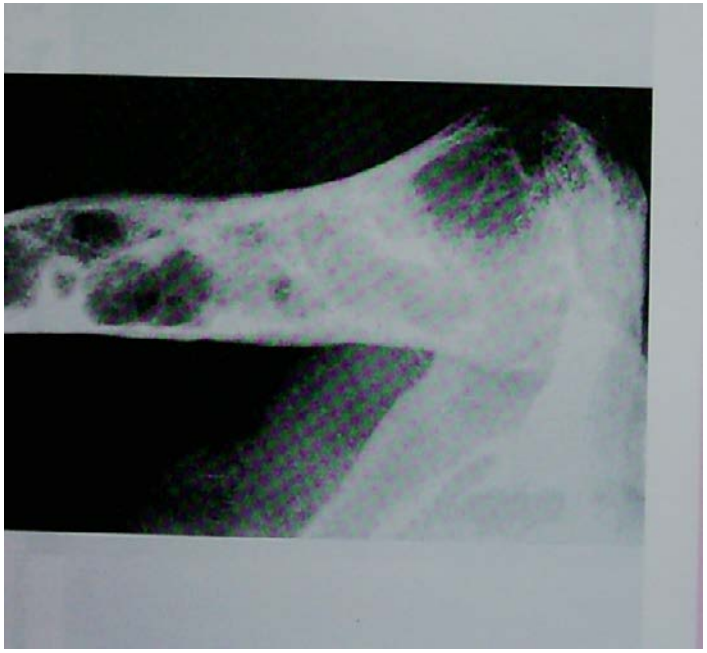
- Generalized reduction in bone density(osteoporosis).
- Partial loss of lamina dura
- Focal lesion (brown lesion) appear as large sharply defined , round/oval unilocular RL area ,
- (may be multilocular)

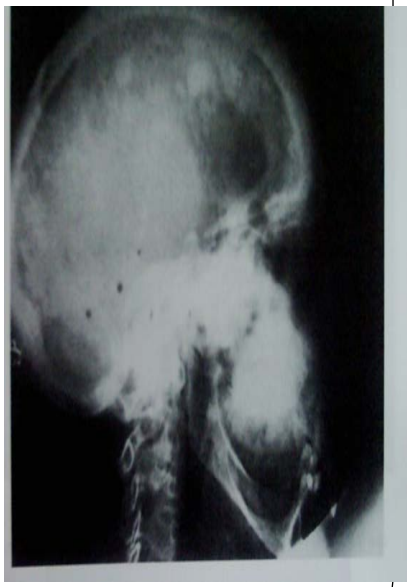
Ostitis fibrosa cystica

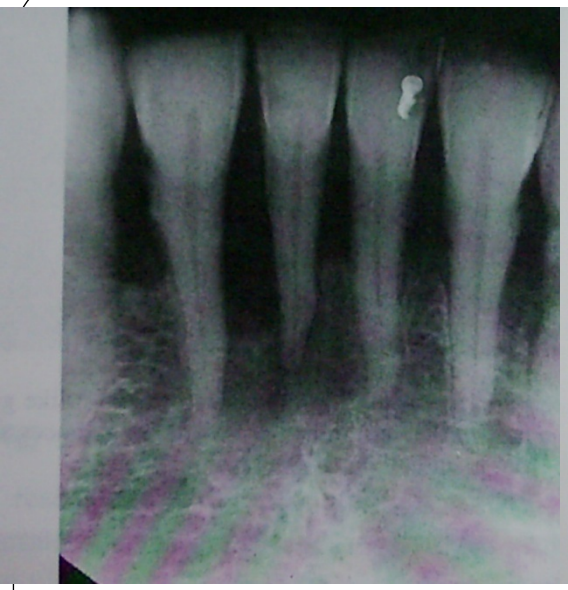
- Brown lesions are more in mandible than maxilla.

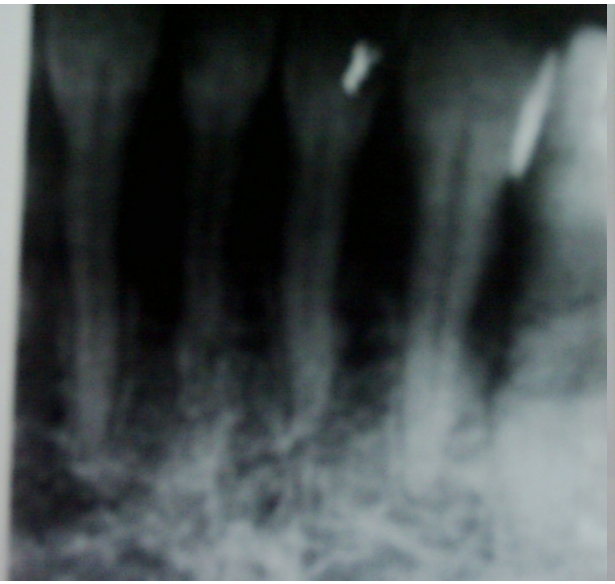


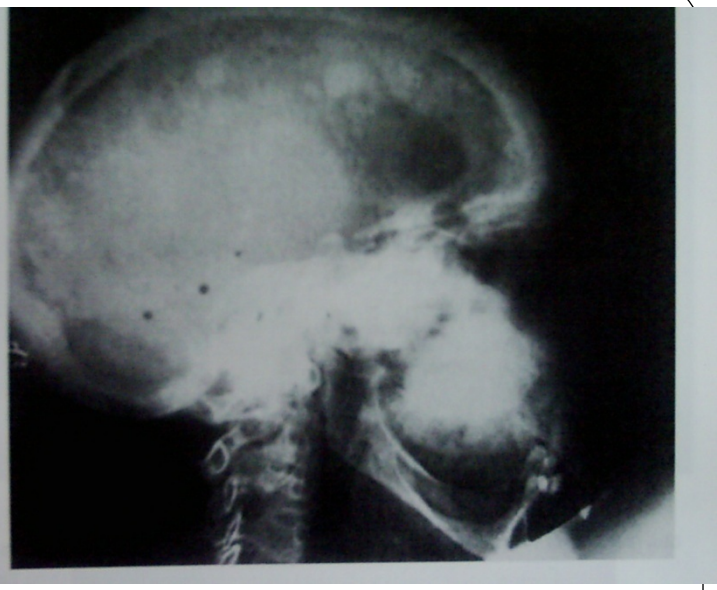


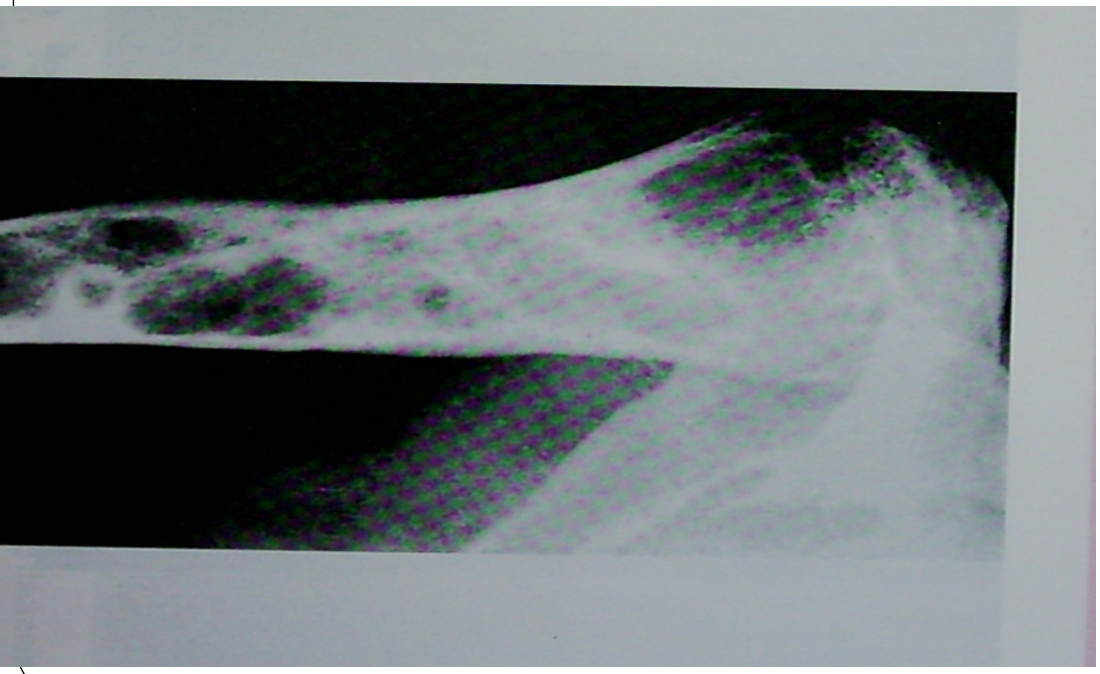


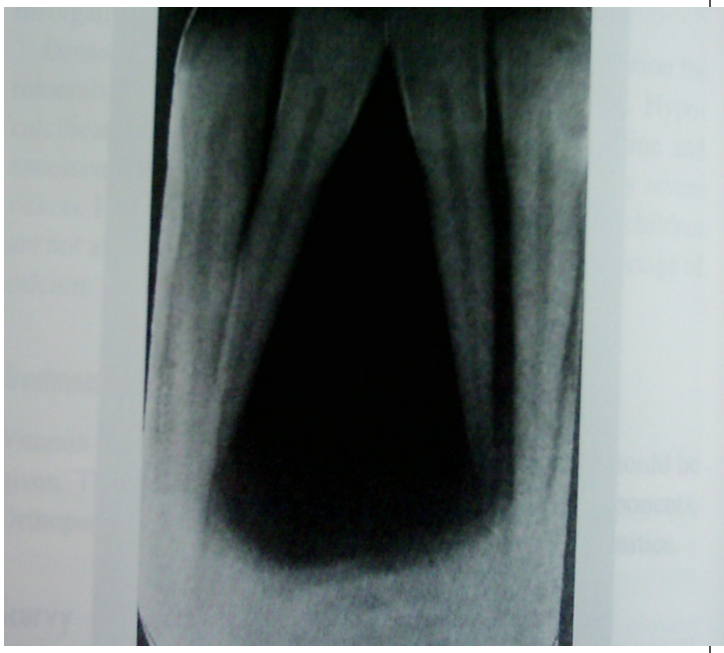












Secondary Hyperparathyroidism

Due to contineous production of PTH in response to chronic low level of Ca (hypocalcemia), as a result of chronic renal failure ,in patients undergoing renal dialysis, rickets , osteomalacia , & intestinal malabsorption.

