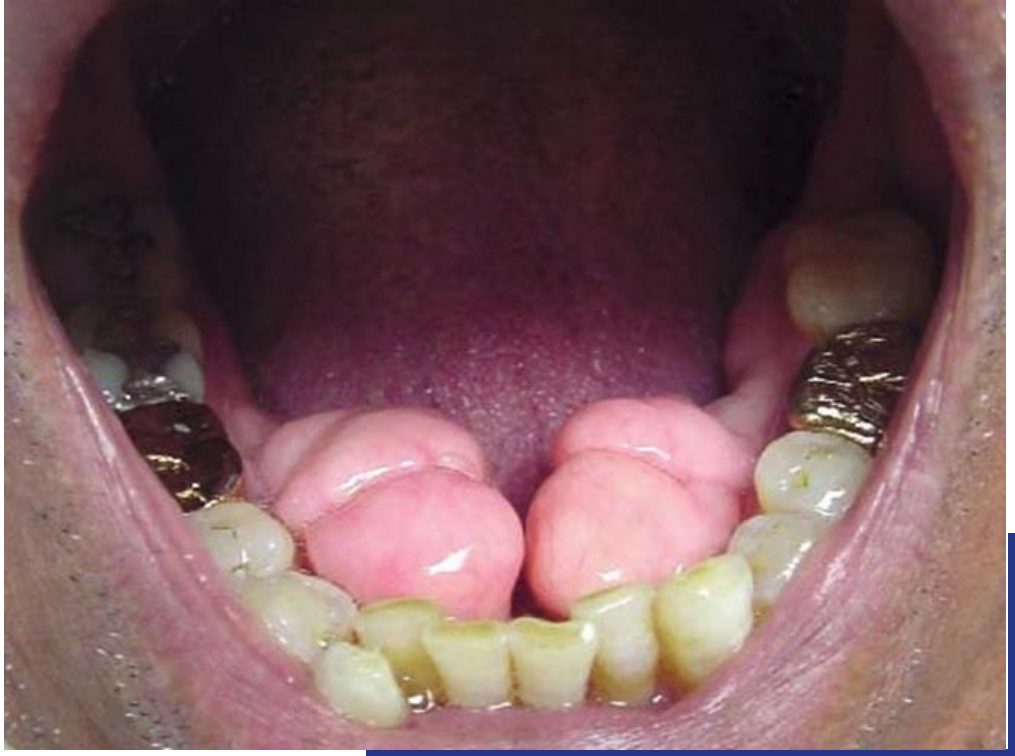


THE UNIVERSITY OF WESTERN AUSTRALIA

Oral Pathology module

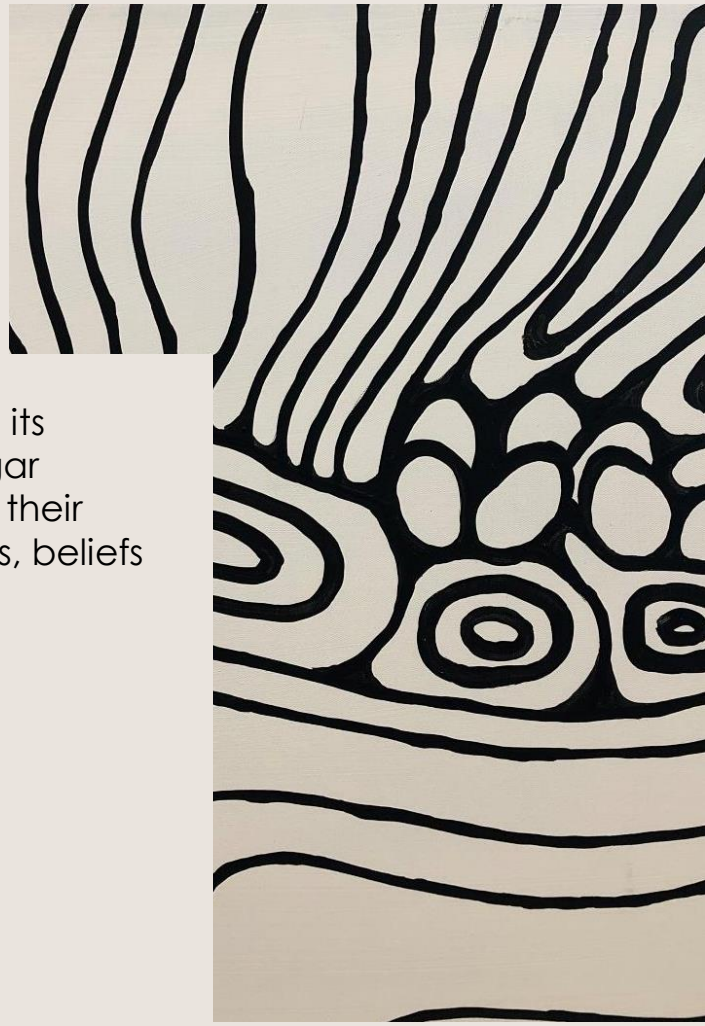
Bone and Metabolic Disorders

A/Prof Omar Kujan

BDS DipOPath MDSc MFDS RCPS FHEA FRCPath PhD

Acknowledgement
of country

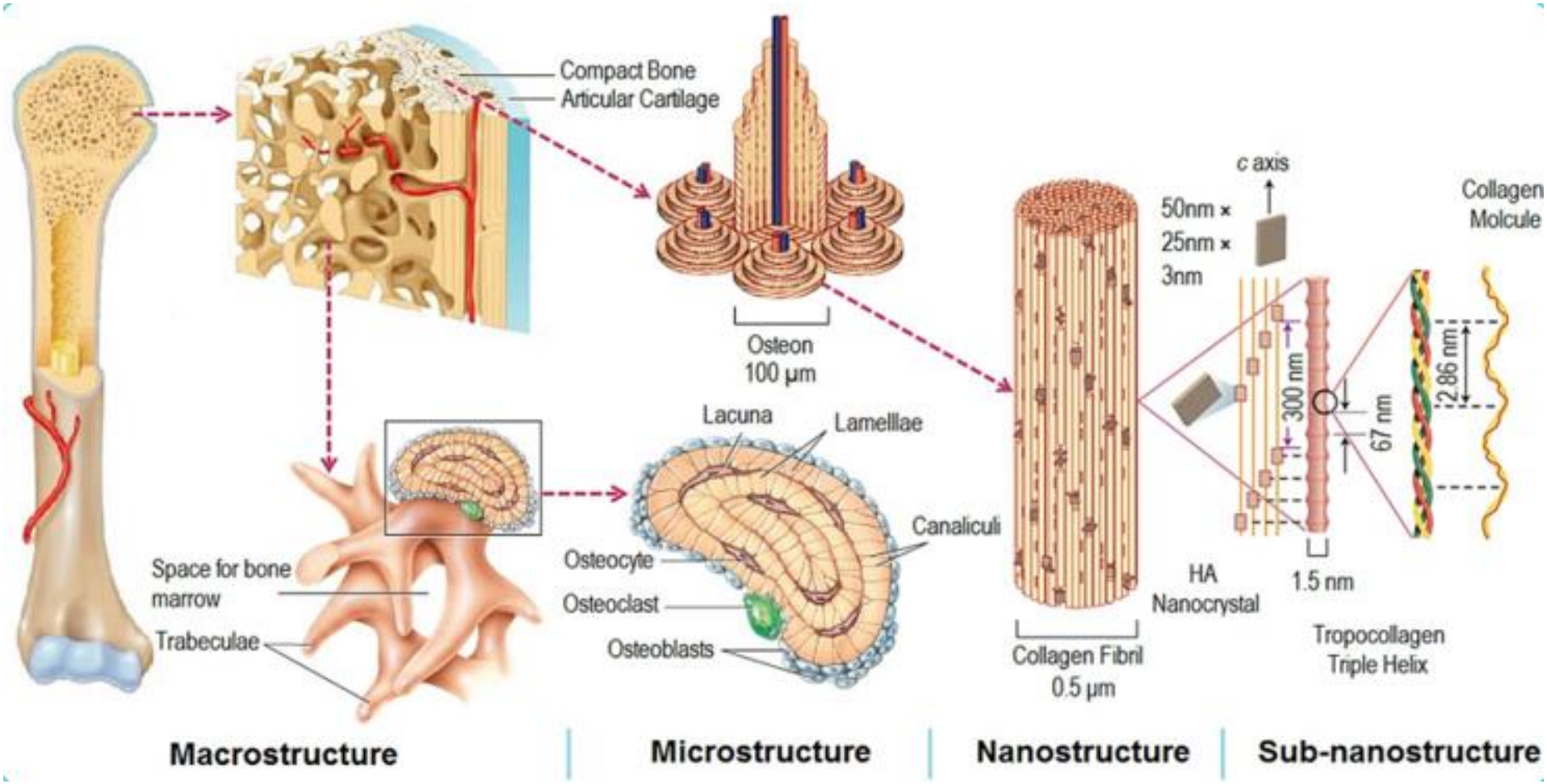
The University of Western Australia acknowledges that its campus is situated on Noongar land, and that Noongar people remain the spiritual and cultural custodians of their land, and continue to practise their values, languages, beliefs and knowledge.



Artist: Dr Richard Barry Walley OAM

Learning outcomes

1. Explain the aetiology, pathogenesis, clinical (including radiographic) and histopathological features of bone diseases


Compact Bone
Articular Cartilage
Osteon
100 µm
Lacuna
Lamelllae
Canaliculi
Osteocyte
Osteoclast
Osteoblasts
Space for bone marrow
Trabeculae
c axis
50nm ×
25nm ×
3nm
Collagen Molcule
300 nm
67 nm
2.86 nm
HA Nanocrystal
1.5 nm
Tropocollagen Triple Helix
Collagen Fibril
0.5 µm
Macrostructure
Microstructure
Nanostructure
Sub-nanostructure

Radiography

- Periapical
- OPG
- CBCT
- CT Scan

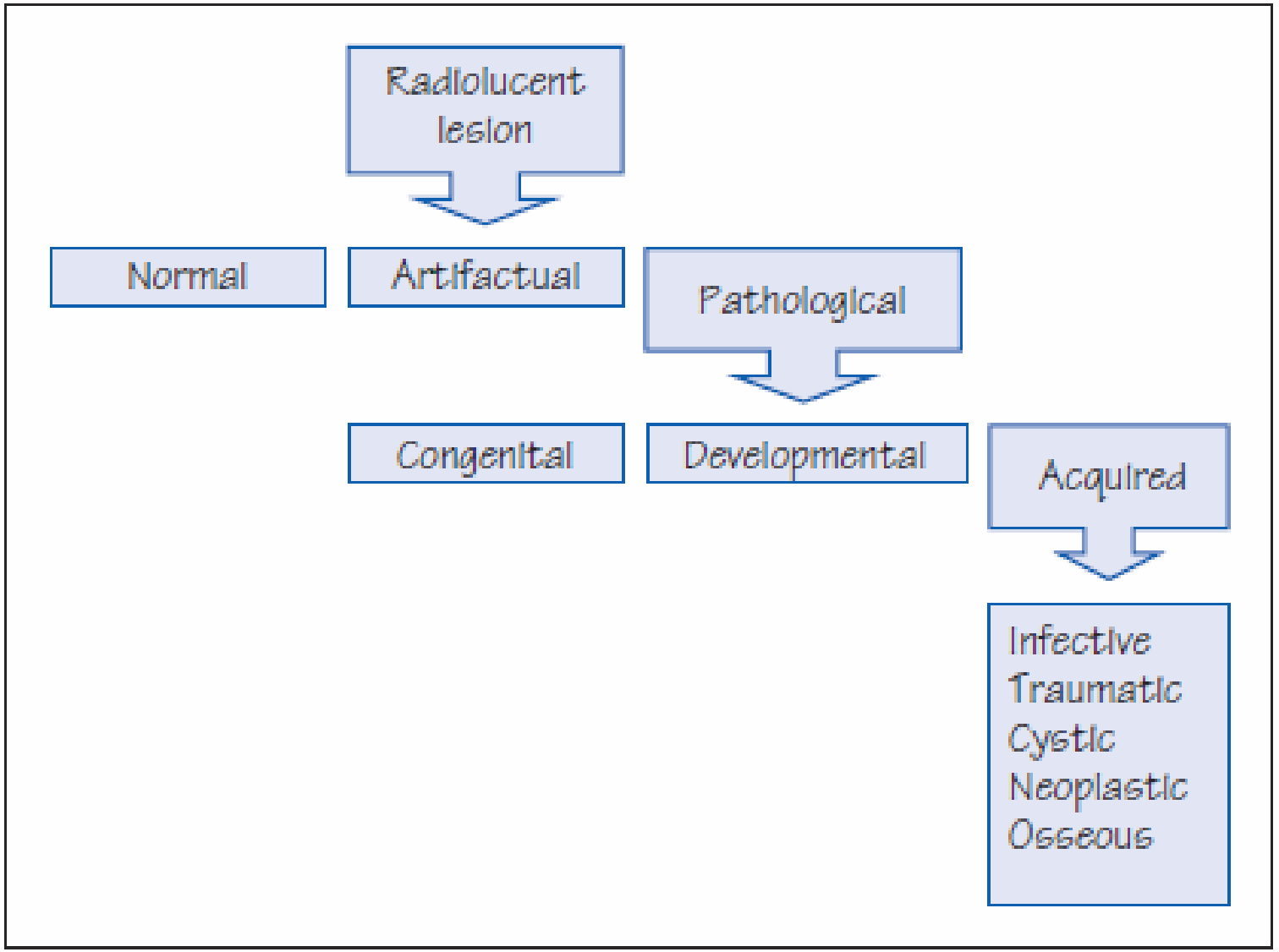


Figure 53.1a Radiolucent lesions.

Source: Oral Medicine and Pathology at a glance, 2010, Scully et al.

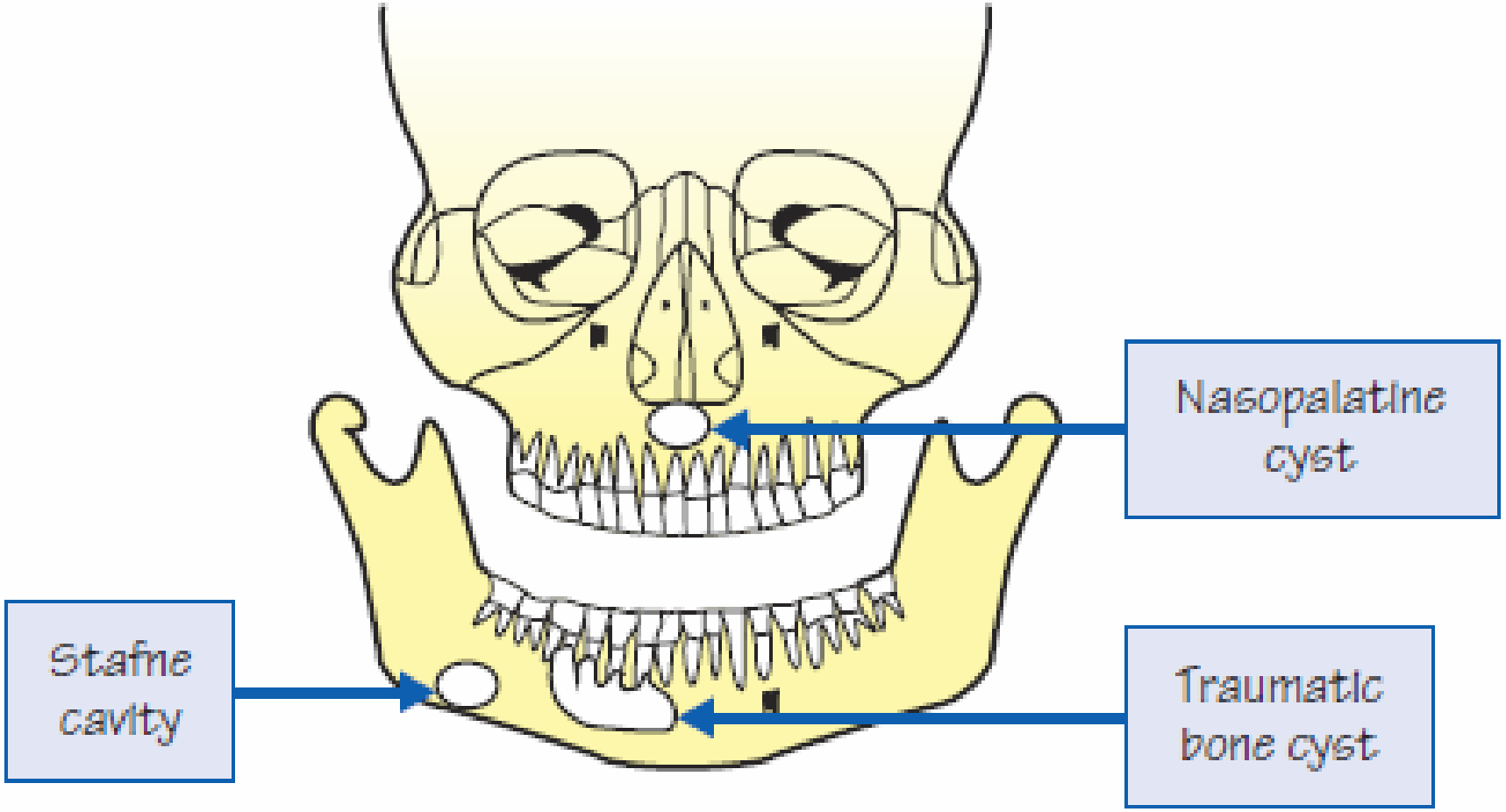


Figure 53.1b Nonodontogenic radiolucent cystic lesions.

Source: Oral Medicine and Pathology at a glance, 2010, Scully et al.