In such cases there is reduction in vit D which is required for calcium absorption & metabolism.

Rickets & osteomalacia

- Due to vit D deficiency (essential for Ca & Ph metabolism).
- Failure (defect) in mineralization of osteoid & cartilage.
- X-ray similar to osteoporosis.
- Vit D deficiency due to lack of sunlight exposure , dietary causes.
- Dental defect = Enamel hypoplacia , delayed teeth eruption.

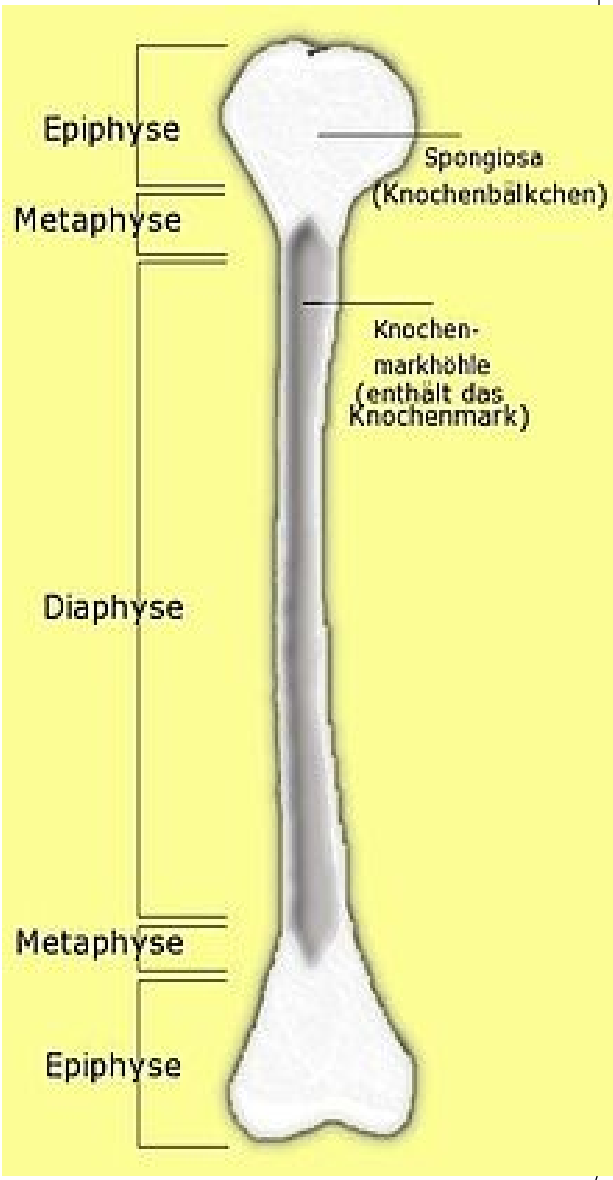
Acromegaly

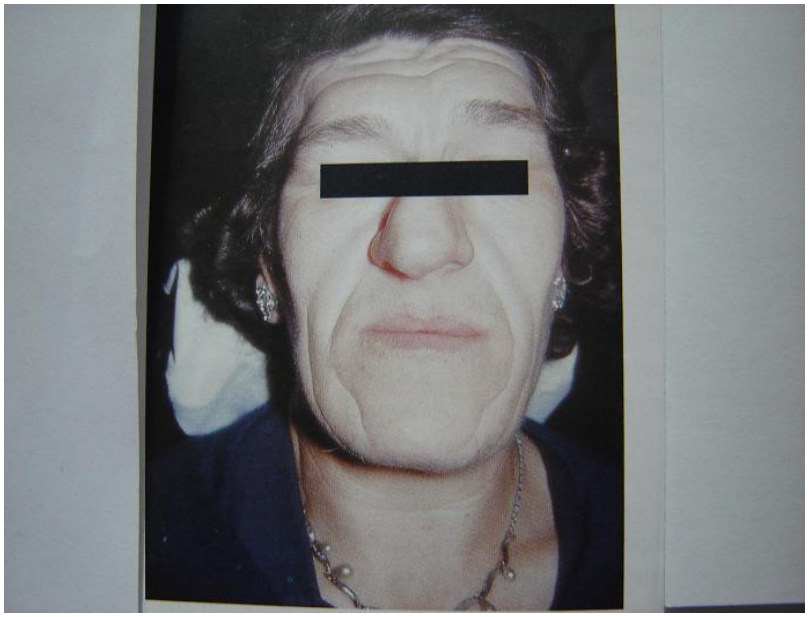
- Prolonged & excessive secretion of pituitary growth hormone **(adenoma of anterior lobe of pituitary)**developing after the epiphyses closed

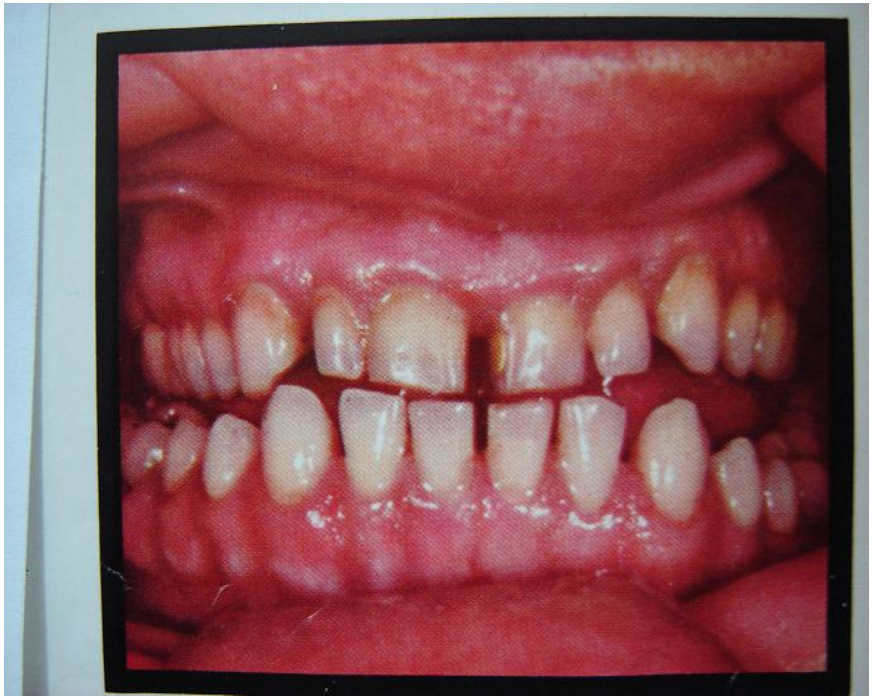
.

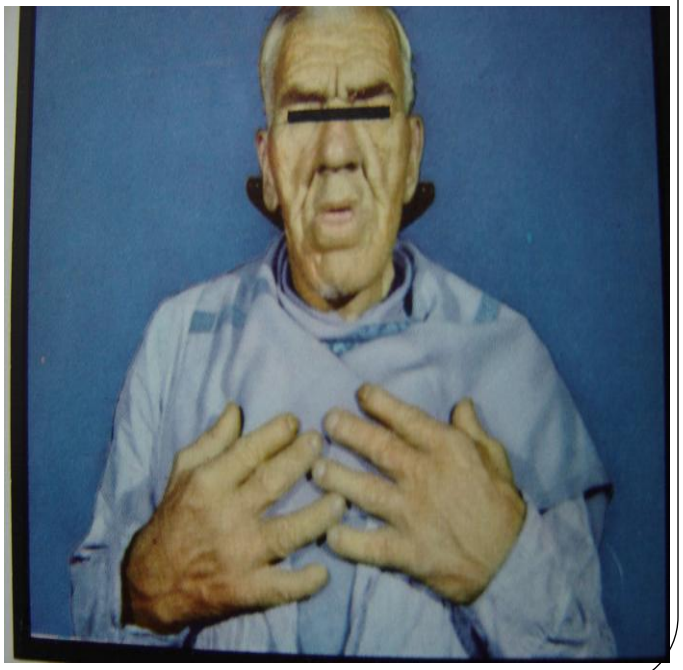
- Renewed growth of bones of the jaw, hand , feet, with overgrowth of some soft T).
- Main features → Continued condylar growth → Enlargement of the lower jaw → Gross prognathism , macroglossia , teeth spacing.
- Soft T of the lips , nose are become enlarged & thickened.

- Gigantism= Over secretion of pituitary growth hormone, before epiphyseal closure (fused) .