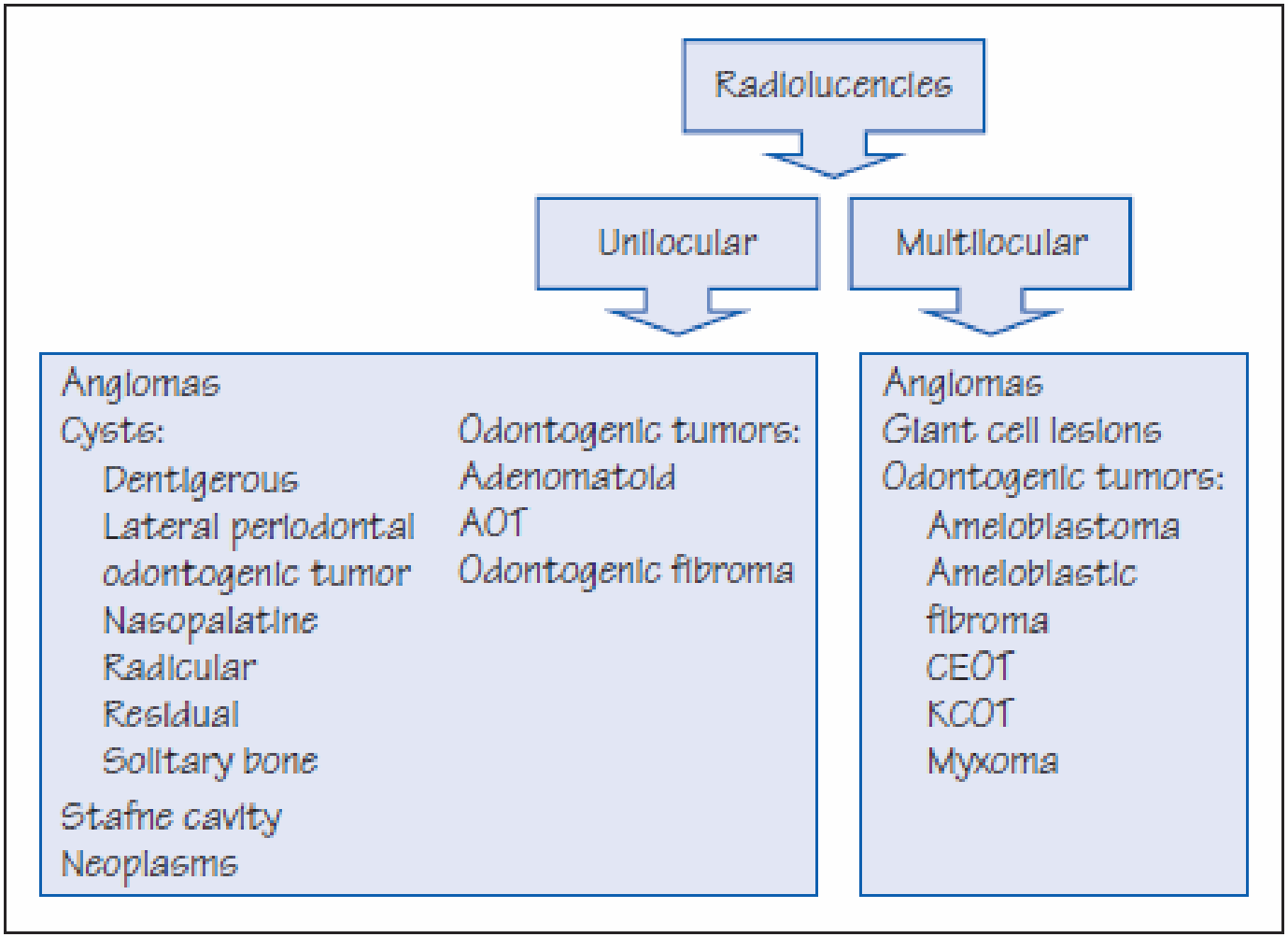


Figure 53.4b Radiolucent lesions. CEOT, calcifying epithelial odontogenic tumor; KCOT, keratocystic odontogenic tumor; AOT, adenomatoid odontogenic tumor.

Source: Oral Medicine and Pathology at a glance, 2010, Scully et al.

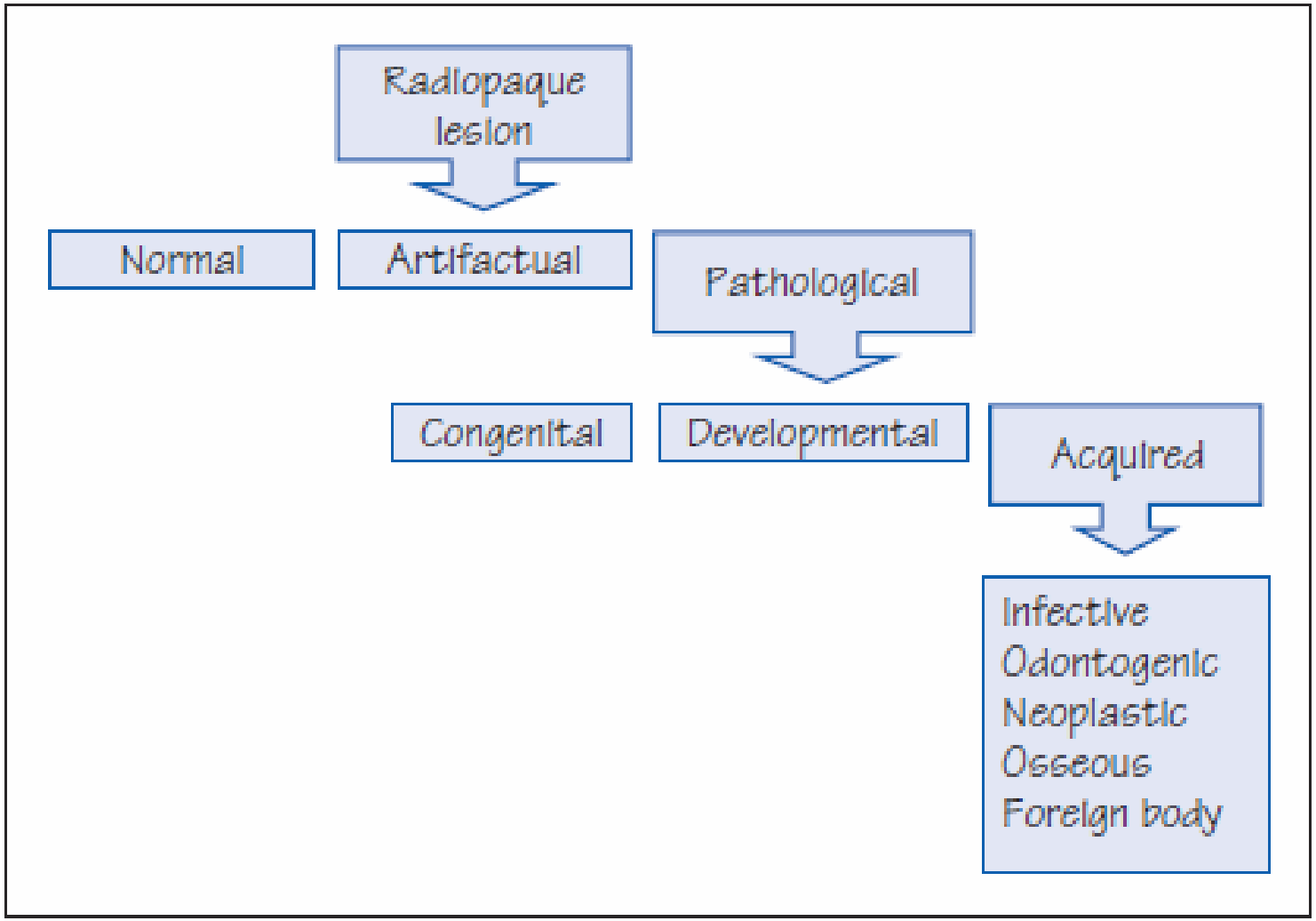
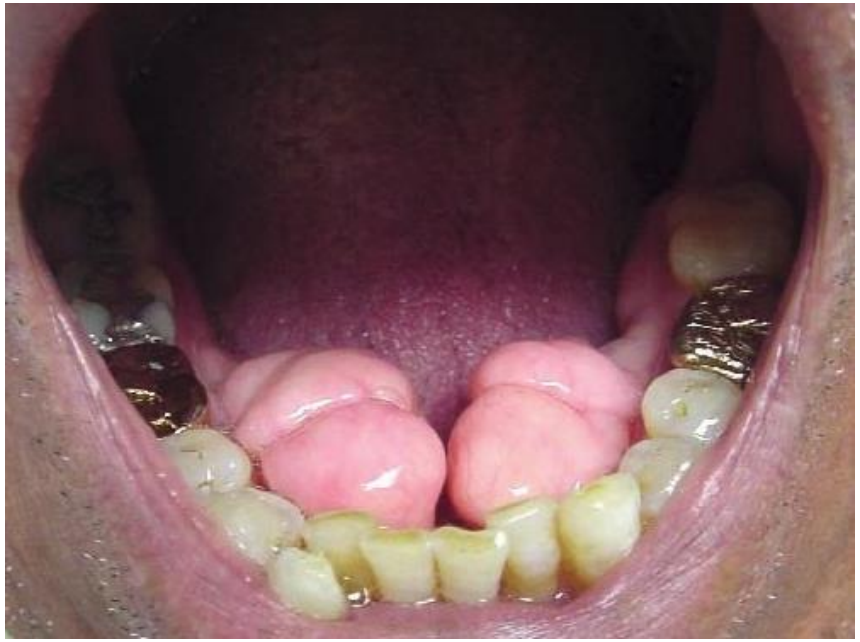


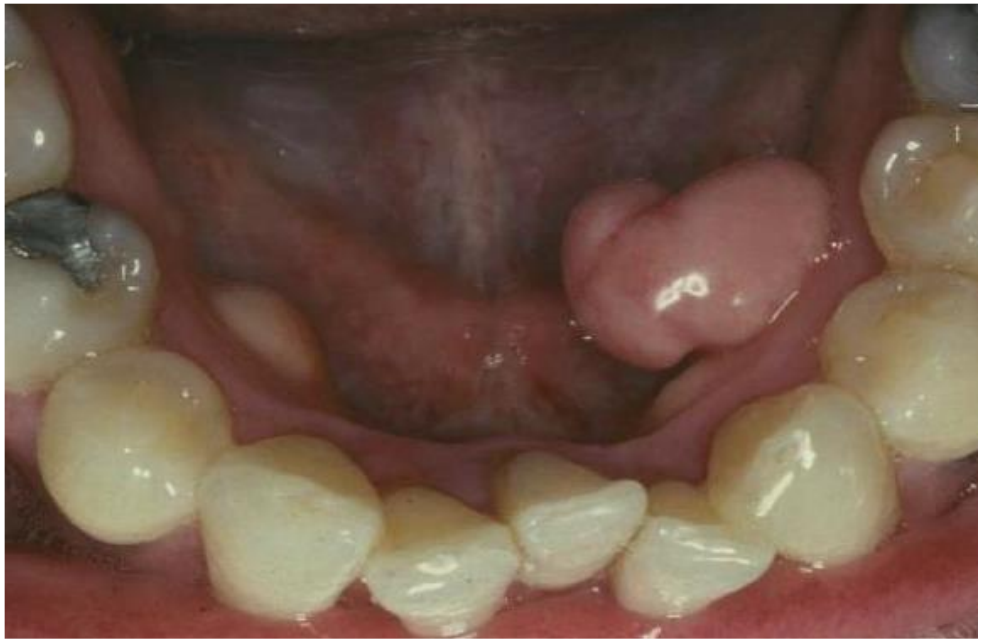
Figure 53.4a Radiopaque lesions.

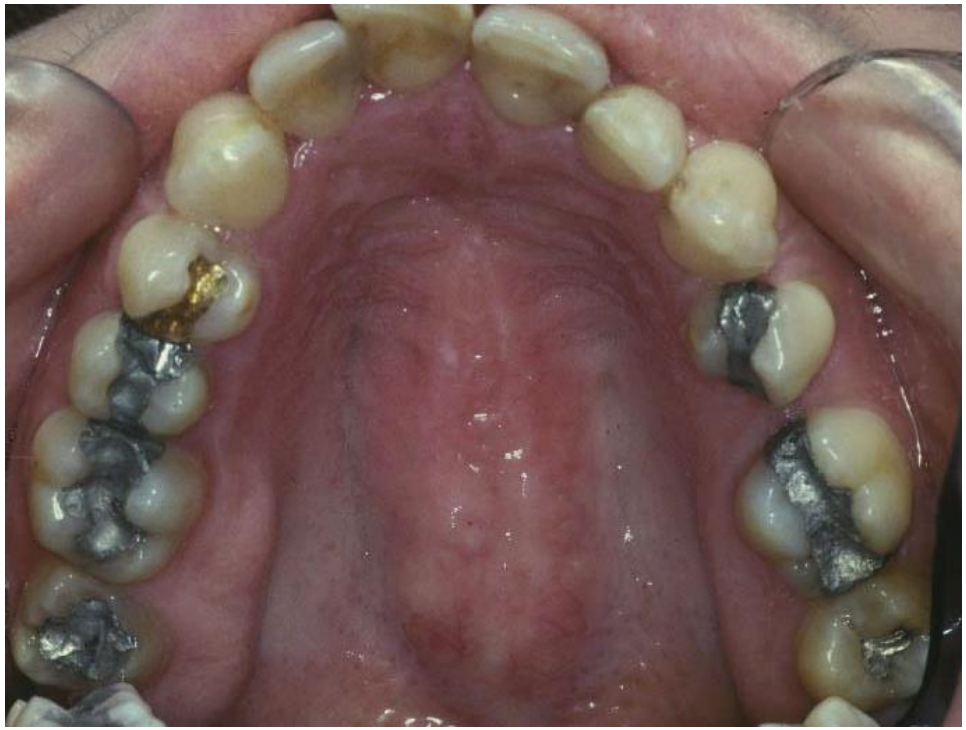
Source: Oral Medicine and Pathology at a glance, 2010, Scully et al.

Tori and Exostosis

- Tori
  - 2-10% of adults;
  - Clinically: exophytic, hard, uninodular or multinodular bony masses covered by mucosa that may be ulcerated from trauma;
  - torus palatinus and torus mandibularis on the midline of palate and lingual mandible (usually bilateral and symmetric), respectively;
  - often site of bisphosphonate-associated osteonecrosis

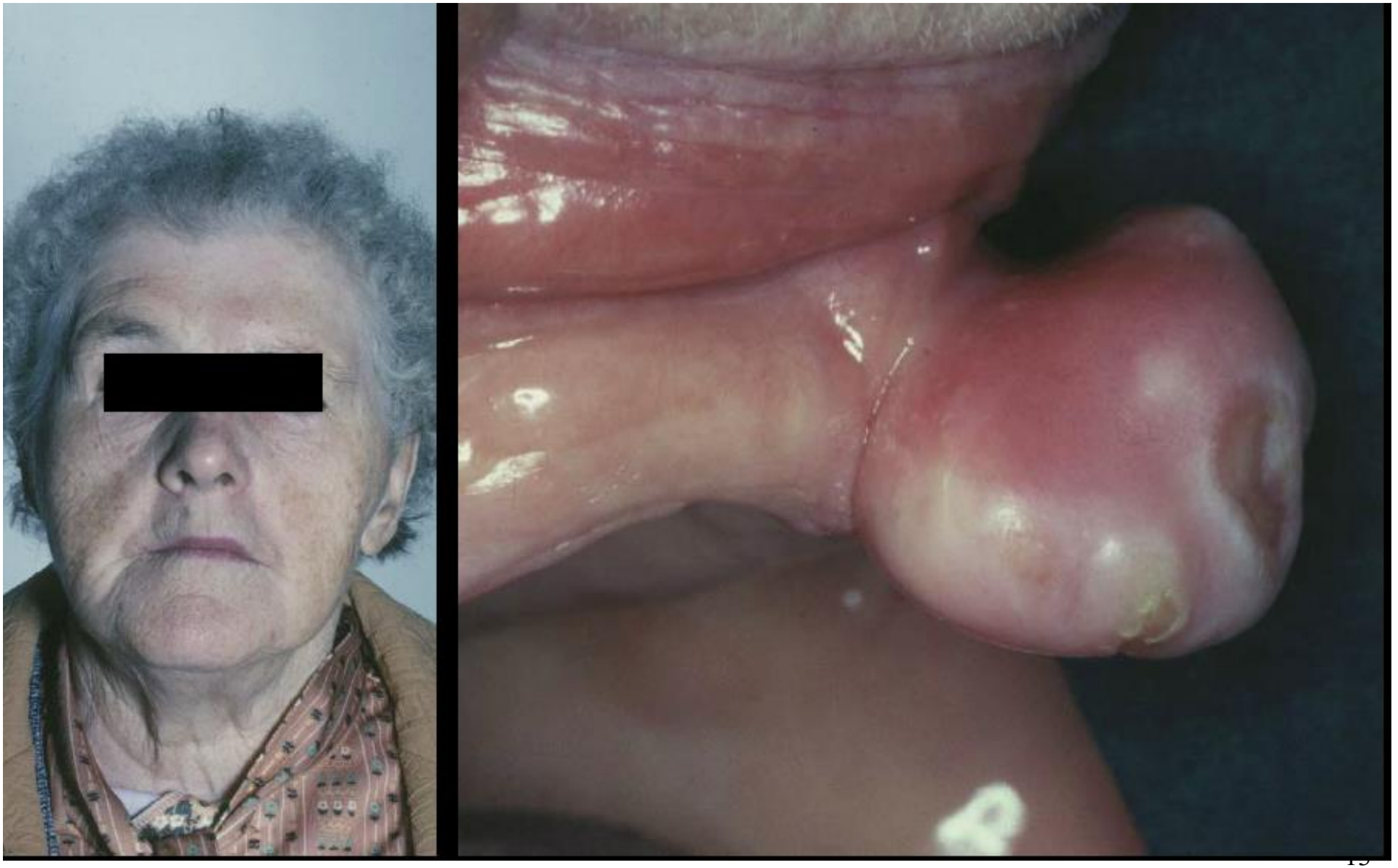






Tori and Exostosis

- Exostoses:
  - 27% of adults;
  - male predilection (5 : 1);
  - Clinically: outgrowths of bone, nodular or sessile frequently on aspects of mandible and maxilla or ascending arch of the palate and more than 90% having concurrent tori
- Possible aetiology:
  - Chronic irritation
  - Periosteal proliferation
  - Bone formation



Differential diagnosis

- Biopsy is not necessary unless the lesion is radiographically progressive; histopathology is similar, and bone is often sclerotic.

- DD:
  - Condensing osteitis is similar to idiopathic osteosclerosis but is found at or very close to the apices of teeth and is likely reactive to chronic occlusal trauma or low-grade inflammation or odontogenic infection.
  - True osteomas are associated with (autosomal dominant condition associated with mutation in the APC gene and development of colonic polyps and carcinoma, desmoid tumors, supernumerary teeth, and skin cysts).

Osteomyelitis

- Definition: inflammatory condition of the bone, which begins as an infection of the medullary cavity, rapidly involves the haversian systems, and extends to involve the periosteum of the affected area
- Only 2 out of every 10,000 people get osteomyelitis.

Predisposing factors

- Diabetes (most cases of osteomyelitis stem from diabetes)
- Sickle cell disease
- HIV or AIDS
- Rheumatoid arthritis
- Intravenous drug use
- Alcoholism
- Long-term use of steroids
- Hemodialysis
- Poor blood supply
- Recent injury

Osteomyelitis of the Jaws

- The potential source of infection is
    1. Periapical infection
    2. Periodontal pocket's
    3. Acute gingivitis
    4. Penetrating and contaminated injuries
    5. Tooth extraction

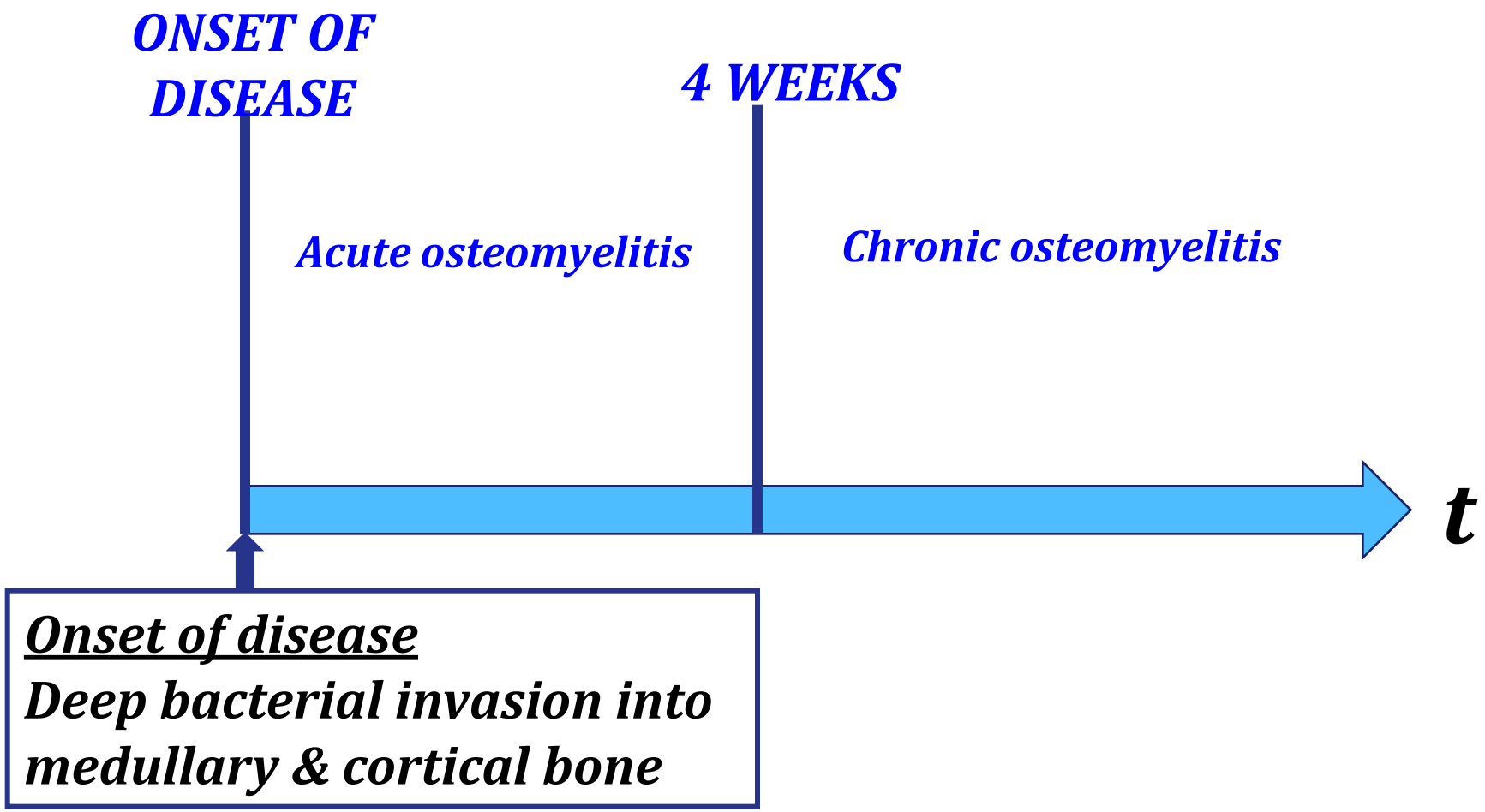
Signs and symptoms

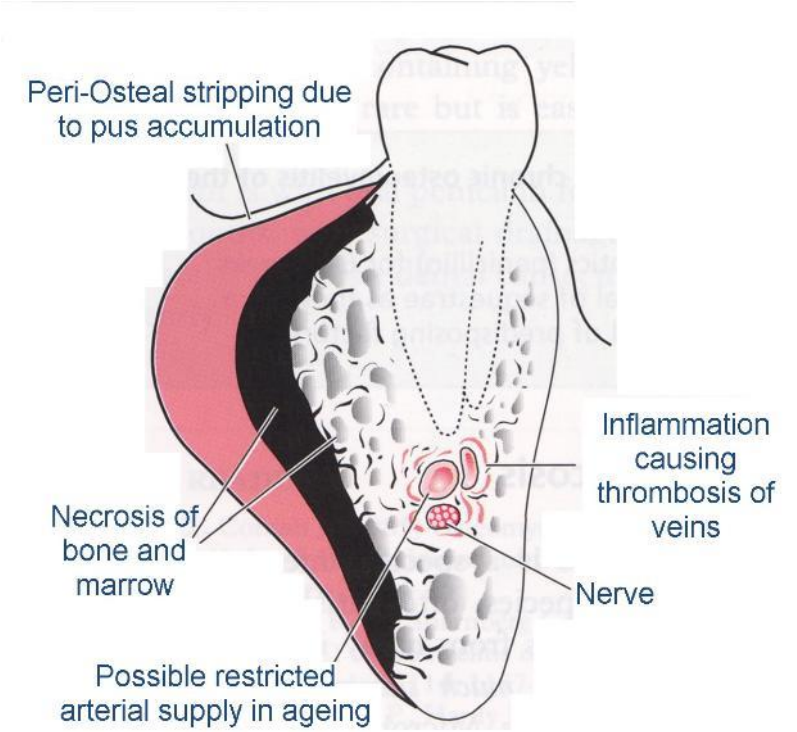
- Fever, irritability, fatigue
- Nausea
- Tenderness, redness, and warmth in the area of the infection
- Swelling around the affected bone
- Lost range of motion

Classification

- Acute osteomyelitis is mainly in children (acute process occurs up to one month after the onset of symptoms)
- Chronic osteomyelitis (mainly adults)
  - primary chronic osteomyelitis (PCO) is defined as chronic non-suppurative osteomyelitis; when PCO occurs in children and adolescents it is termed 'Garré's osteomyelitis'.
  - secondary chronic osteomyelitis (SCO), which is chronic osteomyelitis with suppuration, abscess/fistula formation, and sequestration at some stage of the disease due to a defined, infectious aetiology.

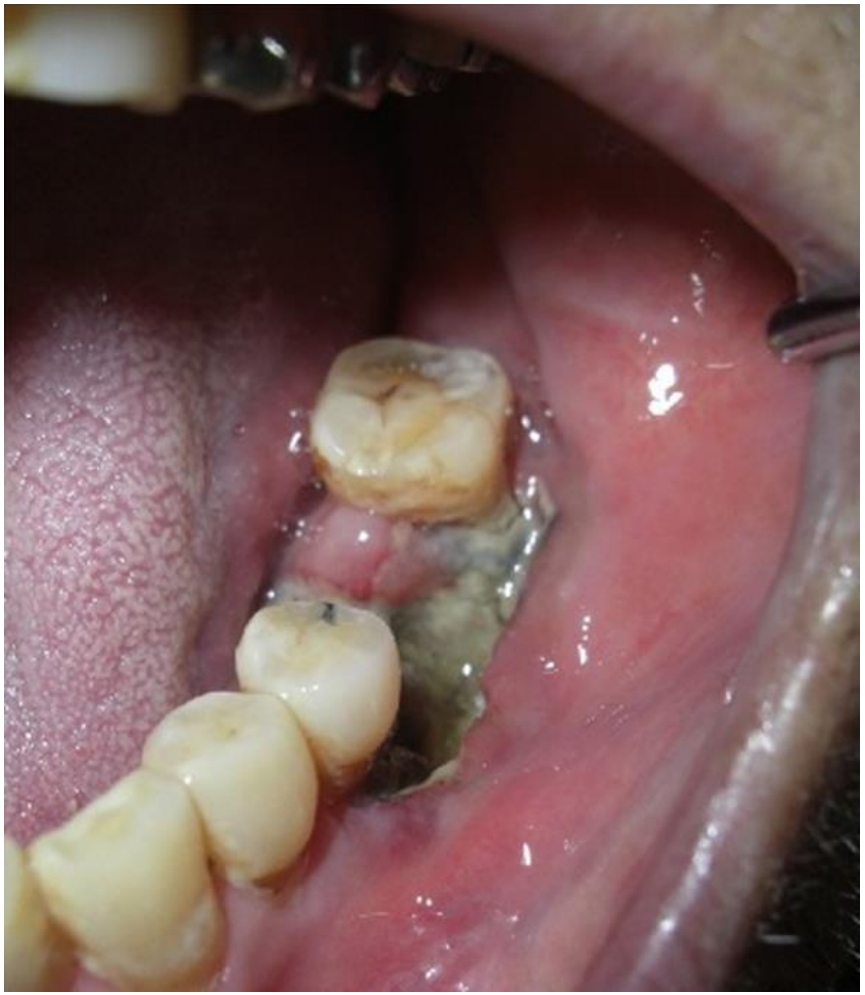
Reference	Classification	Classification criteria
Hjorting-Hansen E Decortication in treatment of osteomyelitis of the mandible. *Oral Surg Oral Med Oral Pathol 1970 May;29(5):641-55*	I. Acute/subacute osteomyelitis II. Secondary chronic osteomyelitis III. Primary chronic osteomyelitis	Classification based on clinical picture and radiology
Marx RE Chronic Osteomyelitis of the Jaws *Oral and Maxillofacial Surgery Clinics of North America, Vol 3, No 2, May 91, 367-81* Mercuri LG Acute Osteomyelitis of the Jaws *Oral and Maxillofacial Surgery Clinics of North America, Vol 3, No 2, May 91, 355-65*	I. Acute osteomyelitis 1. Associated with Hematogenous spread* 2. Associated with intrinsic bone pathology or peripheral vascular disease* 3. Associated with odontogenic and nonodontogenic local processes* II. Chronic osteomyelitis 1. Chronic recurrent multifocal osteomyelitis of children 2. Garrè's osteomyelitis 3. Chronic suppurative osteomyelitis – Foreign body related – Systemic disease related – Related to persistent or resistant organisms 4. True chronic diffuse sclerosing osteomyelitis	Classification based on clinical picture and radiology, etiology, and pathophysiology Classification of acute osteomyelitis by Mercuri, classification of chronic osteomyelitis by Marx. The arbitrary time limit of one month is used to differ acute from chronic osteomyelitis * From Waldvogel and Medoff 1970
Panders AK, Hadders HN Chronic sclerosing inflammations of the jaw. Osteomyelitis sicca (Garre), chronic sclerosing osteomyelitis with fine-meshed trabecular structure, and very dense sclerosing osteomyelitis. *Oral Surg Oral Med Oral Pathol 1970 Sep;30(3):396-412*	I. Primarily chronic jaw inflammation 1. Osteomyelitis sicca (synonymous osteomyelitis of Garrè, chronic sclerosing nonsuppurative osteomyelitis of Garrè, periostitis ossificans) 2. Chronic sclerosing osteomyelitis with fine-meshed trabecular structure 3. Local and more extensive very dense sclerosing osteomyelitis II. Secondary chronic jaw inflammation III. Chronic specific jaw inflammations – Tuberculosis – Syphilis – Lepra – Actinomycosis	Classification based on clinical picture and radiology Classification of chronic osteomyelitis forms only


ONSET OF DISEASE
4 WEEKS
Acute osteomyelitis
Chronic osteomyelitis
t
Onset of disease
Deep bacterial invasion into medullary & cortical bone



Pathogenesis of Mandibular *Osteomyelitis*

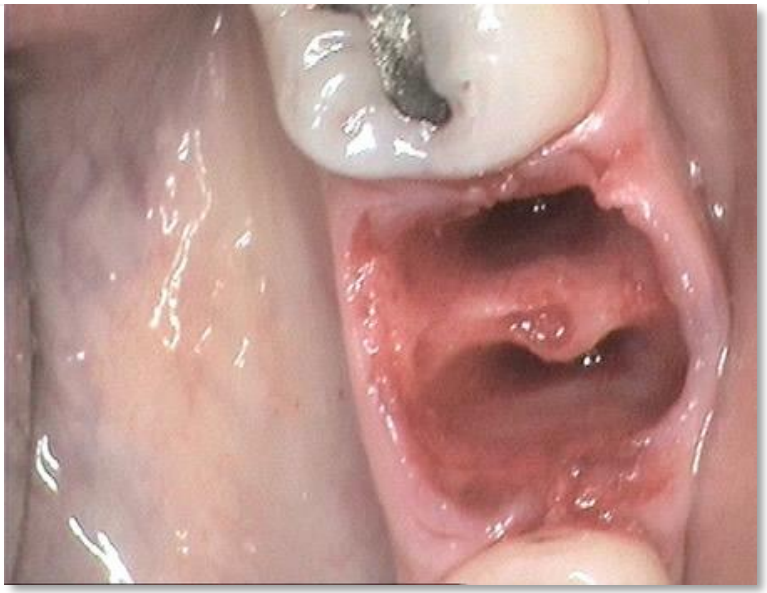
Inflammation causes thrombosis of vessels in the marrow, '*peri-osteal stripping*' by pus (or surgery) causes loss of peri-osteal blood supply, with consequent bone necrosis. This encourages continuance of infection as well as bone resorption.



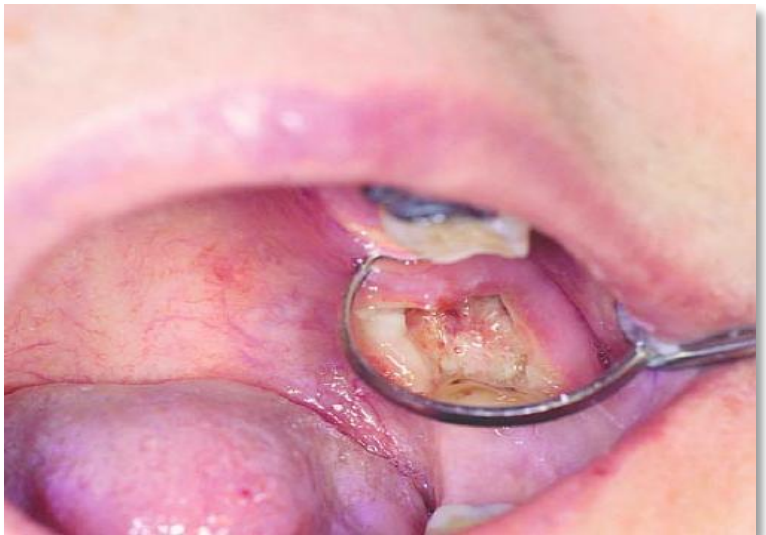
Suei Y, Taguchi A, Tanimoto K. Diagnosis and classification of mandibular osteomyelitis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2005;100(2):207-14. PubMed PMID: 16037779.

Alveolar ostitis (Dry socket)

- Localized inflammation of bone following either failure of blood clot to form in socket, or premature loss or disintegration of clot.



Unpredictable complication of tooth extraction (~1-3%).



Alveolar ostitis (Dry socket)

Etiology:

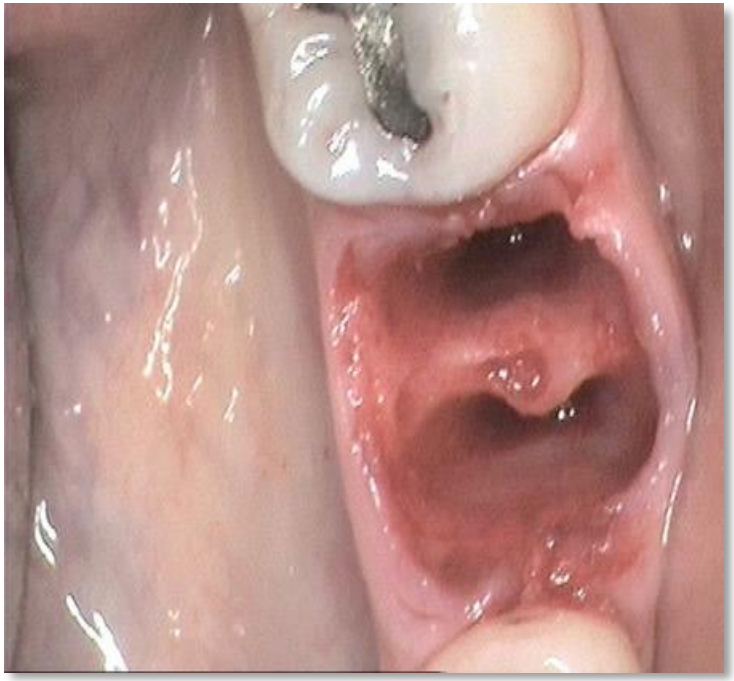
1. Failure of blood clot formation due to Poor blood supply as in:
   . Paget's disease.
   . Osteopetrosis.
   . Following radiotherapy.
   . Excessive use of vasoconstrictor
   in local anesthesia.