Paget's disease (ostitis deformance)

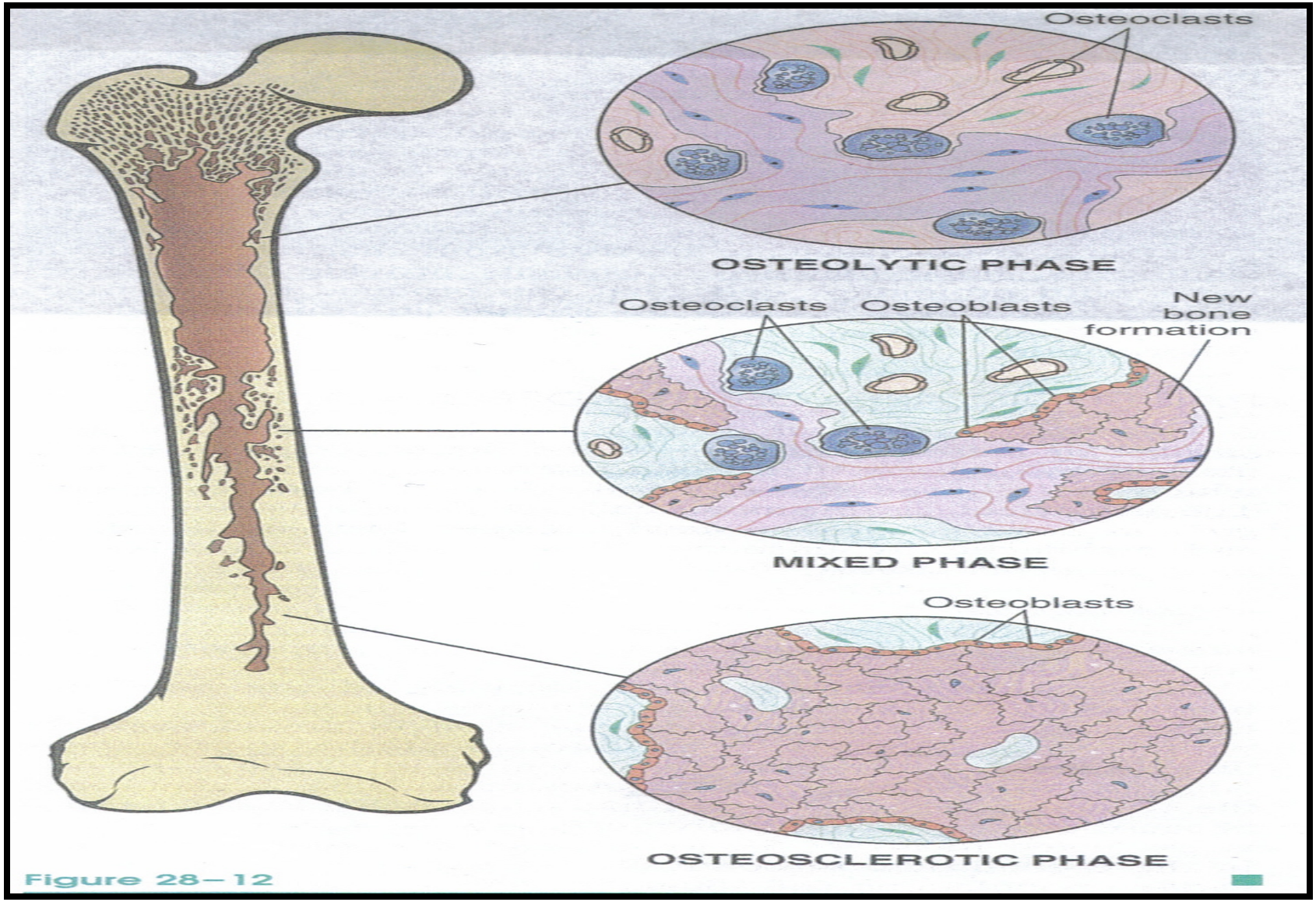
It is a focal alteration of uncoordinated increase in the ostecalstic and osteoblastic activity in one or multiple bone of older adult .

Initially the process is dominated by bone resorption followed by excessive bone formation , producing larger but weaker bone.

The bone formed is unrelated to functional requirement.

Evolves through three phases
1) Osteolytic (desructive)
2) Mixed (lytic and blastic)
3) osteoblastic / sclerotic phases
results in thick, soft porous bone, prone to compression and deformity

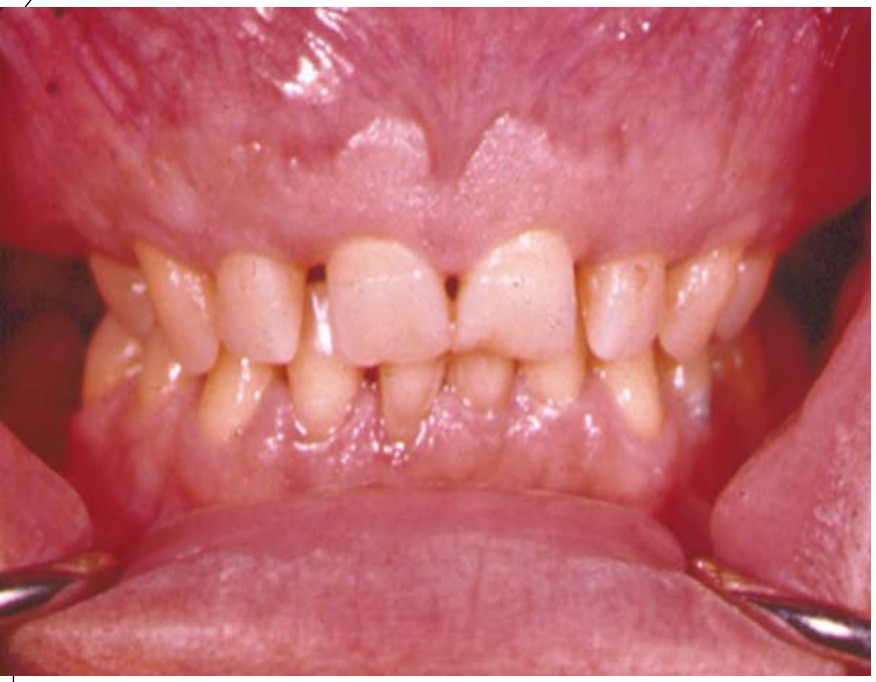
Pagets' Disease

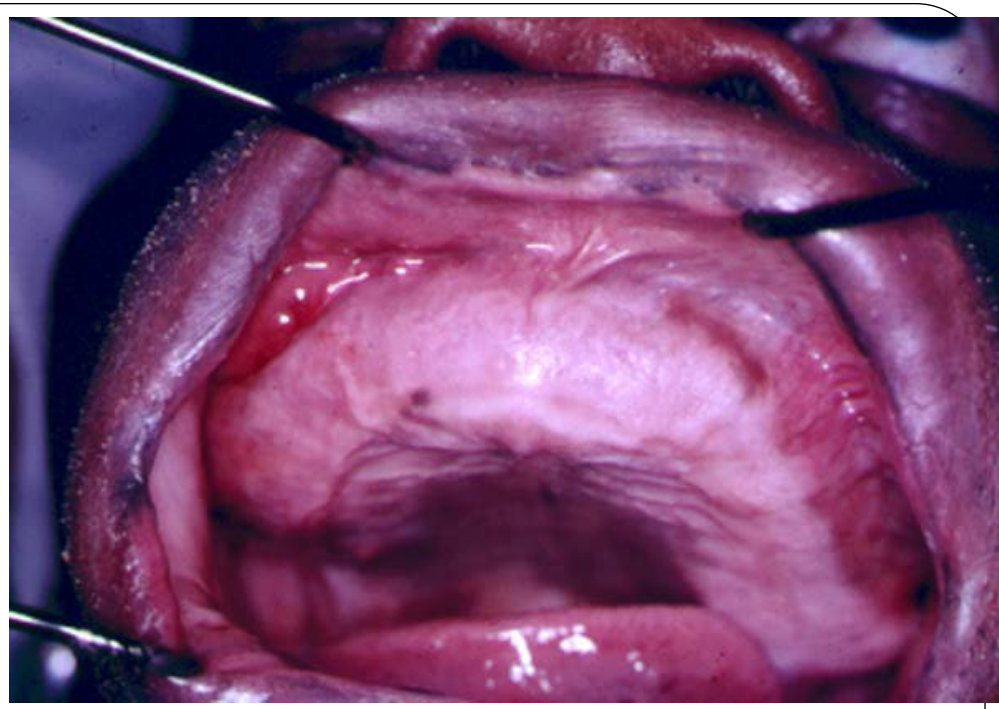


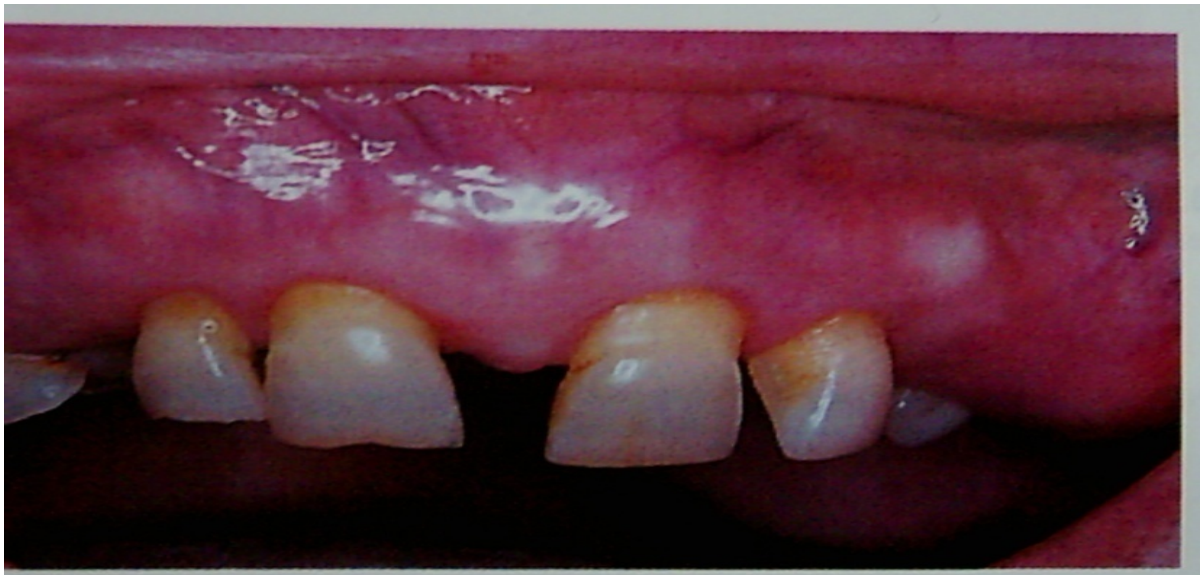
Symptoms:
Bone pain and warmth
Headache or head enlargement
Bowing of lower limbs
Hearing loss

Clinical :

- Asymptomatic , adult pt (over 40 yrs). UK, North America.
- It is a polyostotic in distribution.
- Long bone bending and joint pain . **Simian stance**
- Increase in skull size and compression on cranial foramina lead to paralysis , loss of hearing and sight .
- Maxilla is more commonly involved , thickened alveolar ridge & widened , flat palate & facial deformity. Lion-like facial deformity
- Pt suffer from teeth spacing , lip incompitance, unfitted denture.
- Teeth with hypercementosis & ankylosis (difficult exo).
- Dence & a vascular bone → infection of extracted wound.

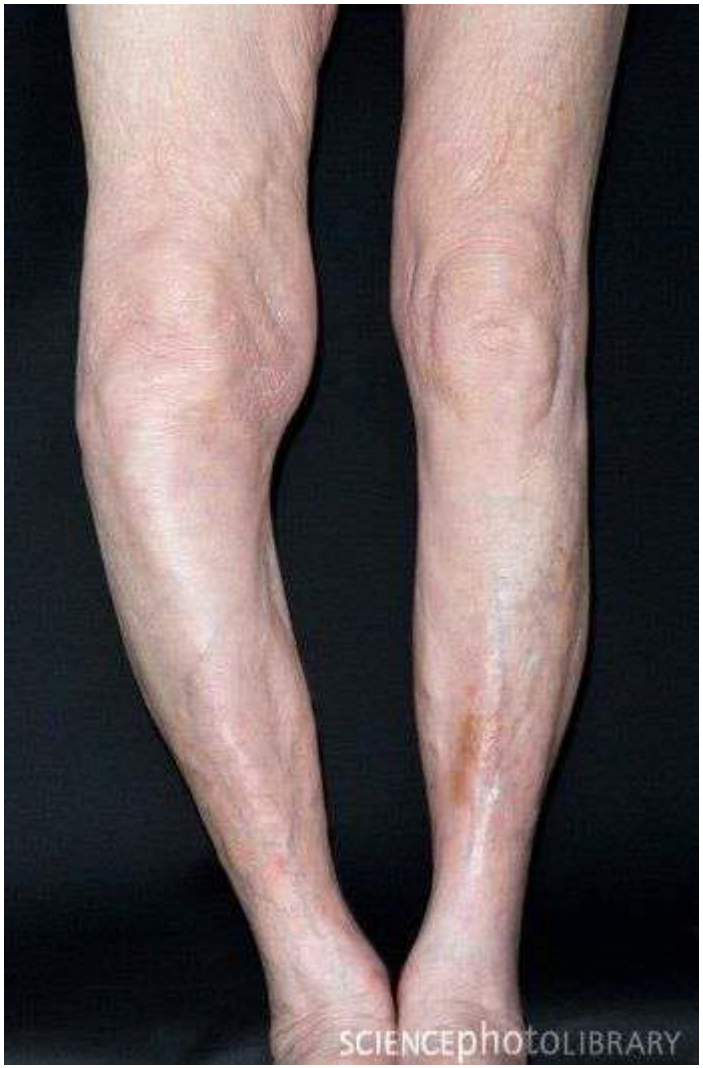






22 Paget's disease of bone. Characteristic features of the


Normal
Paget's disease

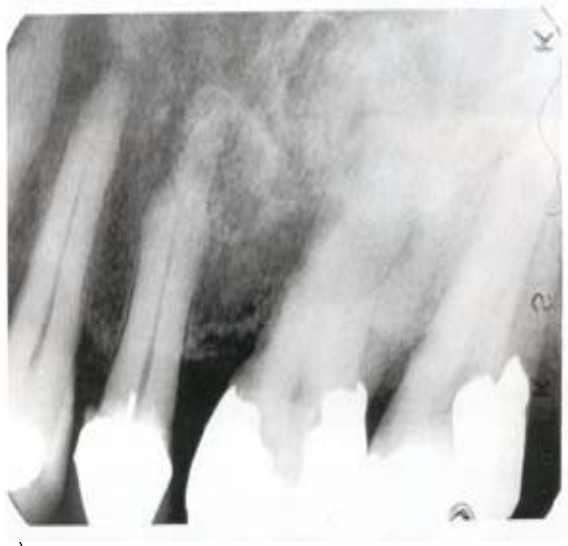

SCIENCEphotoLIBRARY

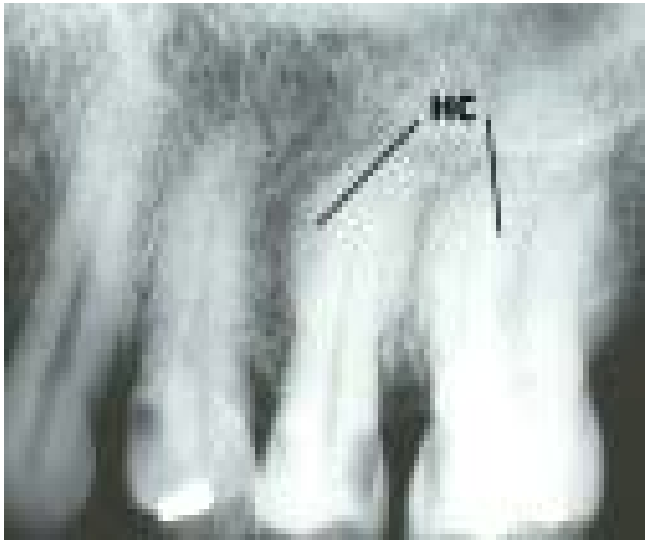
- **Radiographic:**

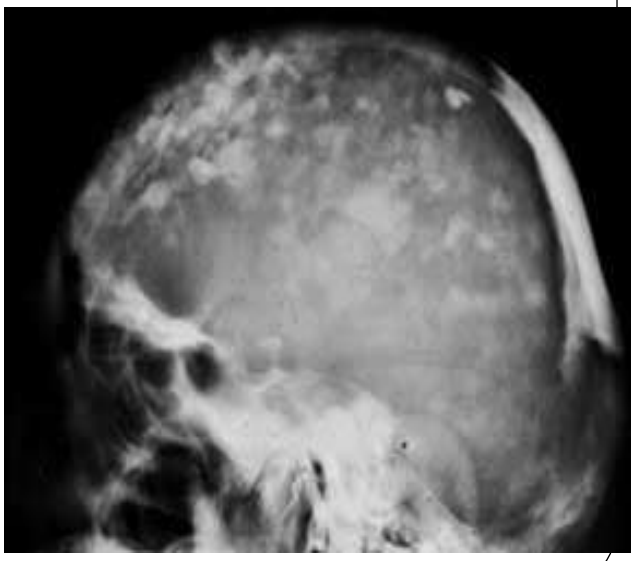
Osteolytic stage reveals radiolucency , later on there is diffuse radiopacity .

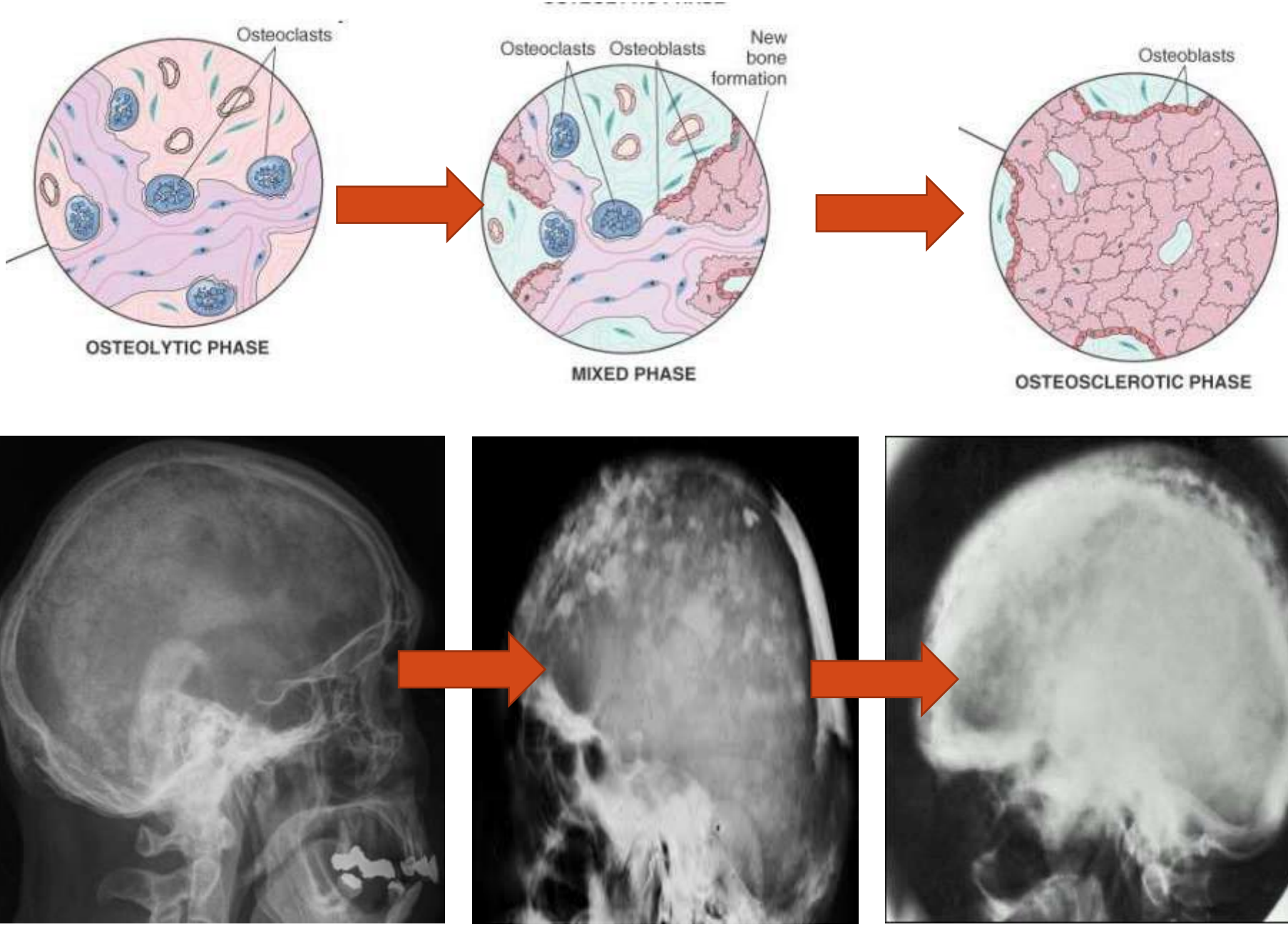
lesion resembling ‘cotton- wool’ especially in skull .

Maxilla and mand= Enlarge with loss of lamina dura ,teeth exhibit hypercementosis.