2. Premature loss of blood clot may be due to:
   . Excessive mouth rinsing.
   . Fibrinolysis by proteolytic bacteria.

Alveolar osteitis (Dry socket)

- **Histopathology:**

Histological section of socket wall reveal formation of necrotic bone containing empty lacunae

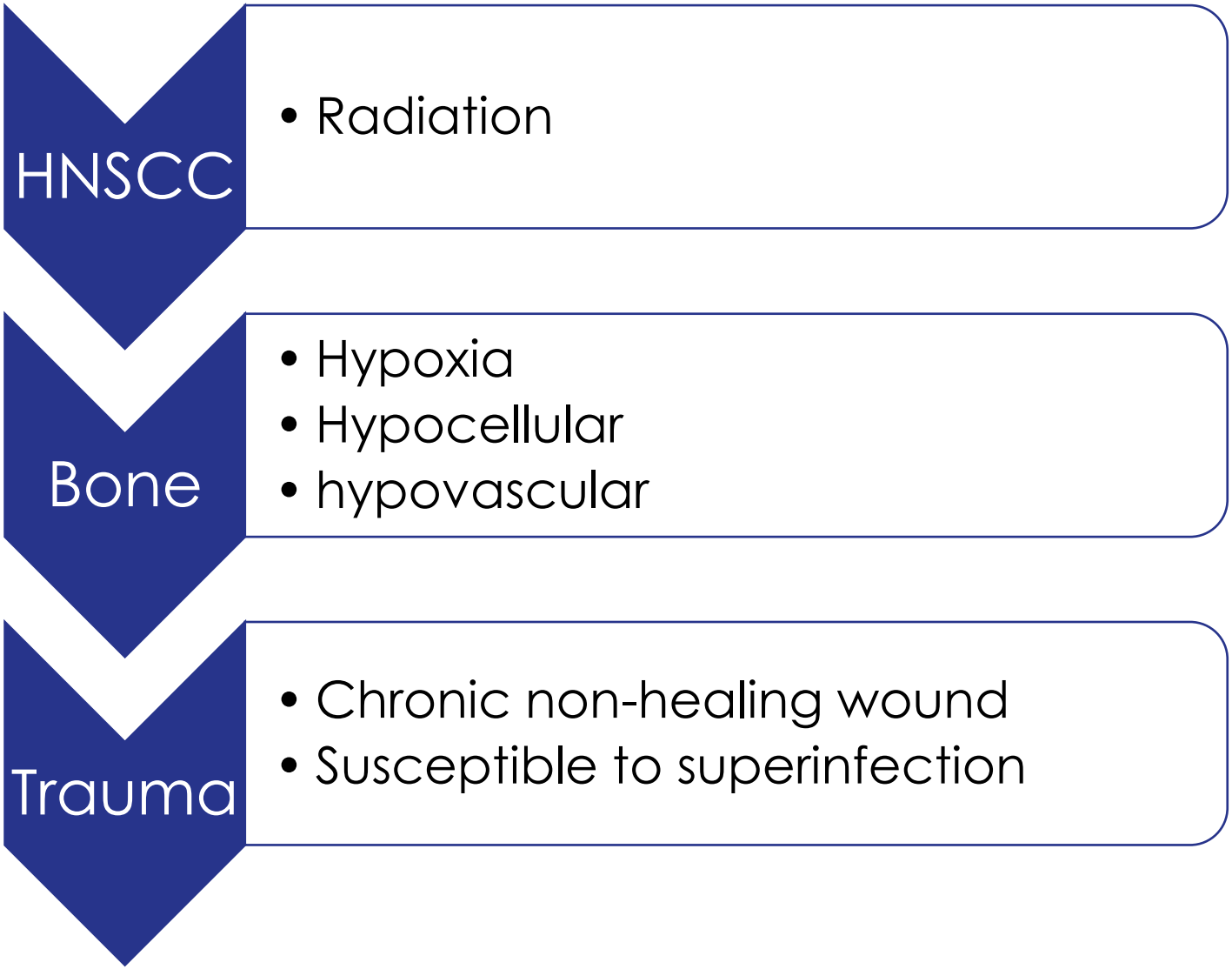


Osteonecrosis

- Osteoradionecrosis
- Osteochemonecrosis (corticosteroids and other cancer and antineoplastic drugs)
  - MRONJ (medication-induced osteonecrosis)
  - BRONJ (bisphosphonate-induced osteonecrosis)
  - Phosphorous necrosis of the jaw (exposure to white phosphorous)

Osteoradionecrosis and Radiosteomyelitis

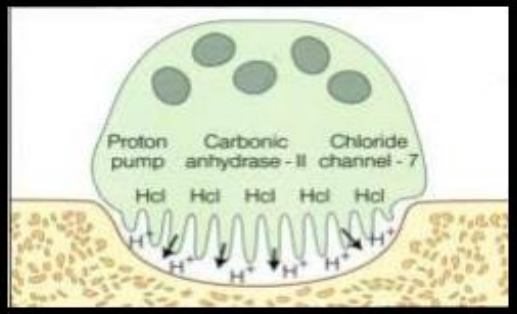
- Radiotherapy in HNSCC
- Osteoradionecrosis was once considered an infection initiated by bacteria, which invaded the radiation-damaged bone
- The term "radiation-induced osteomyelitis" or radio-osteomyelitis was commonly used. Marx (1983)

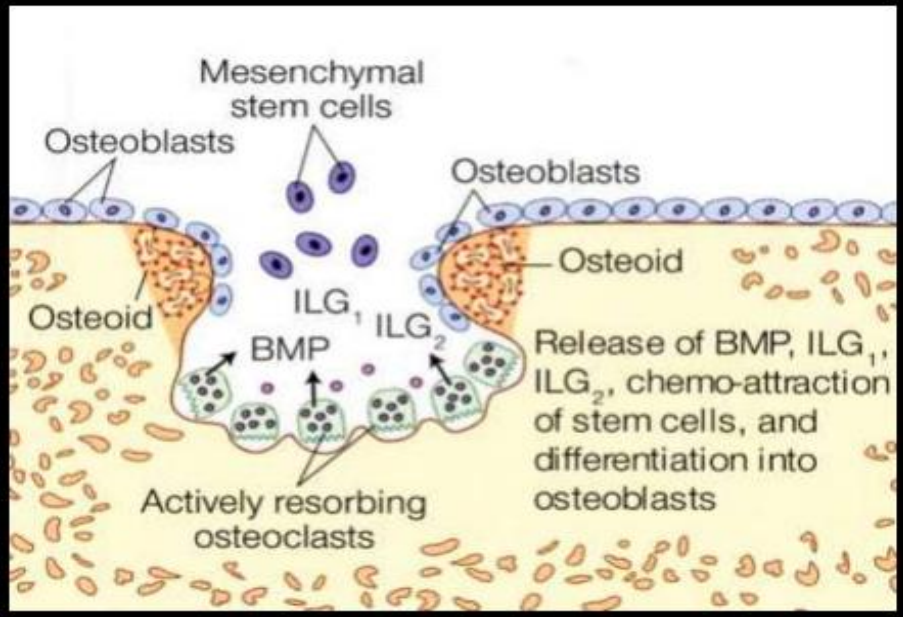

HNSCC
• Radiation
Bone
• Hypoxia
• Hypocellular
• hypovascular
Trauma
• Chronic non-healing wound
• Susceptible to superinfection

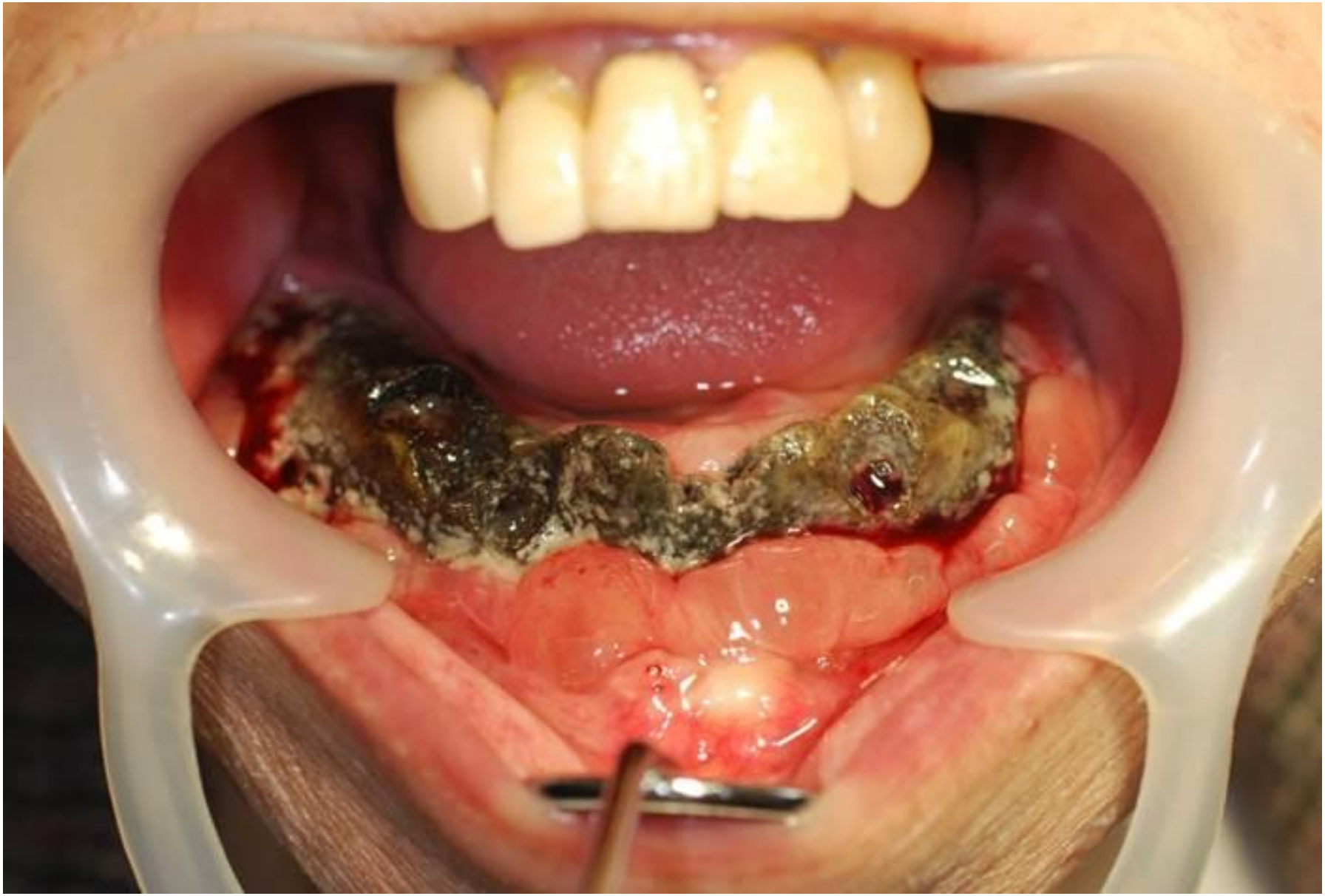
Biologic Action of Bisphosphonates

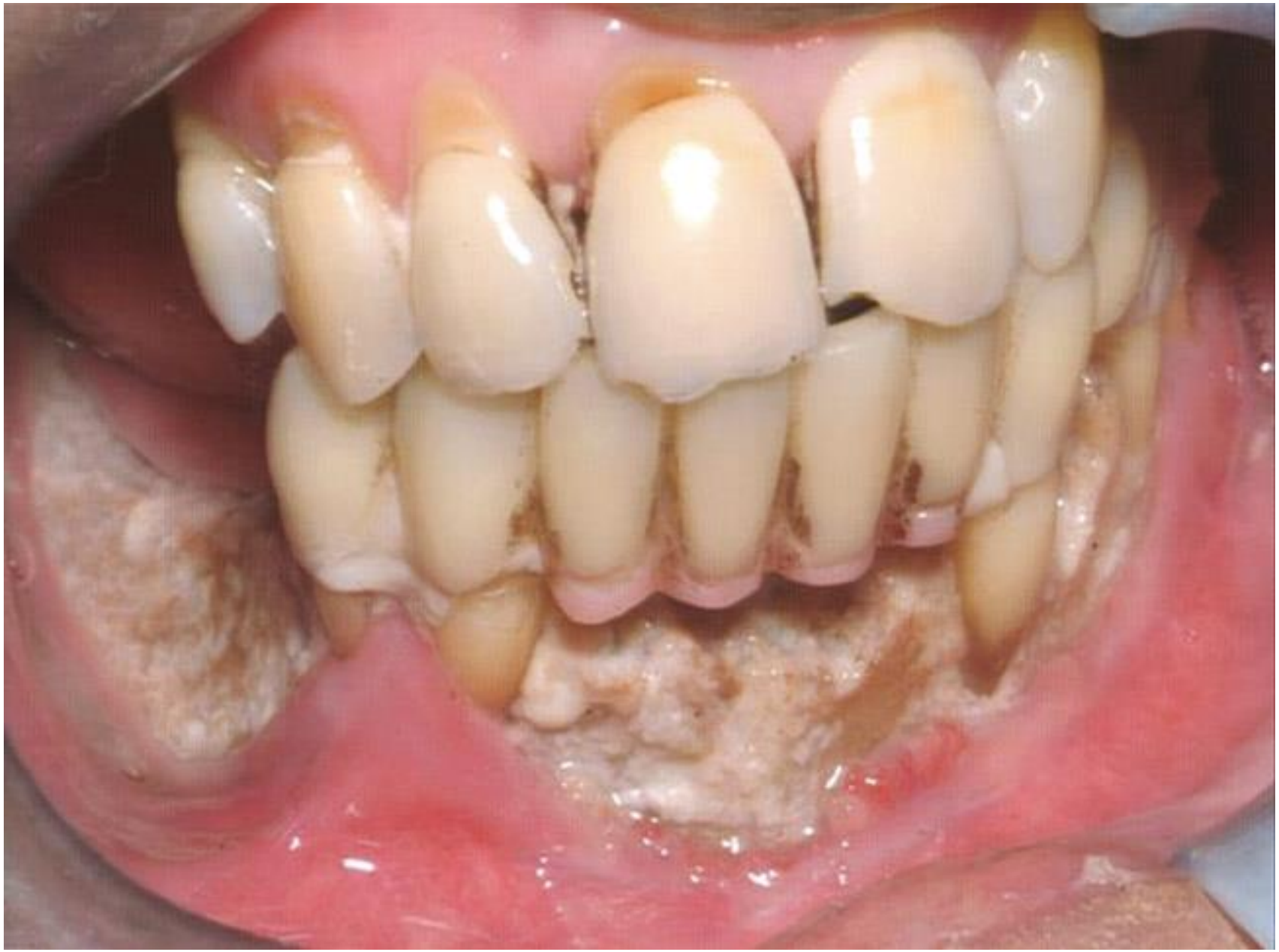
- Osteoclastic toxicity
  - Apoptosis
  - Inhibited release of bone induction proteins
    - BMP, ILG1, ILG2
  - Reduced bone turnover, resorption
  - Reduced serum calcium*
  - Hypermineralization*
    - "sclerotic" changes in lamina dura of alveolar bone