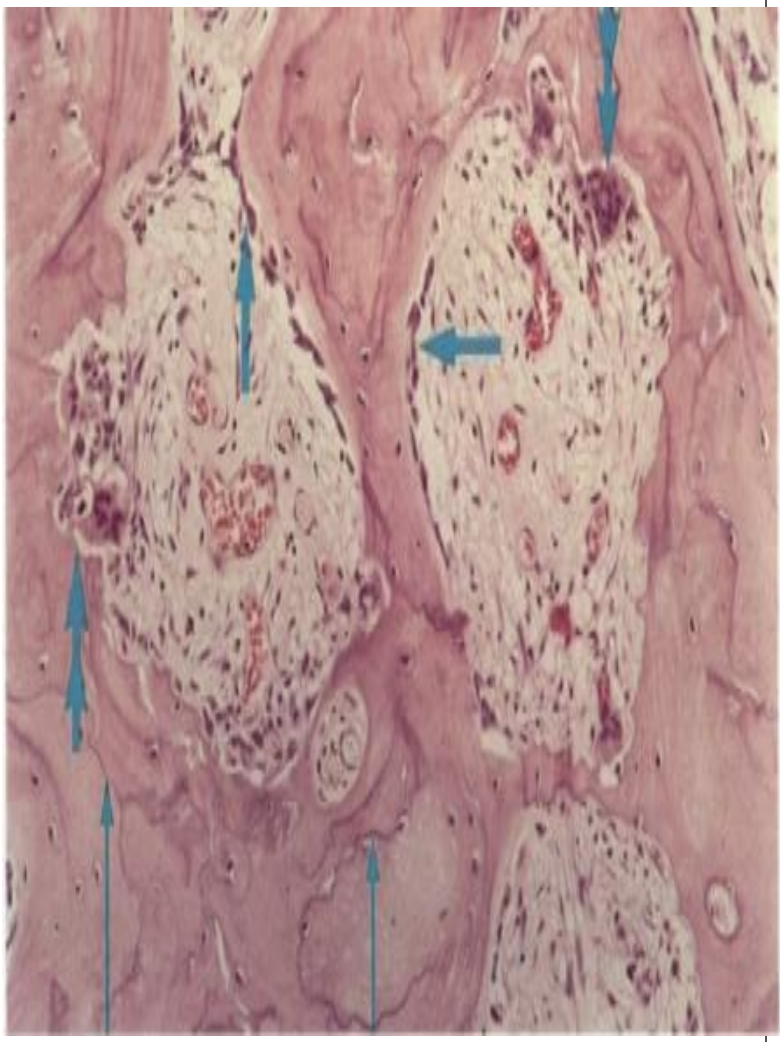




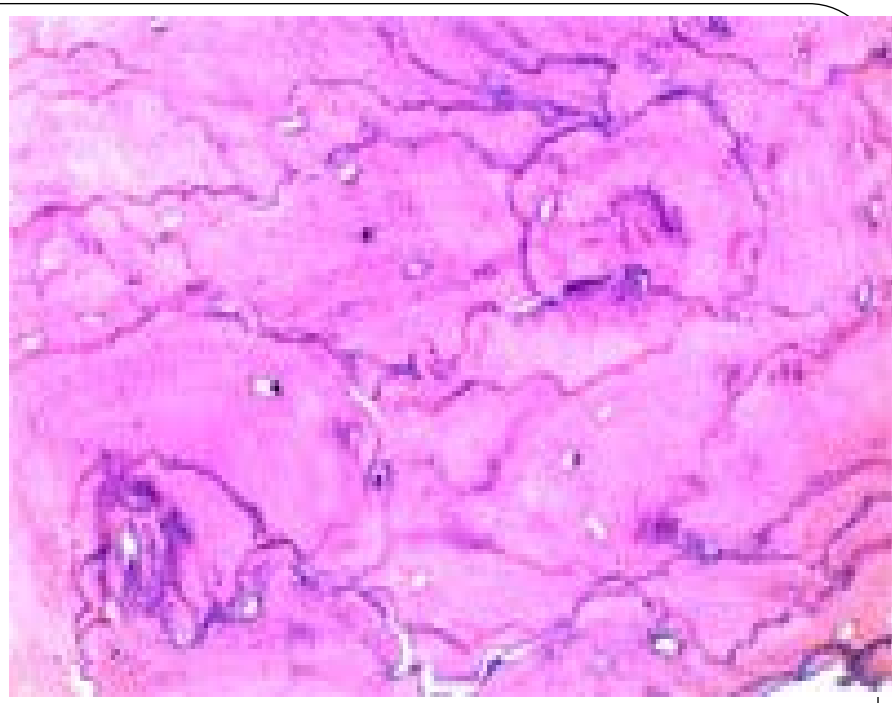

Osteoclasts
OSTEOLYTIC PHASE
Osteoclasts
Osteoblasts
New bone formation
MIXED PHASE
Osteoblasts
OSTEOSCLEROTIC PHASE

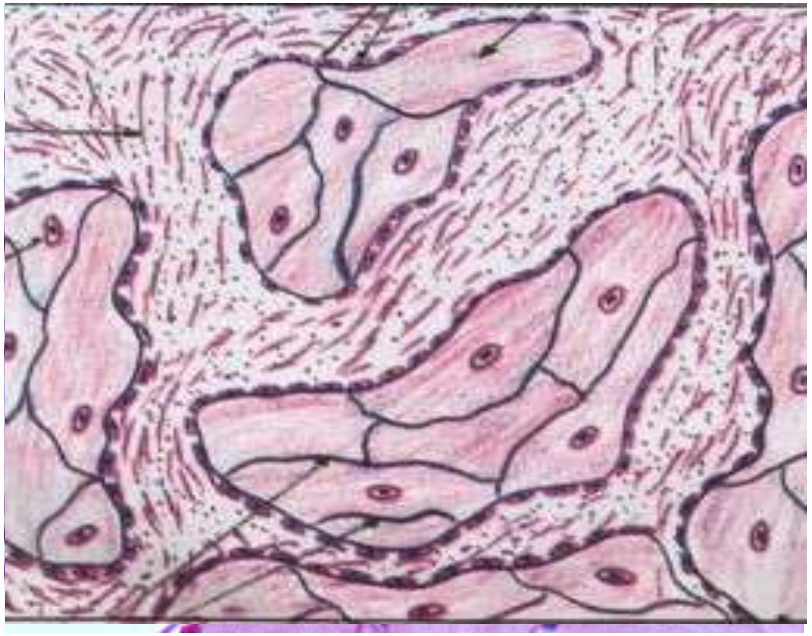
HISTOLOGICAL FEATURES: -

- Alternating bone resorption and deposition seen.
- Thus osteoclastic resorption seen surrounding the trabeculae.
- Simultaneously, osteoblastic activity also seen with formation of osteoid rims around trabeculae.
- Surrounding stroma is highly fibrovascular.
- This hypervascular bone combined with cutaneous vasodilation causes an increase in regional blood flow resulting in rise in skin temperature



- A characteristic feature is presence of basophilic reversal lines in the bones.
- This indicates junction between the alternating resorptive and formative phases of bone.
- It gives a "Mosaic" appearance of the bone.
- The new bone is disordered, poorly mineralized, and lacks structural integrity





The etiology

*Unknown

However

1- Intranuclear viral inclusion bodies have been found within some osteoclastic cells (paramyxovirus)

2-Osteoclastic dysfunction.

3- Genetic predisposition → some show family history.

4- Circulatory disturbances of bone.

Diagnosis:

↑ **Serum alkaline phosphatase, (normal value 63 IU/L increase to 1000-5000 IU/L in polyostotic distribution and 200-500 IU/L in monostotic lesion) (osteoblastic activity)**

Normal Blood calcium & phosphorous.

Treatment : More effective treatment are calcitonin and diphosphonate (disodium editronate) that inhibit bone resorption & reduce pain . It dose not stop the process but slow it . Reduce bone turnover

Surgery is avoided === osteolytic bone is prone to hemorrhage and osteosclerotic bone prone to difficult to manage and produce osteomylitis.

Major complication: Heart failure and Osteosarcoma (1% of cases). OS in Paget's are more aggressive and have poor prognosis

Central Giant Cell Granuloma

- •Intraosseous destructive lesions of the jaws
- •Far less common than peripheral giant cell granuloma
- •10-30 yrs of age; Female > Male
- •Mandible > Maxilla; Ant. > Post.
- •Mandibular lesions frequently cross the midline
- •Asymptomatic or painless expansion
- **Two types:**

Nonaggressive **(No pain, Slow growth, No cortical perforation)**

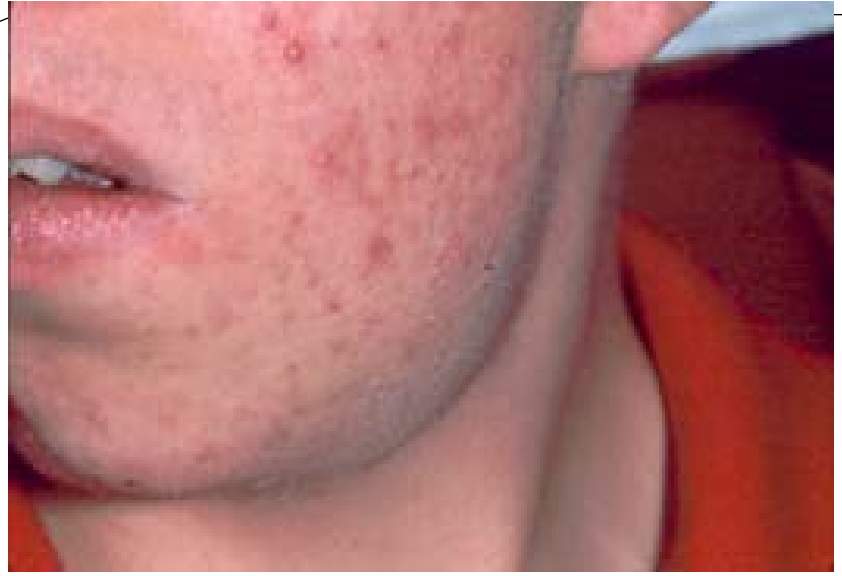
Aggressive **(Pain, Rapid growth , Perforation of the cortical plates and resorption of roots)**