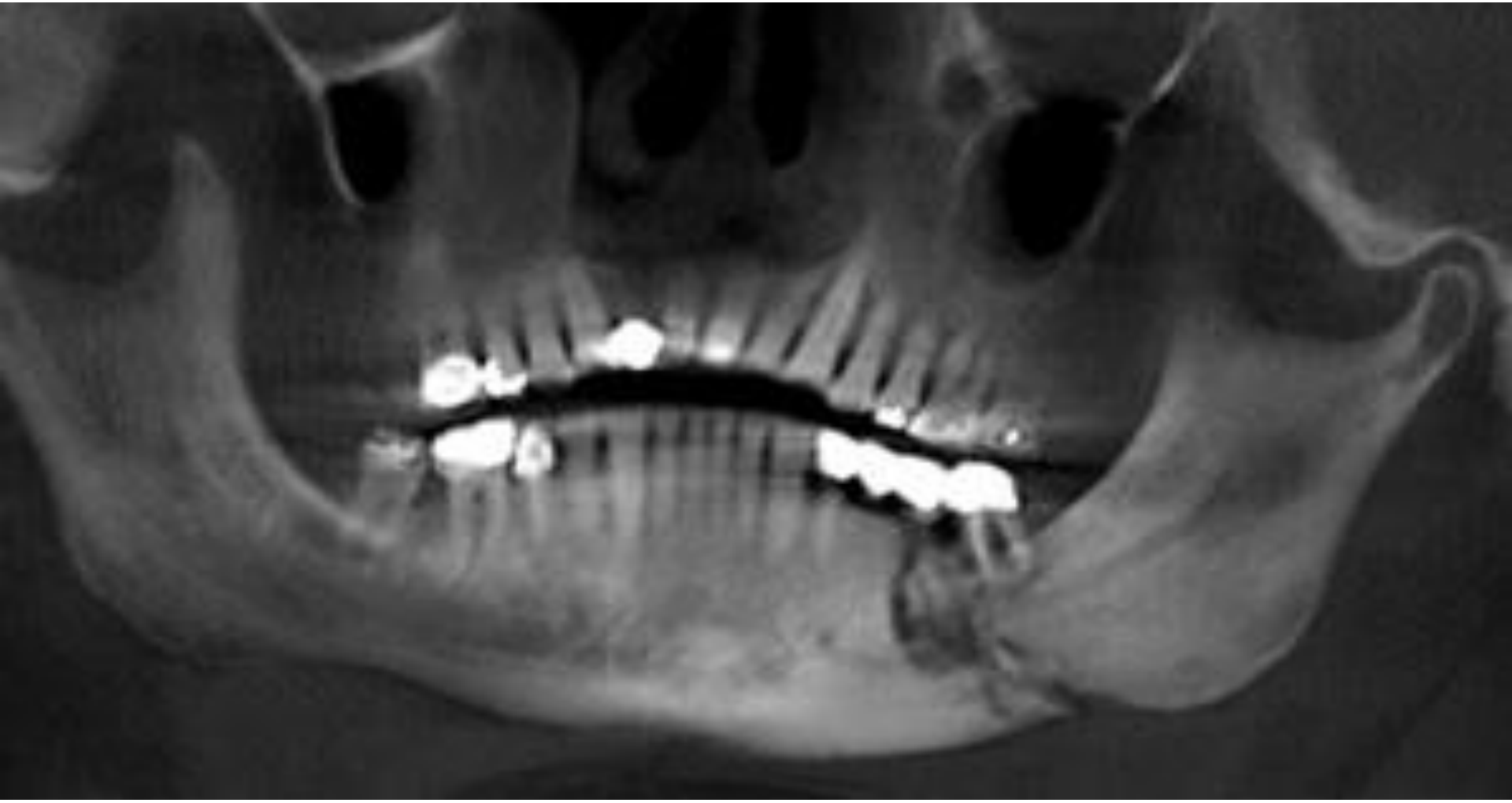
  ** = goal of medicinal use*

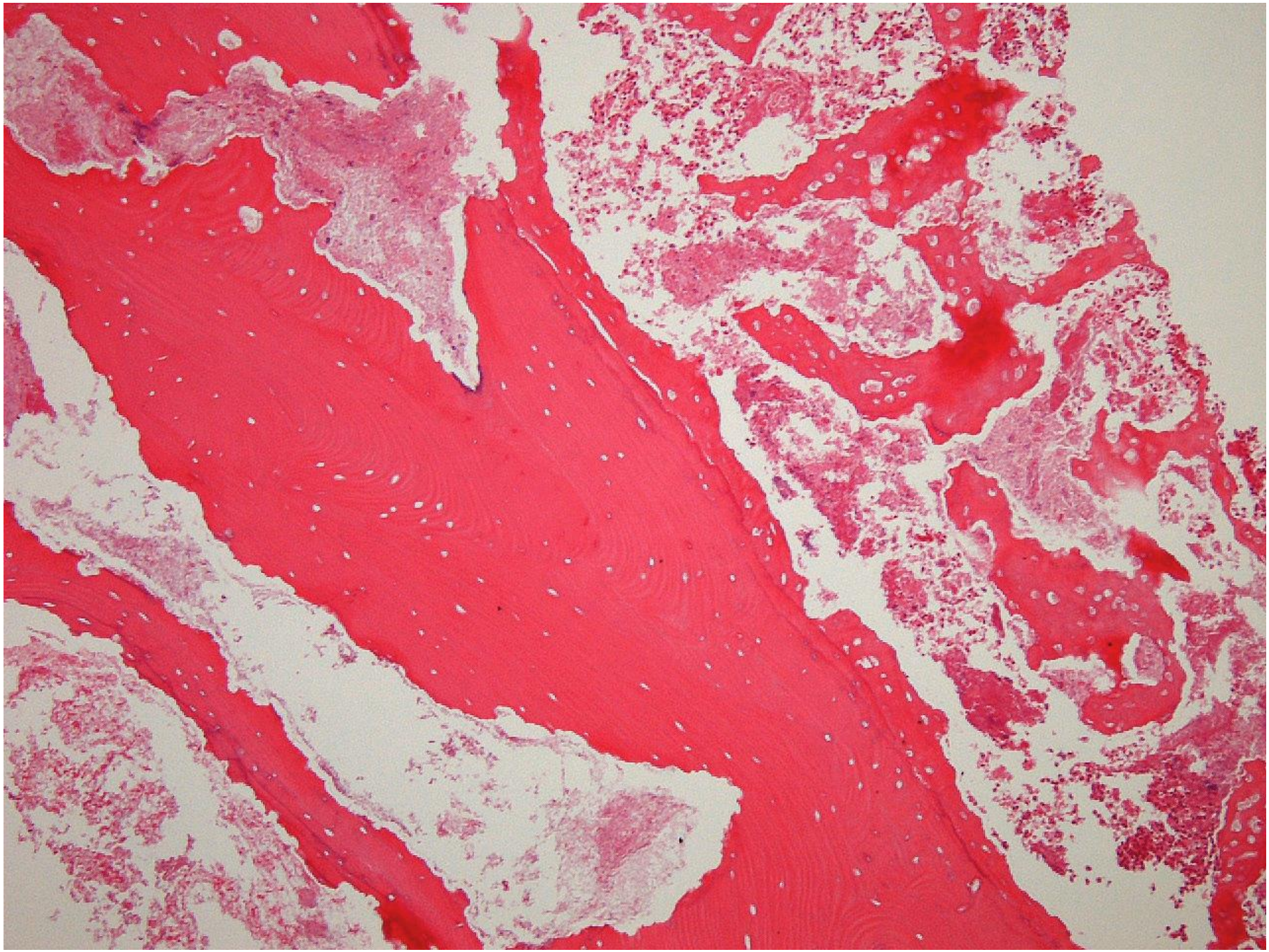












saving faces | changing lives®

American Association of Oral and Maxillofacial Surgeons

Position Paper

Medication-Related Osteonecrosis of the Jaw—2014 Update

Special Committee on Medication-Related Osteonecrosis of the Jaws:

Salvatore L. Ruggiero, DMD, MD, Clinical Professor, Division of Oral and Maxillofacial Surgery, Stony Brook School of Dental Medicine, Hofstra North Shore-LIJ School of Medicine, New York Center for Orthognathic and Maxillofacial Surgery, Lake Success, NY

Thomas B. Dodson, DMD, MPH, Professor and Chair, Associate Dean for Hospital Affairs, University of Washington School of Dentistry, Department of Oral and Maxillofacial Surgery, Seattle, WA

John Fantasia, DDS, Chief, Division of Oral Pathology, Hofstra North Shore-LIJ School of Medicine , New Hyde Park, NY

Reginald Goodday, Professor, Department of Oral and Maxillofacial Sciences, Dalhousie University, Halifax, NS

Tara Aghaloo DDS, MD, PhD, Associate Professor, Oral and Maxillofacial Surgery, Assistant Dean for Clinical Research, UCLA School of Dentistry, Los Angeles, CA

Introduction

The Special Committee recommends changing the nomenclature of bisphosphonate-related osteonecrosis of the jaw (BRONJ). The Special Committee favors the term **medication-related osteonecrosis of the jaw (MRONJ)**. The change is justified to accommodate the growing number of osteonecrosis cases involving the maxilla and mandible associated with other antiresorptive (denosumab) and antiangiogenic therapies.

MRONJ adversely affects the quality of life, producing significant morbidity. Strategies for management of patients with, or at risk for, MRONJ were set forth in the American Association of Oral and Maxillofacial Surgeons (AAOMS) updated *Position Paper on Bisphosphonate-Related Osteonecrosis of the Jaws* and approved by the Board of Trustees in 2009.[1] The *Position Paper* was developed by a Special Committee appointed by the Board and composed of clinicians with extensive experience in caring for these patients and basic science researchers. The knowledge base and experience in addressing MRONJ has expanded, necessitating modifications and refinements to the previous *Position Paper*. This Special Committee met in September 2013 to appraise the current literature and revise the guidelines as indicated to reflect current knowledge in this field. This update contains revisions to

Oral Surg Oral Med Oral Pathol Oral Radiol. 2015 Aug;120(2):207-26. doi: 10.1016/j.oooo.2015.03.001. Epub 2015 Mar 11.

World Workshop on Oral Medicine VI: Controversies regarding dental management of medically complex patients: assessment of current recommendations.

Napeñas JJ[1], Kujan O[2], Arduino PG[3], Sukumar S[4], Galvin S[5], Baričević M[6], Costella J[7], Czerninski R[8], Peterson DE[9], Lockhart PB[10].

Author information

Abstract

OBJECTIVES: Current recommendations for safe and effective dental management are less than optimal for some medical conditions because of limited evidence, conflicting conclusions, or both. This review (1) compiled and evaluated dental management recommendations for select medical conditions; (2) summarized recommendations and their assigned levels of evidence; (3) identified areas of conflict, ambiguity, or both; and (4) identified issues that warrant future research, enhanced consensus statements, or both.

STUDY DESIGN: Systematic literature searches were performed for guideline publications, systematic and narrative reviews, and opinion documents containing recommendations for (1) medication-related osteonecrosis of the jaw (MRONJ); (2) cardiovascular diseases (CVDs); (3) prosthetic joints (PJs); and (4) systemic steroid therapy (SST).

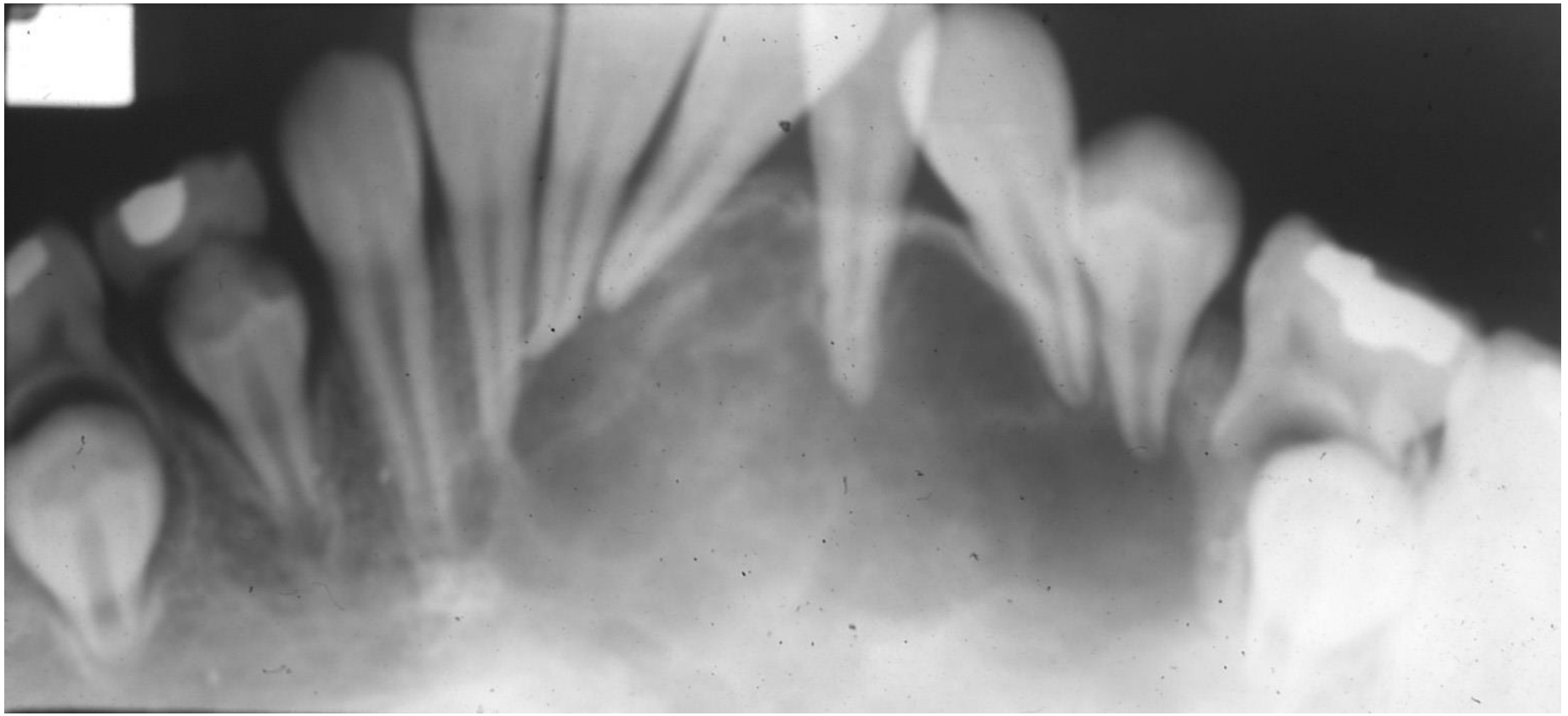
RESULTS: The search yielded the following numbers of publications that met the inclusion criteria: MRONJ - 116; CVDs - 54; prosthetic joints - 39; and systemic steroids - 12.

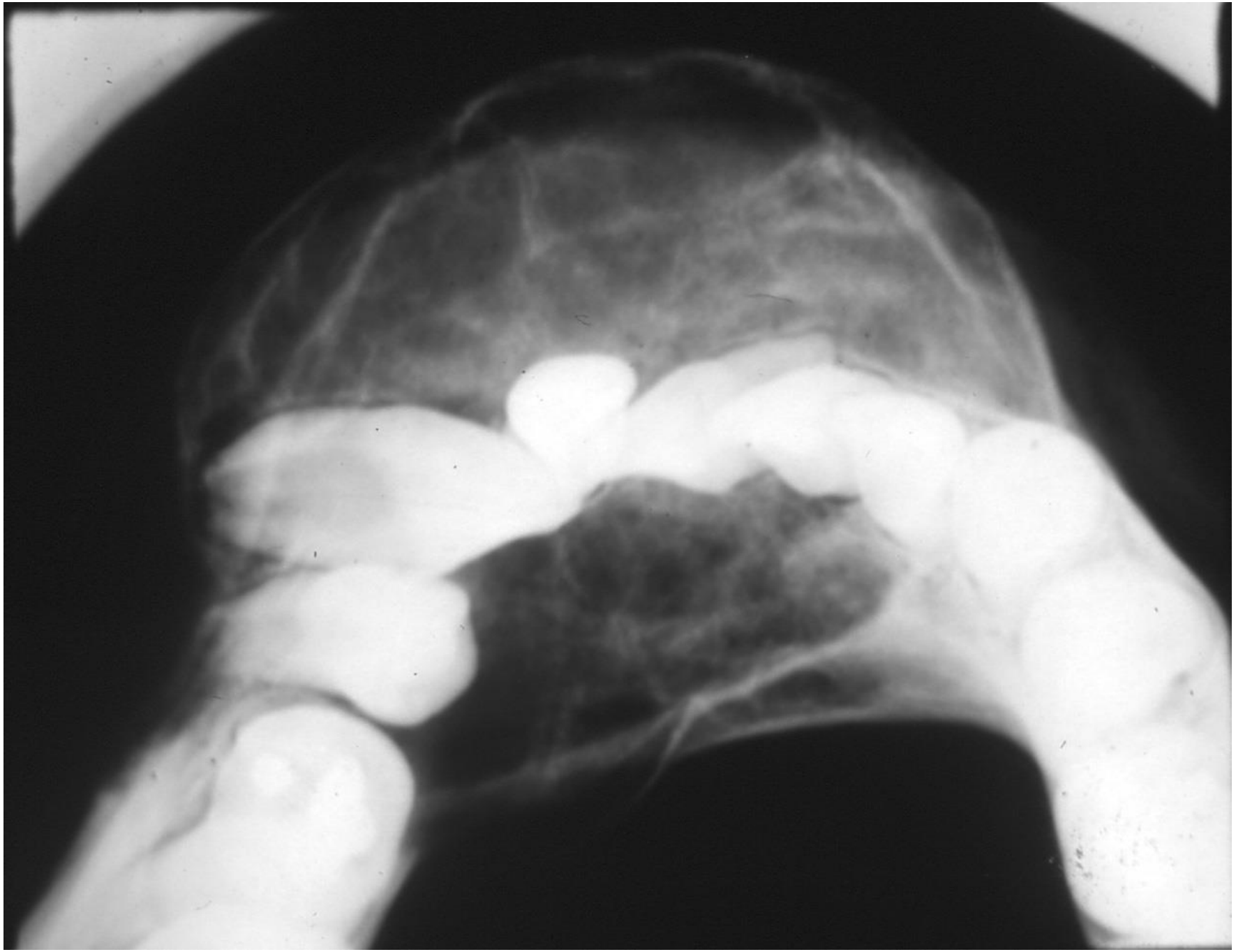
CONCLUSIONS: Very few of the compiled recommendations were assigned or linked to levels of evidence by their authors. Key conclusions include the following: MRONJ-expert recommendations trend toward proceeding with dental treatment with little to no modification in osteoporotic patients on bisphosphonates; CVDs-current recommendations are primarily directed to general surgery and applied to dentistry; PJs-routine antibiotic prophylaxis is not indicated for dental treatment; and SST-steroid supplementation is not indicated for most patients undergoing dental procedures under local anesthesia.

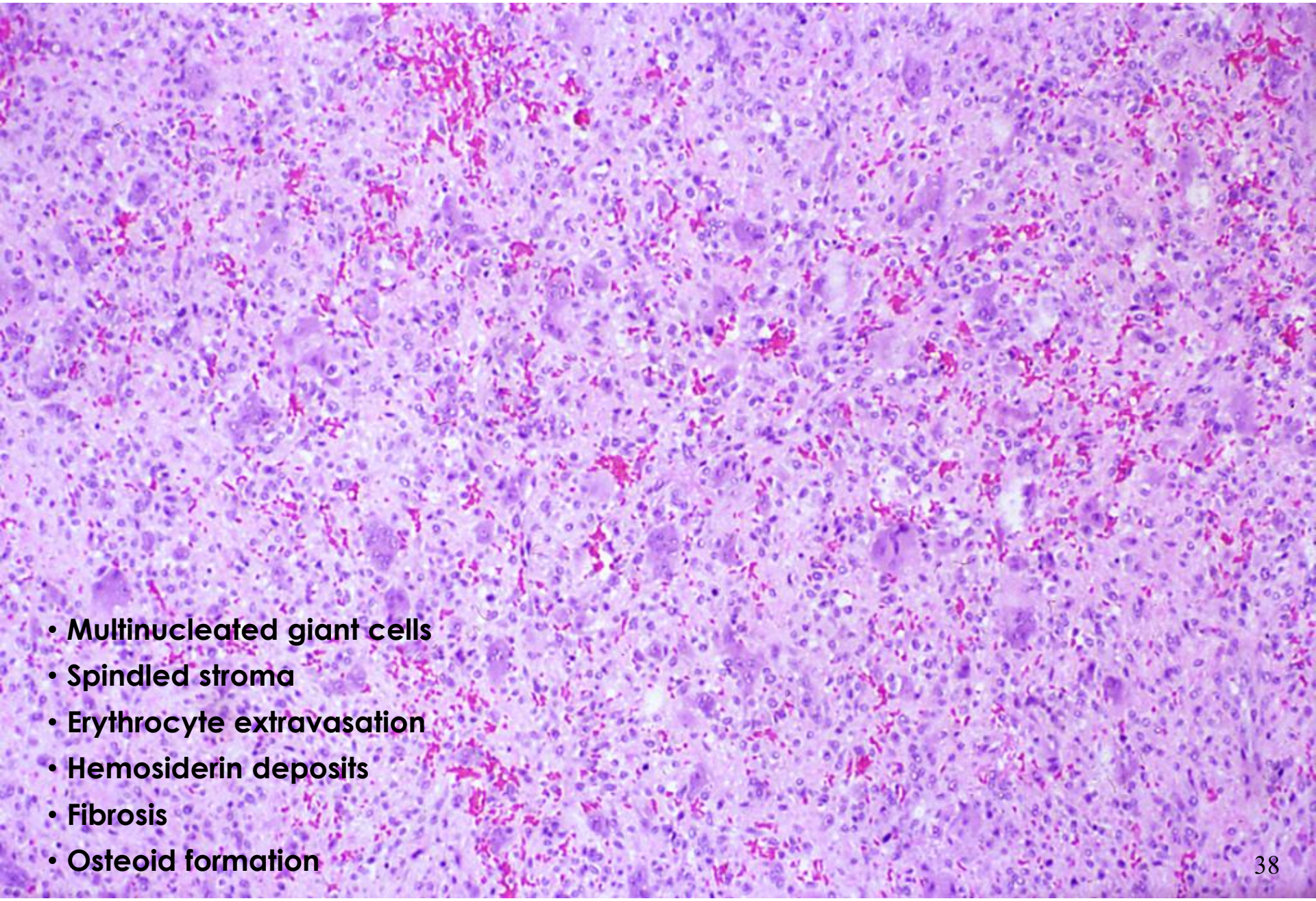
Table III. Key recommendations from guideline statements and systematic reviews: dental management of patients receiving bisphosphonates for osteoporosis (none of the publications assigned levels of evidence for any of the recommendations)

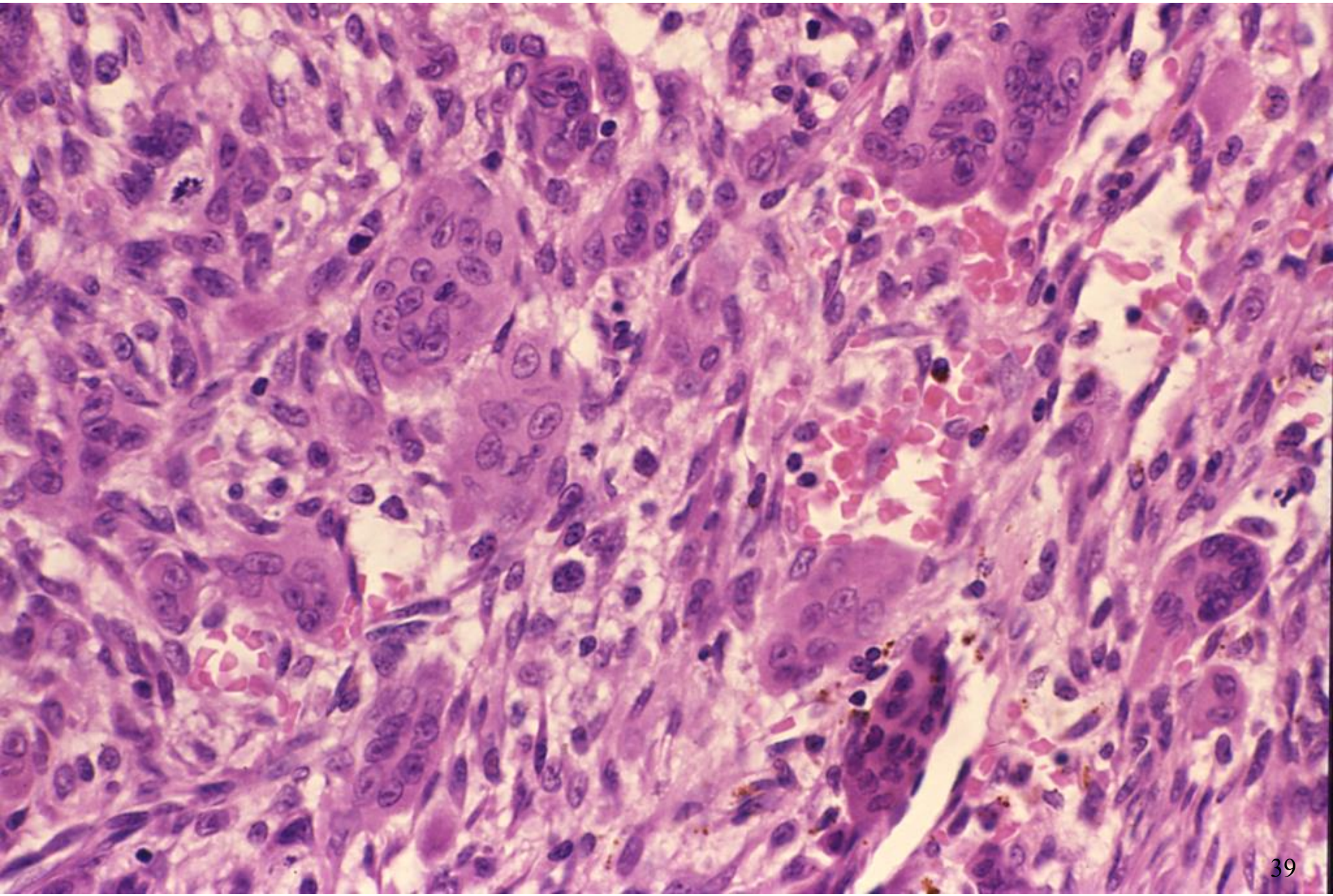
	Level of evidence[*] *Class of recommendation*[†]
In all patients, clinicians should discuss:	
• Importance of maintaining good oral hygiene[19]	NA
• Lifestyle changes, such as smoking cessation for those at high risk for MRONJ[19]	NA
• Very rare occurrence of MRONJ[19]	NA
Risk assessment and treatment planning - Potential risk factors for MRONJ:	
Oral risk factors:	
• Recent dentoalveolar trauma[91-93]	NA
• Dental extraction[90,91]	NA
• Dentoalveolar surgery[91]	NA
• Poor oral hygiene[91]	NA
• Oral infections[91]	NA
• Periodontal disease[91]	NA
Systemic risk factors:	
• Greater frequency of administration[91]	NA
• Larger BP dose[91]	NA
• Longer treatment regimens[91]	NA
• Radiation therapy[91]	NA
• Infectious disease[91]	NA
• Concomitant therapy with corticosteroids[90,92]	NA
• Compromised immune status or immunodeficiency[92]	NA
• Advanced age[92]	NA
• Chronic diseases[92]	NA

Central Giant Cell Granuloma






• Multinucleated giant cells
• Spindled stroma
• Erythrocyte extravasation
• Hemosiderin deposits
• Fibrosis
• Osteoid formation



Central Giant Cell Granuloma

Etiology: non-neoplastic – reactive lesion
Age: wide range (60% < 30 years of age)
Gender: female > male
Site: anterior mandible (70%)
Symptoms: painless expansion
Radiograph:
- unilocular to multilocular radiolucency
 - 0.5 – 10.0 cm

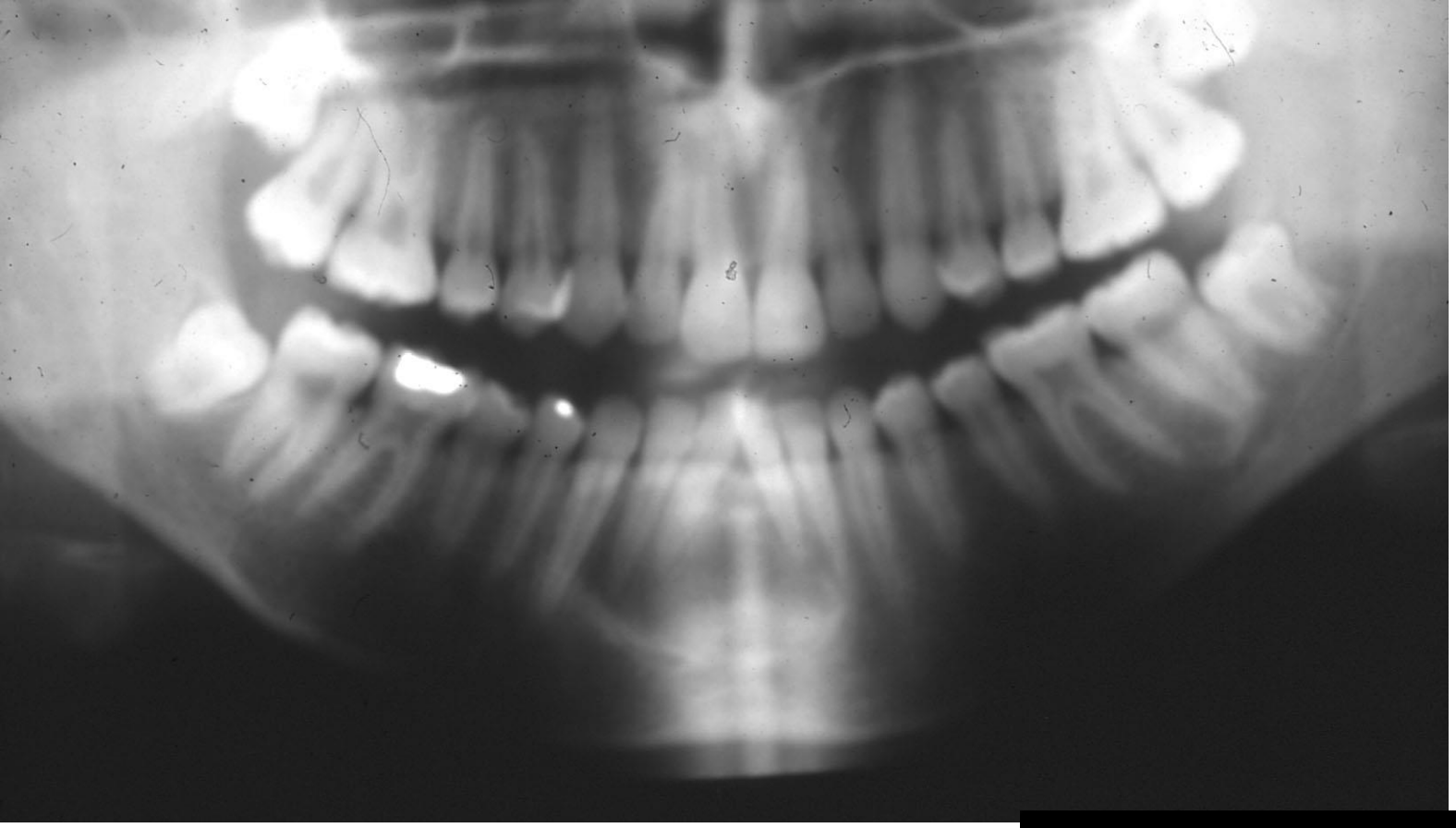
Central Giant Cell Lesion
Differential Diagnosis:

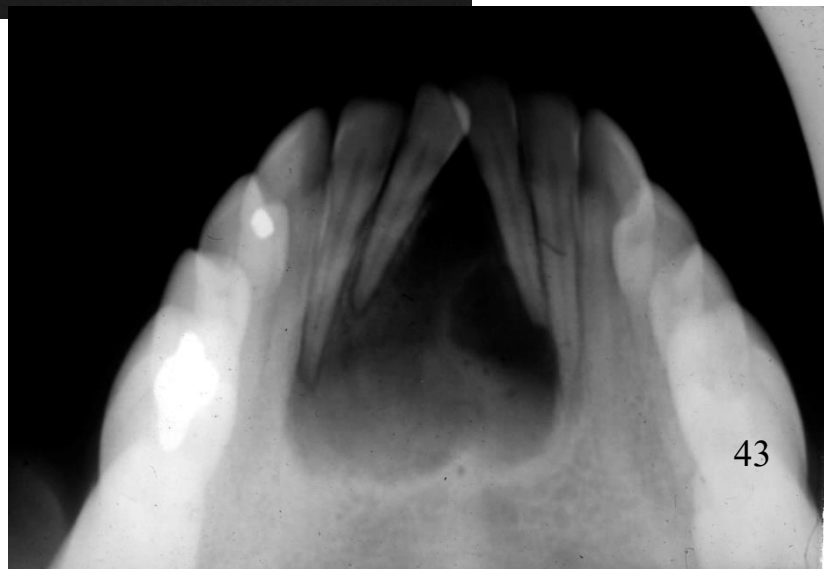
- Central giant cell granuloma
- Brown tumor – hyperparathyroidism
- Aneurysmal bone cyst
- Cherubism
- Giant cell tumor
- Benign fibro-osseous lesion

Hyperparathyroidism

Brown tumour

(osteitis fibrosa cystica)





Total Resolution of hyperparathyroidism-related jaw lesion by Vitamin D therapy

- Case report

Case Rep Dent. 2021; 2021: 5510724.
Published online 2021 Jul 17. doi: 10.1155/2021/5510724
PMCID: PMC8313313
PMID: 34336304

Can Vitamin D Therapy Contribute to the Conservative Resolution of Osteolytic Lesions of the Jaws?

Kamis Gaballah,[1] Sami Kenz,[2] Raeefa Anis,[3] and Omar Kujan[4]

Associated Data

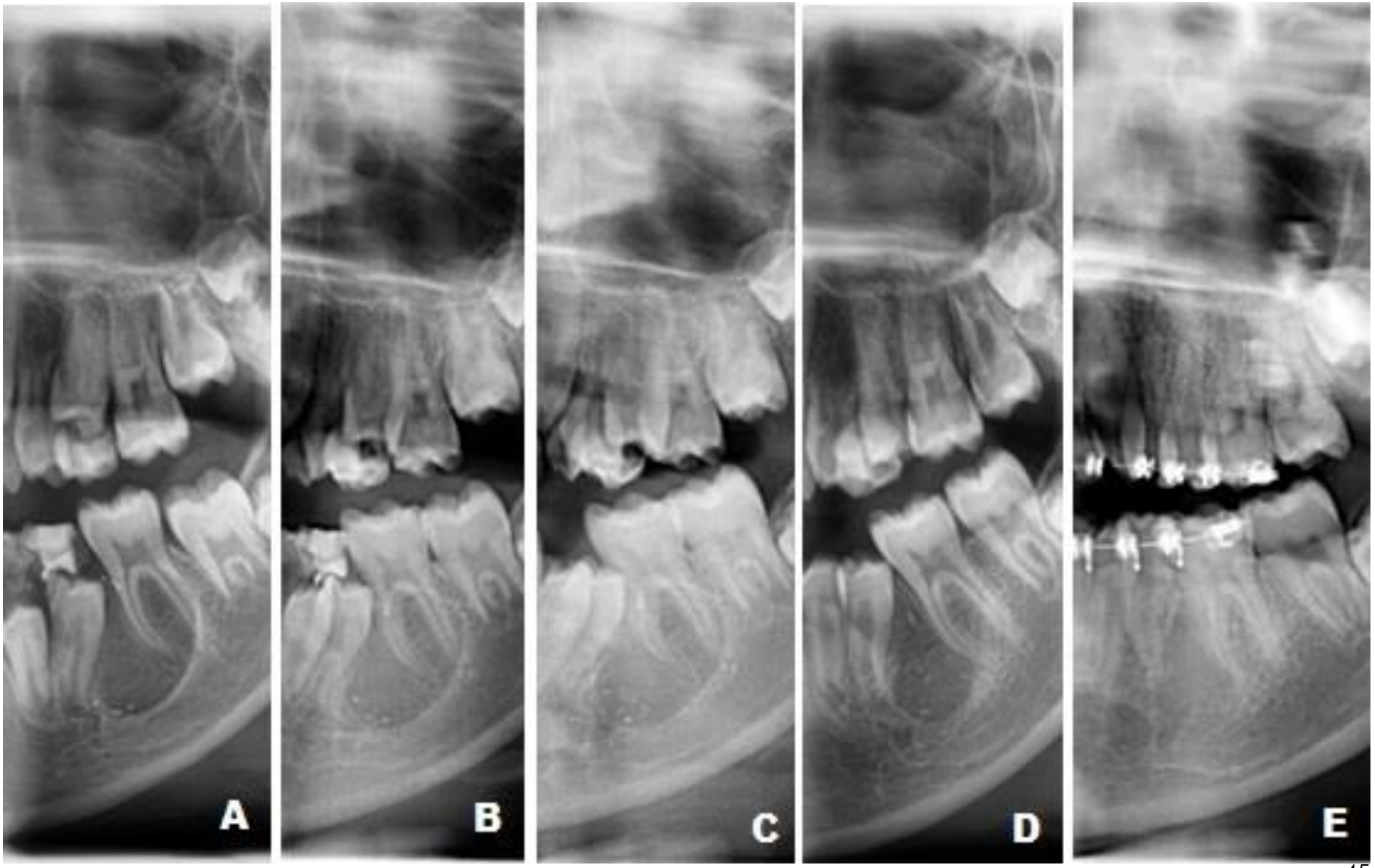
▸ **Data Availability Statement**

Abstract

Go to: ▸

Osteolytic lesions of the jaw are not uncommon. Such lesions usually arise from local pathologies, but some have systemic backgrounds. We describe a 12-year-old girl who presented with an asymptomatic left mandibular swelling. The bony swelling was corresponding to a radiolucent lesion in the left premolar/molar region. This lesion could have represented an inflammatory and developmental odontogenic jaw cyst, giant cell lesion, and odontogenic tumor. However, the workup investigations revealed secondary hyperparathyroidism due to vitamin D deficiency. A vitamin D replacement was initiated with a single I.M. injection of 300,000 I.U followed by 10,000 I.U orally, weekly. Six weeks later, her Vitamin D and parathyroid hormone were normalized, and she showed significant clinical and radiological improvement of the jaw lesion. At 18 months, follow-up the panoramic image revealed complete resolution of the radiolucency and stable normal parathyroid hormone and vitamin D levels. In conclusion, Jaw bone lesions can develop secondary to hyperparathyroidism due to vitamin D deficiency, and this should be ruled out before any surgical intervention. Treatment of such lesions lies in the correction of parathyroid excess with a careful and systematic approach. This may prevent unnecessary surgical intervention in such patients.