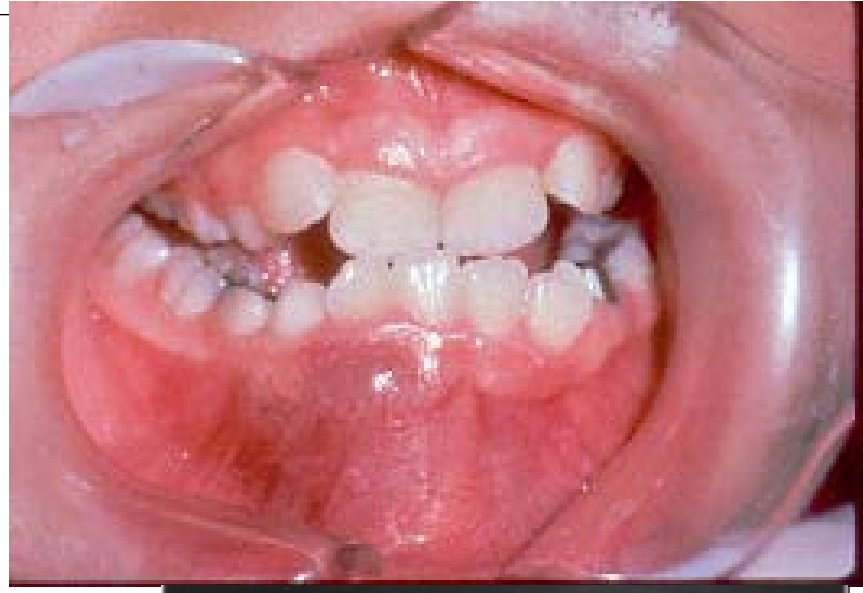
Radiographic features

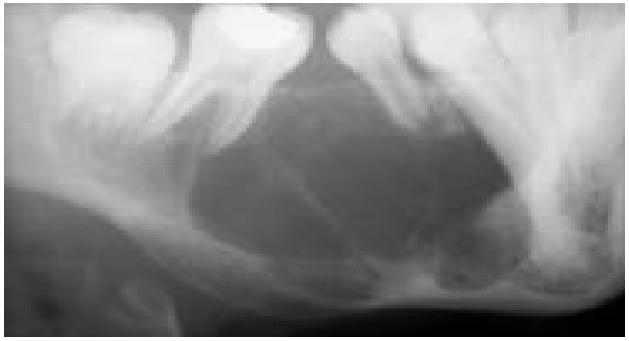
- Non-specific unilocular or multilocular radiolucency
- Well-demarcated
- Aggressive lesions show cortical perforation and root resorption

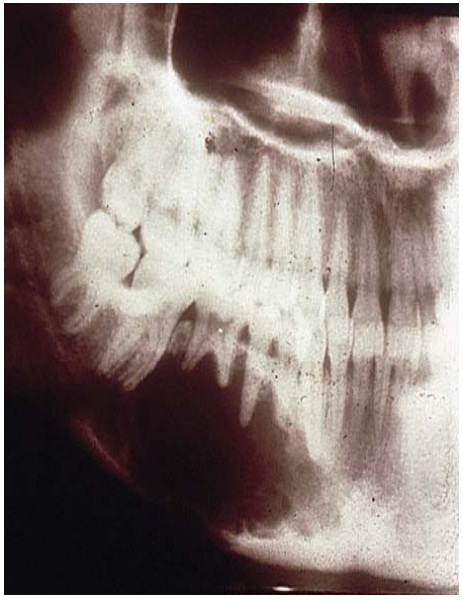
Most lesions occur in anterior portions of Jaw

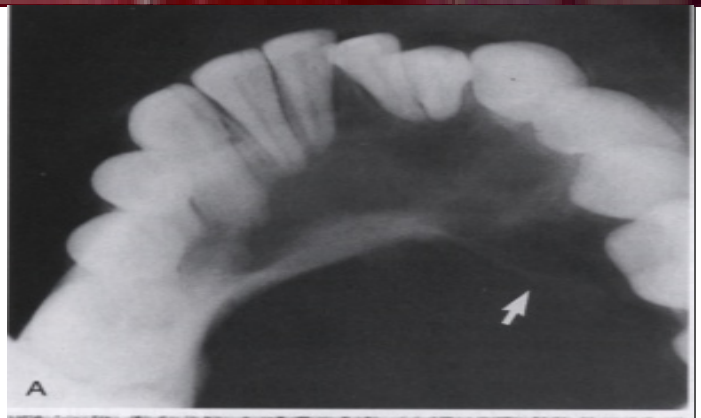
- DD of unilocular: Periapical lesions
- DD of multilocular: Ameloblastomas/other odontogenic lesions , ABC.







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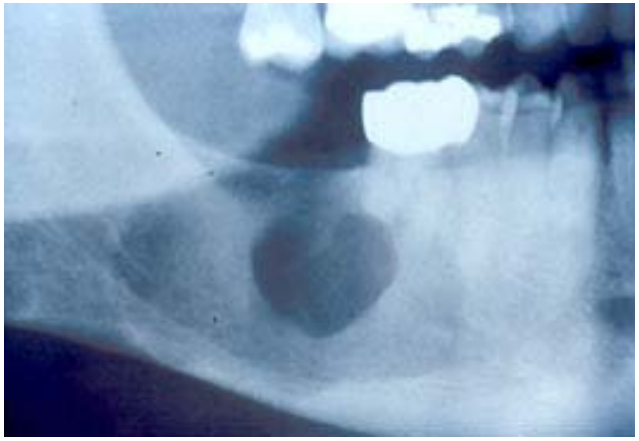

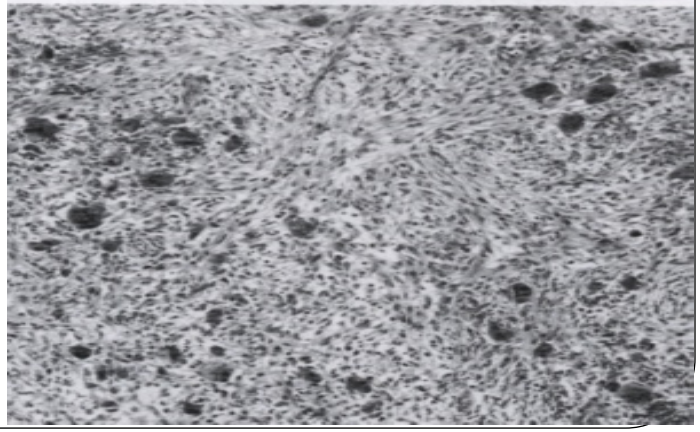

Histopathology

- •Lesion composed of giant cells containing 5-20 nuclei in a background of fibrous CT.

Foci of osteoid and newly formed bone may also be seen.
Areas of hemorrhage and hemosiderin deposition are common

Treatment

- •Surgical curettage
- •15 –20% recurrence rate
- •Long-term prognosis is good
- •No metastasis

Osteopetrosis:

- Rare hereditary skeletal disorder caused by failure of normal osteoclast function, result in thickening of cortical bone and sclerosis of cancellous bone (excessive bone mineralization and less ostoelytic activity).

Clinical types – infantile (fatal), intermidiate & adult(less severe type) osteopetrosis

There will be compression on the cranial nerve by sclerosis of the foramina of the bone of the skull , delayed eruption of the teeth is the common oral finding, erupted teeth may be ankylosed

- **X-ray :**Generalized increase in bone density .

- **Complications**:

*frequent fracture, *lack bone marrow haematopoitic function * tendency for sever osteomylitis of the jaw, *difficult extraction.

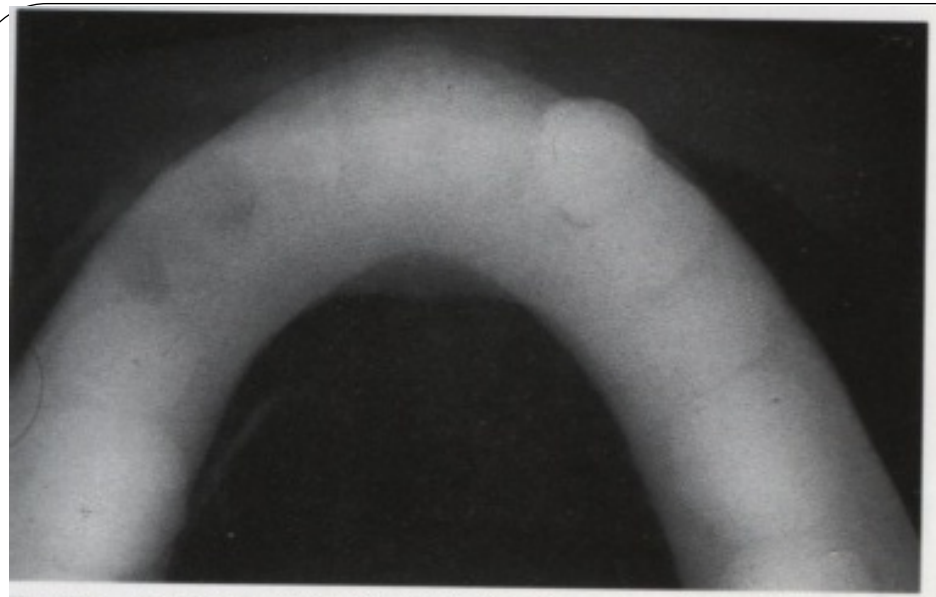

Fig. 8.5 Osteopetrosis: radiograph showing such extreme bone density that the teeth are barely visible.

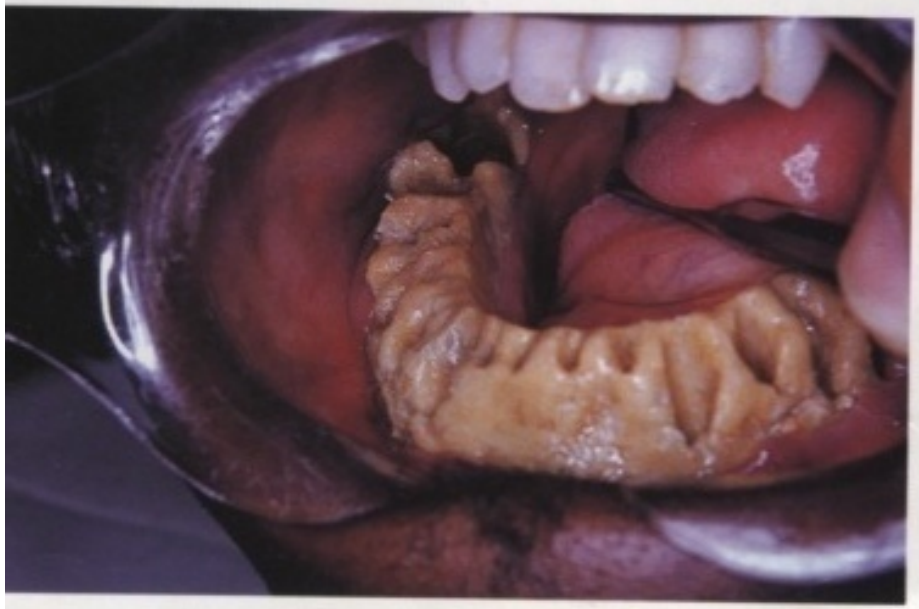

Fig. 8.6 Osteopetrosis: necrosis of the body of the mandible following extraction of the teeth from the same patient as in the previous picture.

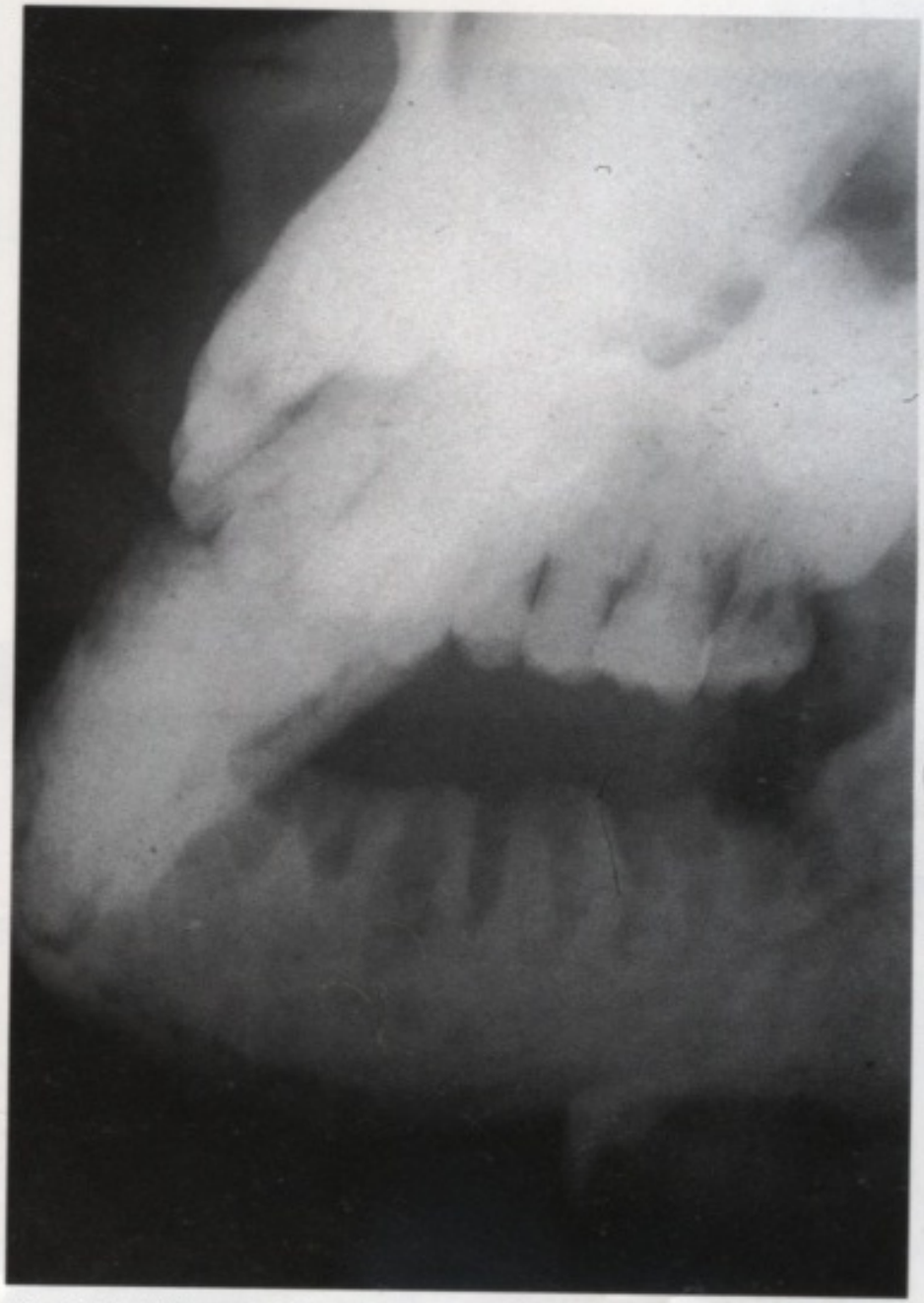

Fig. 8.7 Osteopetrosis: radiograph of the same patient as in the previous pictures showing the line of separation of the sequestrating

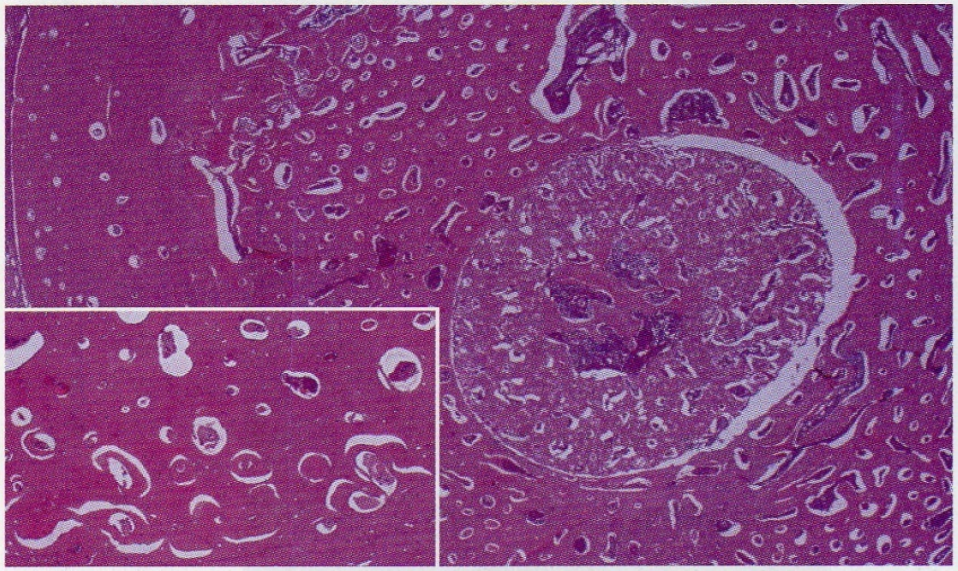

Figure 14-5 ◆ Osteopetrosis. Low-power photomicrograph showing sclerotic bone that is replacing the normal cancellous bone. The inset shows a nodular pattern of the dense bone obliterating the marrow spaces.

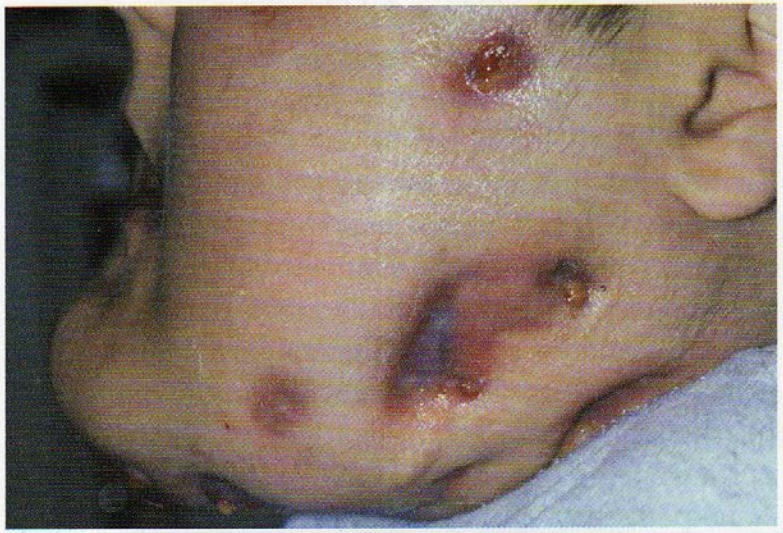

Figure 14-3 ◆ Osteopetrosis. This 24-year-old white man has the infantile form of osteopetrosis. He has suffered from mandibular osteomyelitis, and multiple draining fistulae are present on his face. (Courtesy of Dr. Dan Sarasin.)

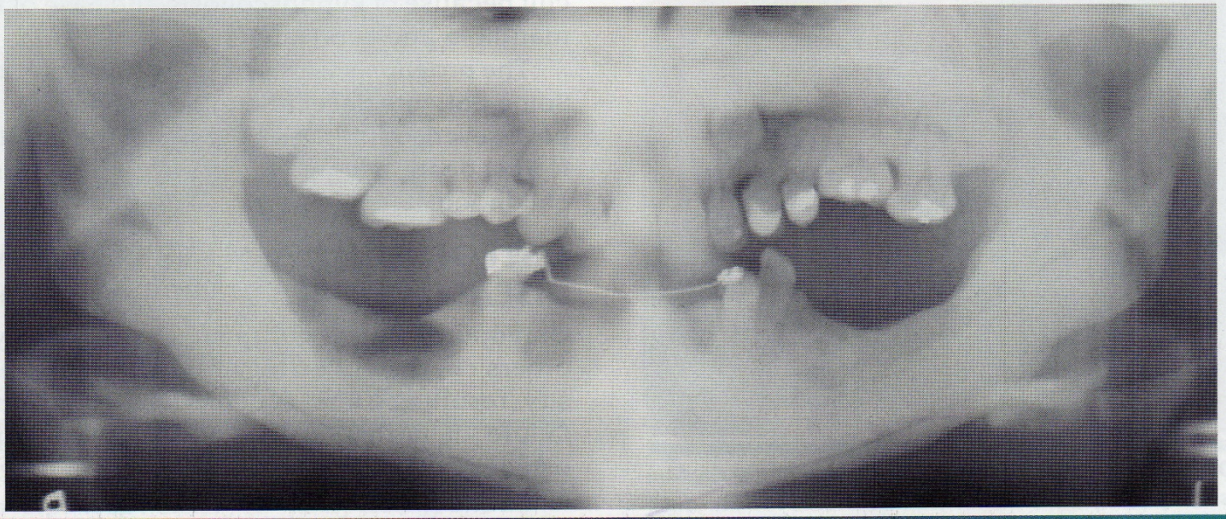

Figure 14-4 ◆ Osteopetrosis. Extensive mandibular involvement is apparent in this radiograph of a 31-year-old woman. She had been diagnosed as having osteopetrosis as a child. There is a history of multiple fractures and osteomyelitis of the jaws. (Courtesy of Dr. Dan Sarasin.)