Case Rep Dent


A
B
C
D
E

Benign cemento-osseous lesions

Fibrous dysplasia

Cemento-osseous dysplasias
- Subtypes: periapical cemental
- focal cemento-osseous
- florid cemento-osseous

Cemento-ossifying fibroma
- Subtypes: conventional
- juvenile active

Fibrous Dysplasia

- Benign disorder of bone
- Non-neoplastic tumor-like lesion
- Developmental defect in bone formation
- Fibrous proliferation
- Disorderly malformed woven bone
- Enlarged deformed bones
- Structurally weak

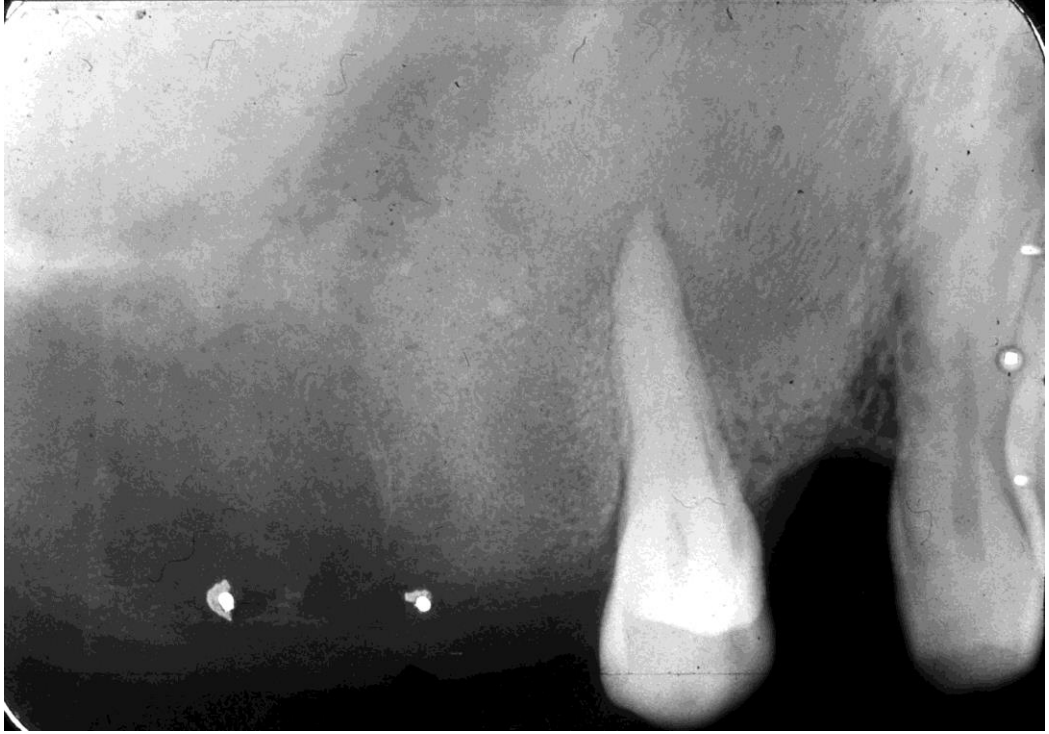
Sites:
- ribs, femur, tibia, pelvis, craniofacial
Age: onset in childhood – adolescence
Single or multiple bony lesions
Slow growing
Painless
Often quiesces at puberty
Genetics: GNAS I gene chromosome 20q13.1-2

Fibrous Dysplasia

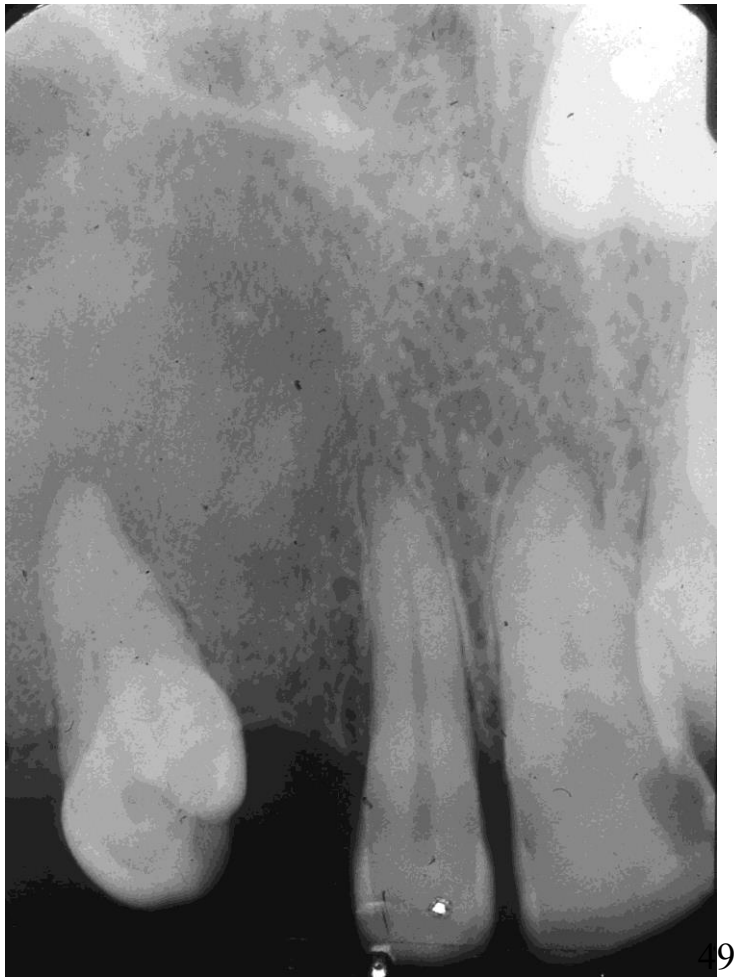
- Monostotic - 70%
  - craniofacial – (25%)
- Polyostotic - 25%
  - craniofacial – (50%)
- McCune-Albright Syndrome - 3%
  - endocrine abnormalities

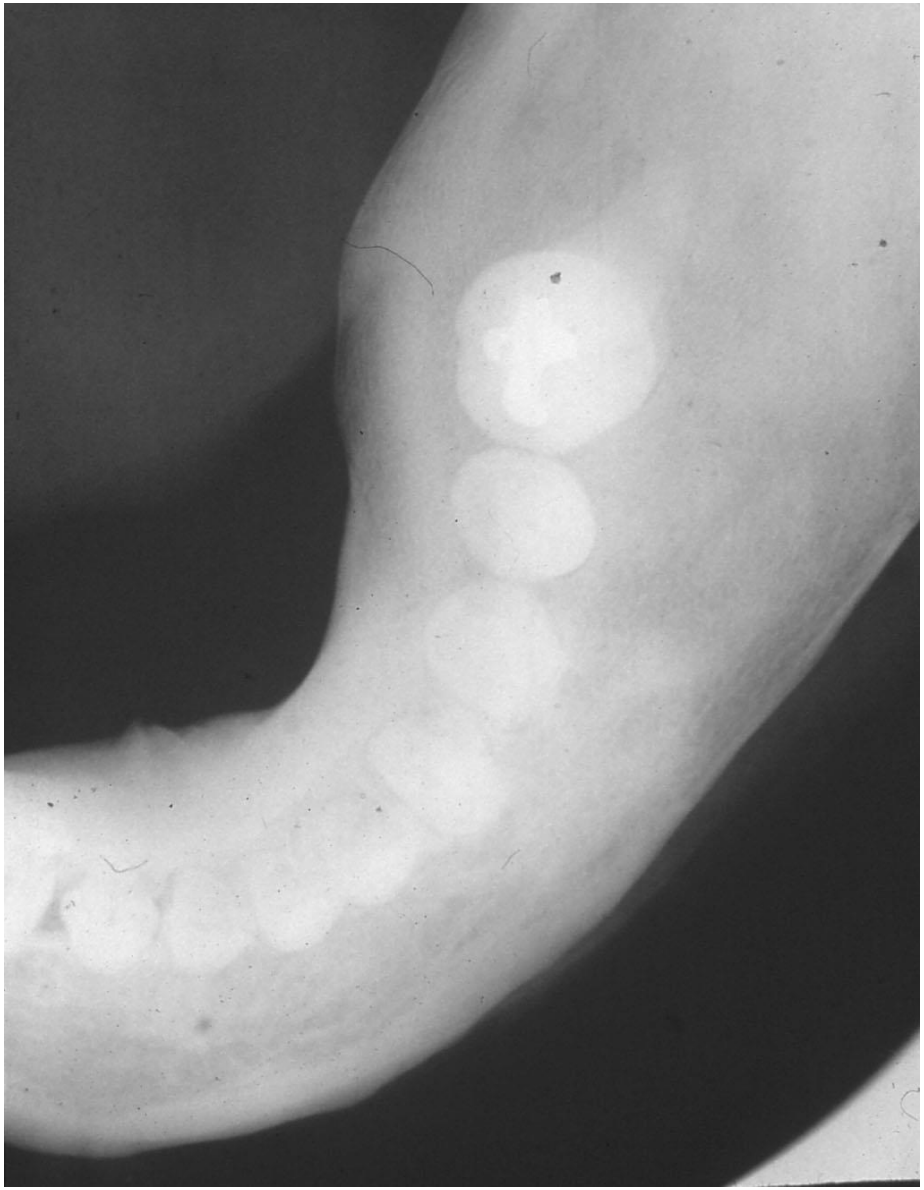
Oral & Maxillofacial Manifestations

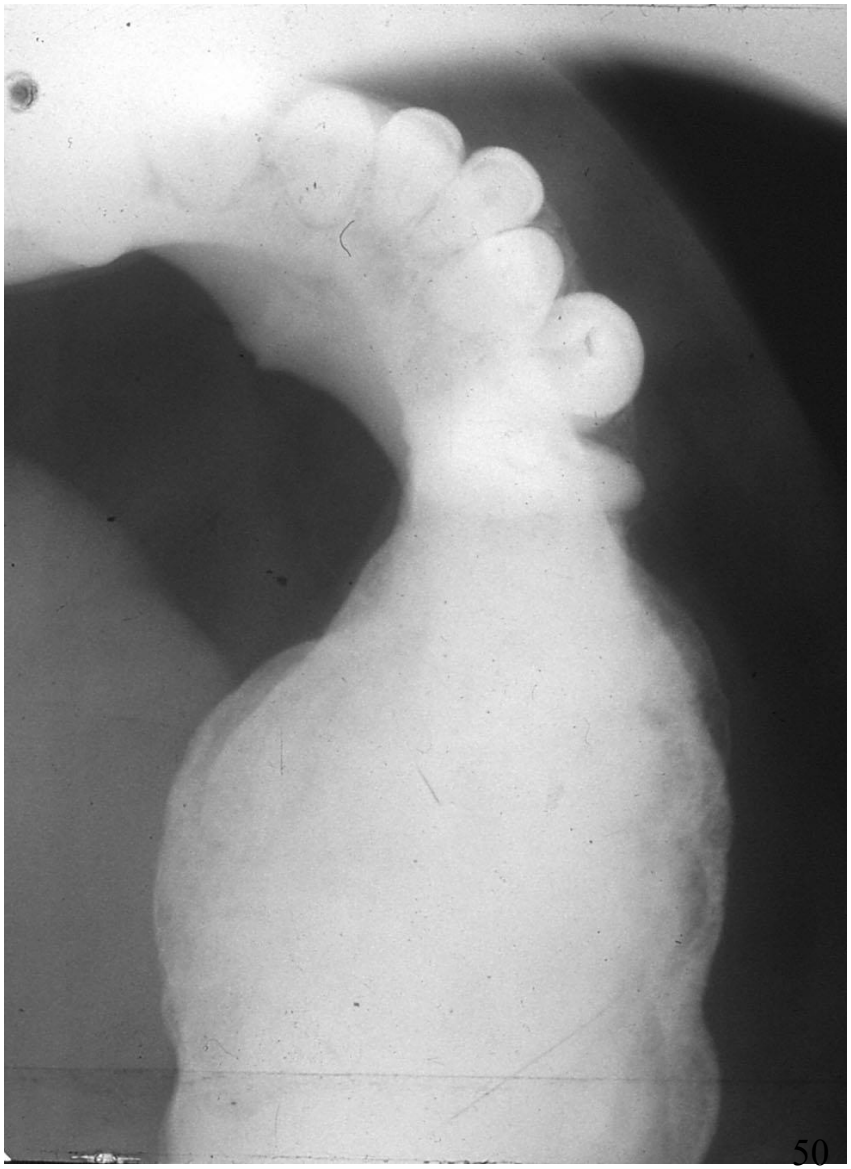
- Painless swelling
- Facial asymmetry
- Malocclusion – displaced teeth
- Headache
- Hearing loss
- Clinical labs: elevated alkaline phosphatase

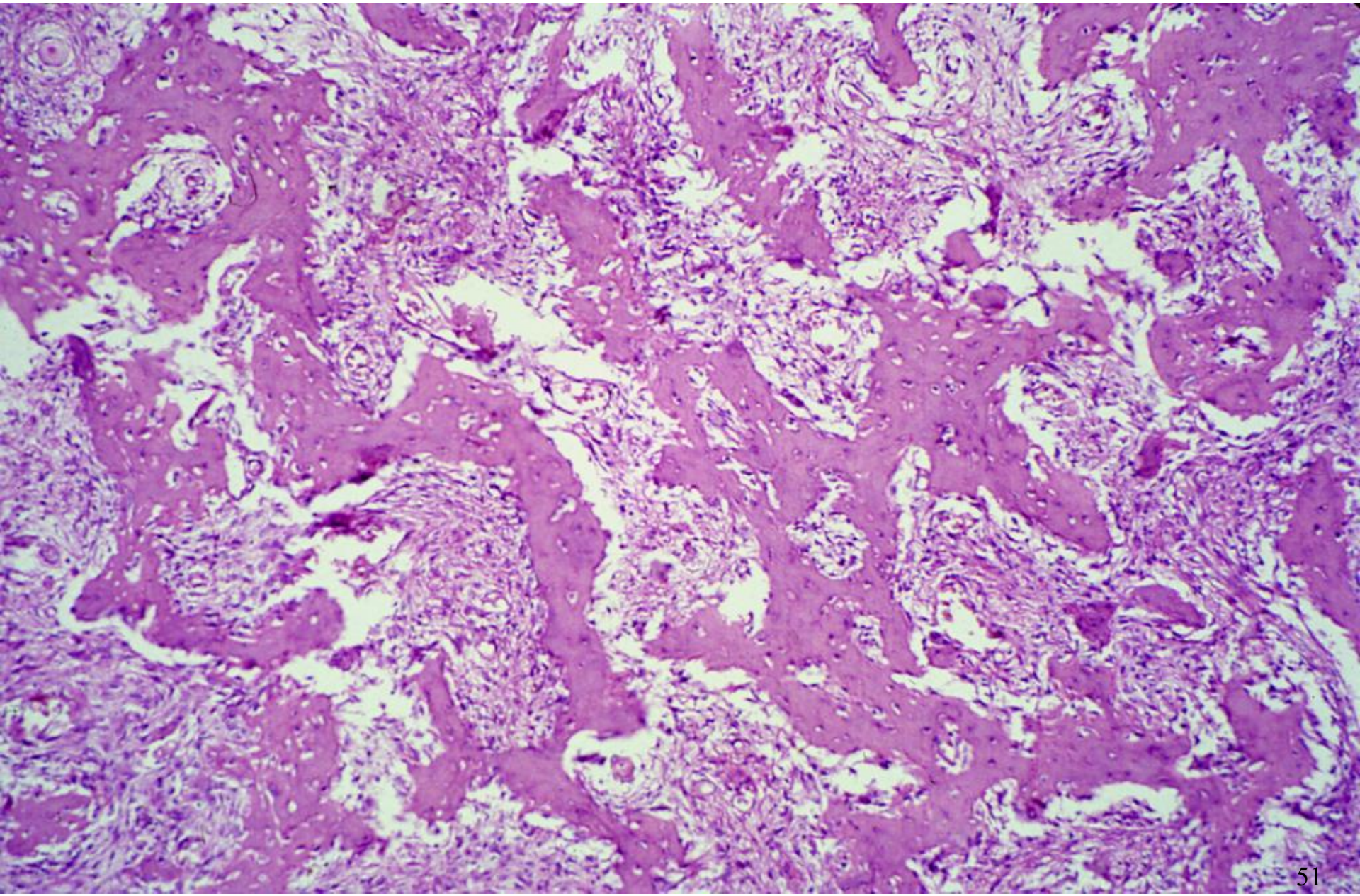


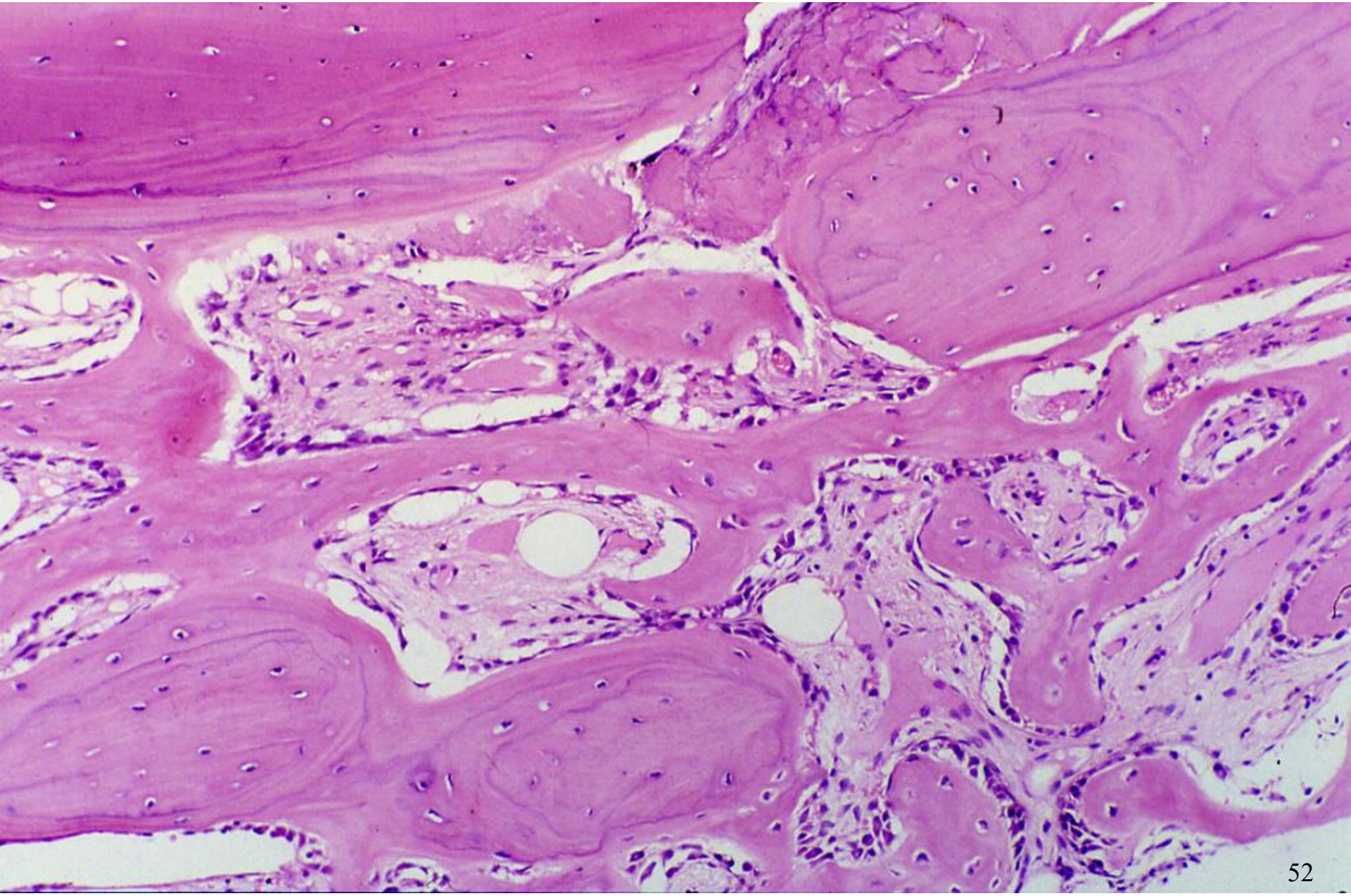
- "Ground glass" opacification
- Diffuse – poorly delineated
- Cortical expansion – fusiform enlargement
- Narrow periodontal ligament
- Obscure lamina dura
- Early lesions – radiolucent/mottled