PATHOGENESIS:

- Osteoclasts fail to function normally.
- As a result, bone remodeling is affected.
- Defective bone resorption combined with continued bone deposition results in thickening of cortical bone and sclerosis of cancellous bone.
- The exact mechanism is unknown. However, deficiency of carbonic anhydrase in osteoclasts is noted. The absence of this enzyme causes defective hydrogen ion pumping by osteoclasts, and this, in turn, causes defective bone resorption by osteoclasts, as an acidic environment is needed for dissociation of calcium hydroxyapatite from bone matrix. Hence, bone resorption fails while its formation persists.

Excessive bone is formed.

Osteogenesis imperfecta (OI) is a genetic disorder characterized by **bones that break easily**, often from little or no apparent cause. There are at least four recognized forms of the disorder, representing extreme variation in severity from one individual to another. For example, a person may have just a few or as many as several hundred fractures in a lifetime.

*Bones fracture easily. Fractures often present at birth, and x-rays may reveal healed fractures that occurred before birth.

*Sclera have a blue, purple, or gray tint.

*Brittle teeth (Dentinogenesis Imperfecta)

*Hearing loss possible.

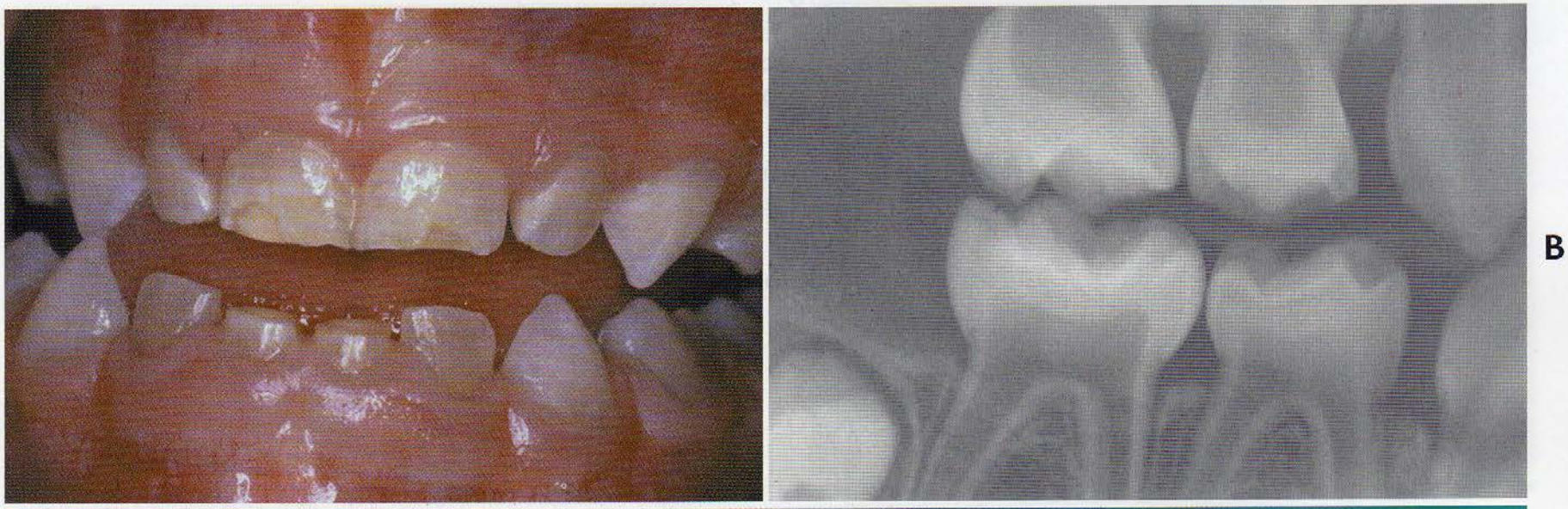

Figure 14-1 • **Osteogenesis imperfecta. A,** Opalescent dentin in a patient with osteogenesis imperfecta. **B,** Bite-wing radiograph of the same patient showing shell teeth with thin dentin and enamel of normal thickness. (Courtesy of Dr. Tom Ison.)

Osteogenisis imperfecta:

Spectrum of disease of bone due to a basic alteration in the formation of bone c.t matrix, resulting in inability of matrix to fully mineralized ,a tendency for multiple broken bone ,blue sclera of eye and associated dentenogenisis imperfecta .

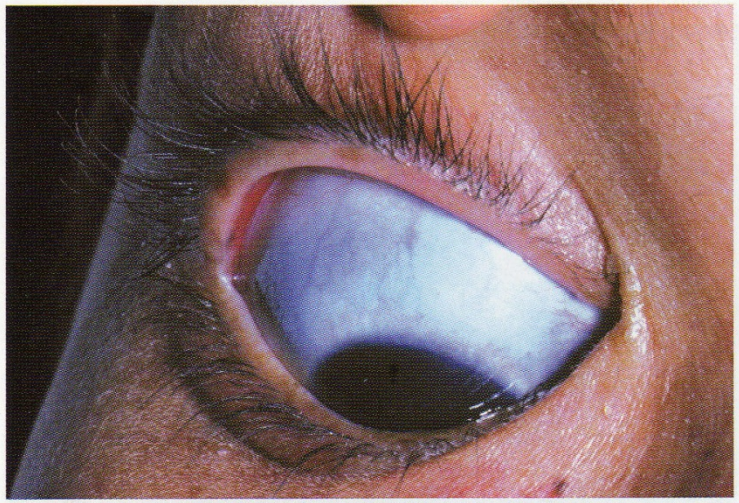

Figure 14-2 • **Osteogenesis imperfecta.** Blue sclera in a patient with osteogenesis imperfecta.

Deformity of long bones

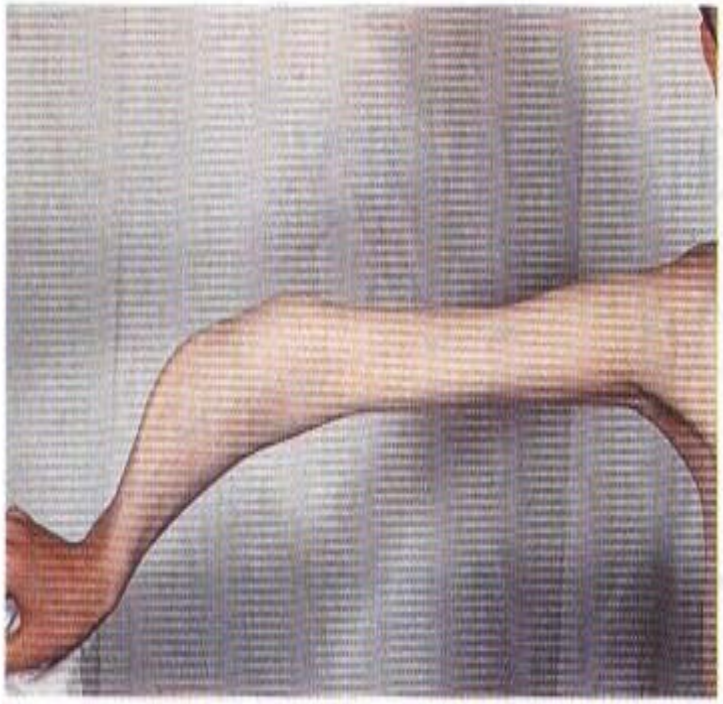

Fig. 16.3 Osteogenesis imperfecta associated with severe deformity of long bones.

Fig. 10.2 Osteogenesis imperfecta. Leg of an infant with a severe type of osteogenesis imperfecta showing severe bending as a result of multiple fractures under body weight.

Cleidocranial dysplasia

An autosomal dominant trait

Abnormalities of the skull,jaws &clavical

Dental anamoles are common

Delayed closure of fontanelles

Nasal bridge is also depressed

Partial or complete absence of the clavicles

Dental manifestation

Narrow high arched palate

Many or most permanent teeth typically remain embedded in the jaw

Many additional unerupted teeth also present

Sometimes many dentigerous cysts

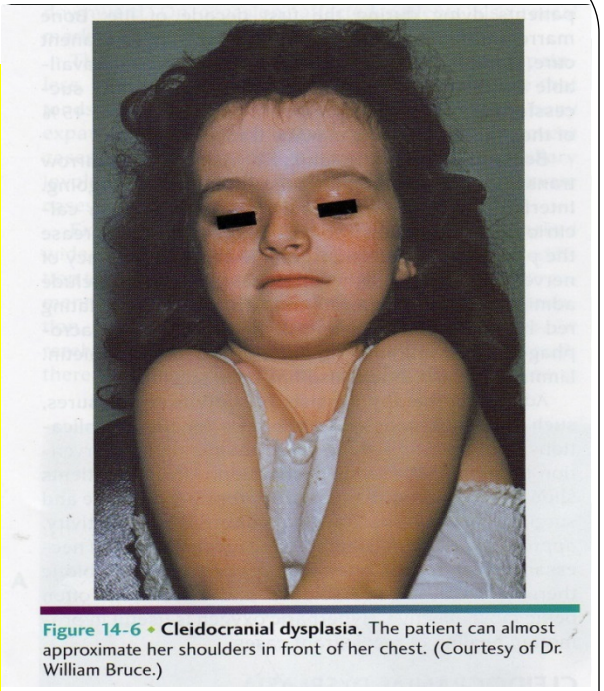

Figure 14-6 • **Cleidocranial dysplasia.** The patient can almost approximate her shoulders in front of her chest. (Courtesy of Dr. William Bruce.)