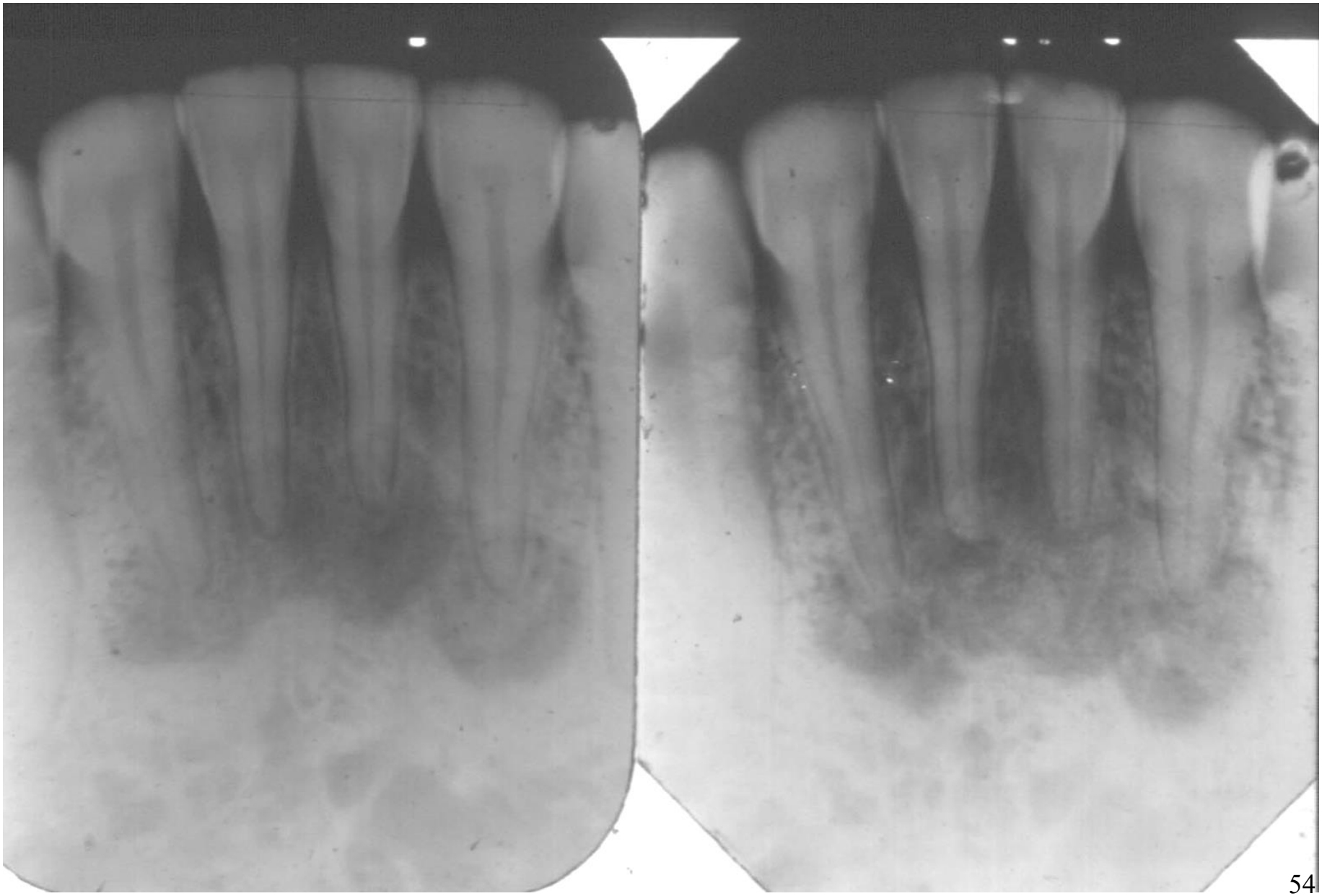


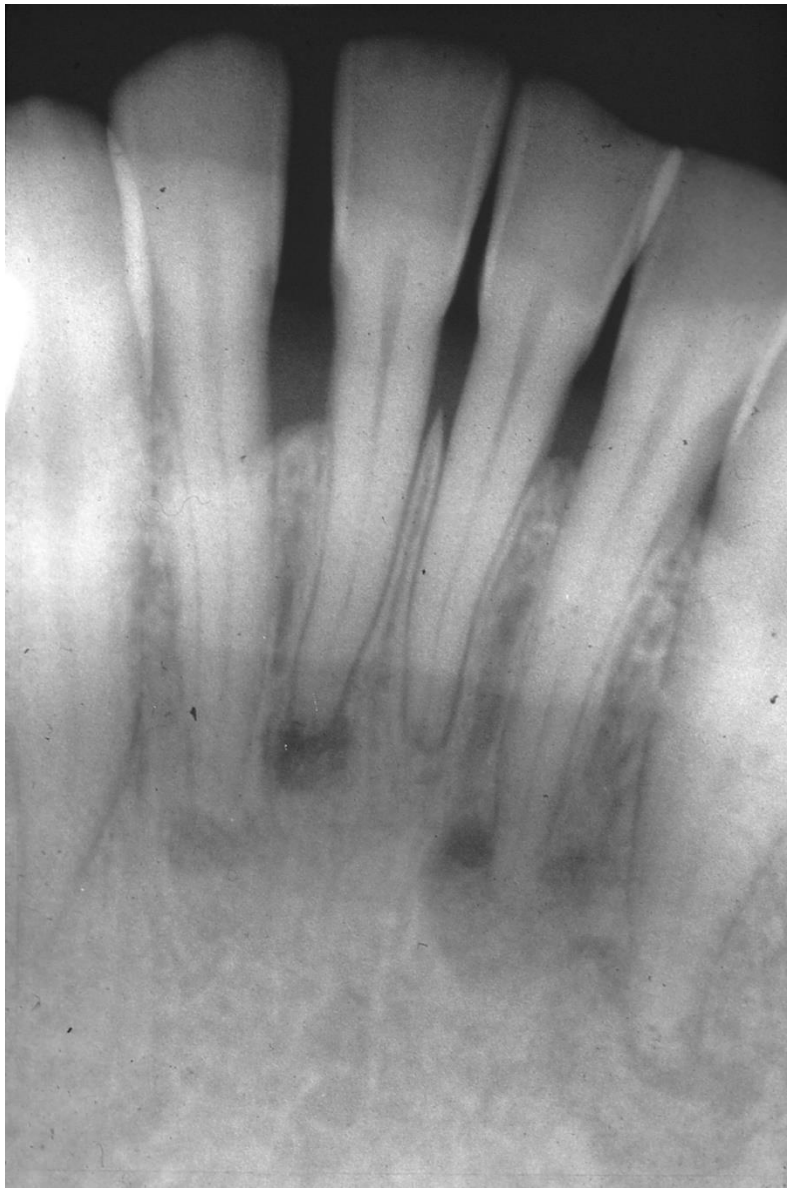


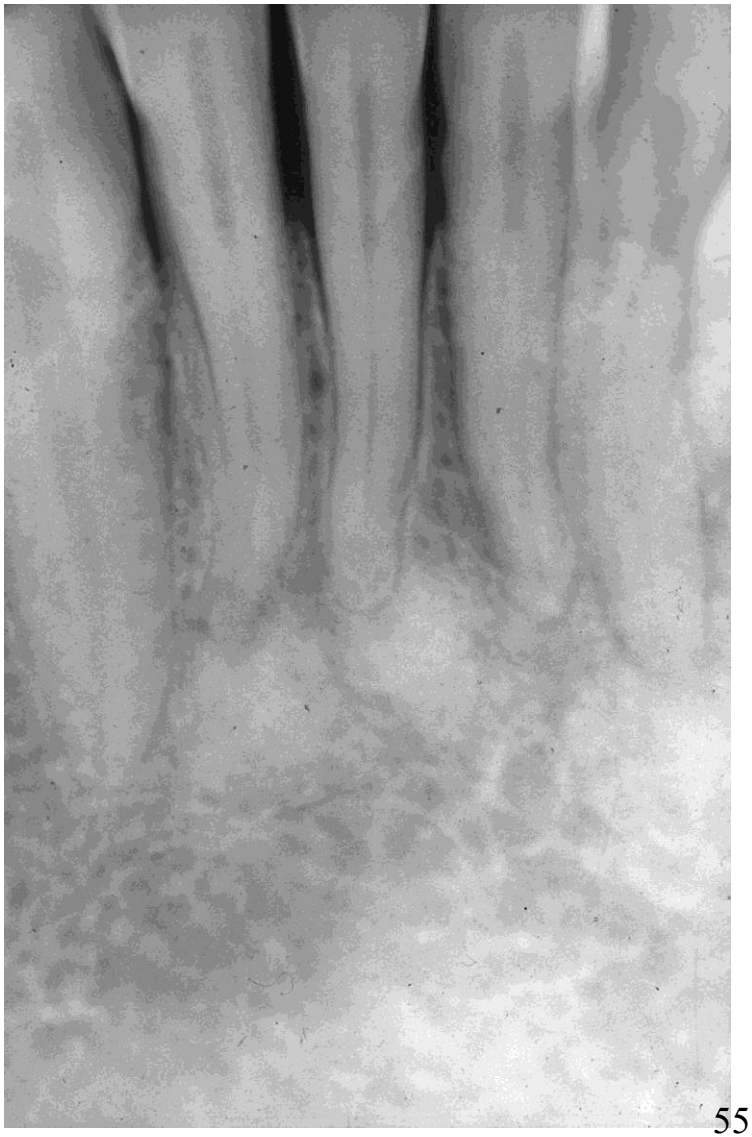


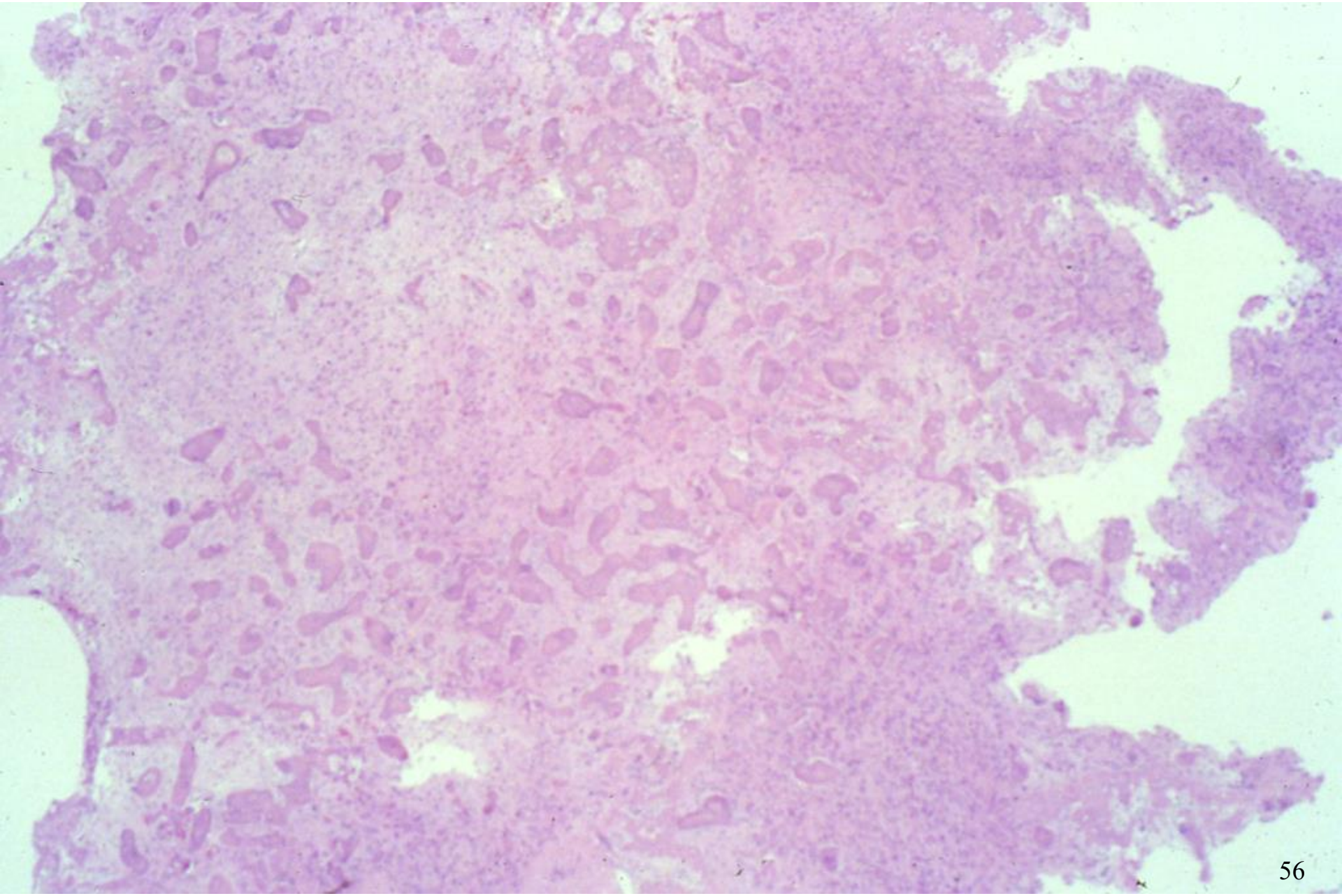
Periapical Cemento-Osseous Dysplasia

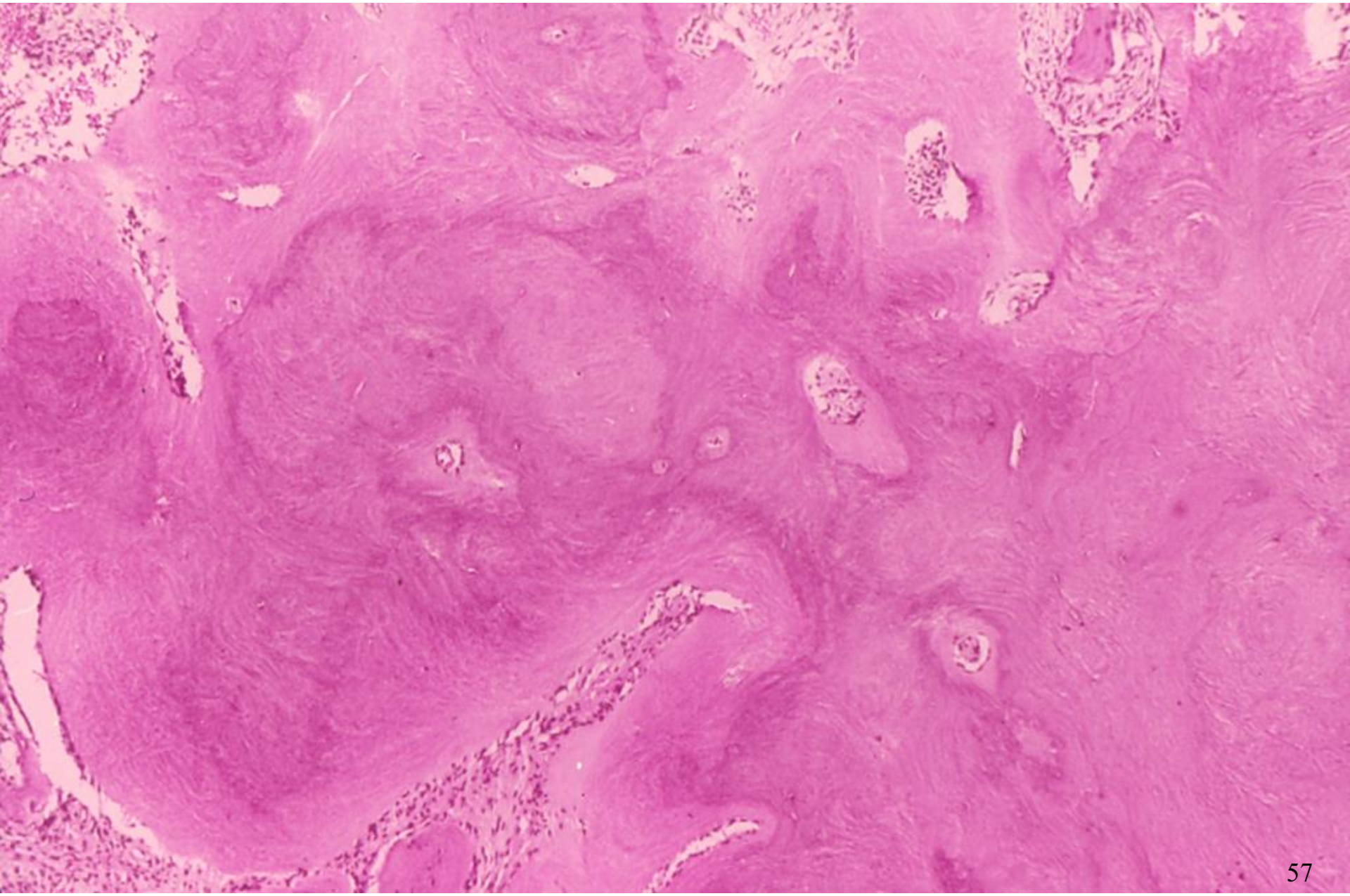
- Benign non-neoplastic dysplastic process
- Incidence: relatively common
- Age: middle age (30 – 50 years)
- Gender: female > male (14:1)
- Race: black
- Site: mandibular anterior – periapical area
- Asymptomatic, vital teeth, non-expansile





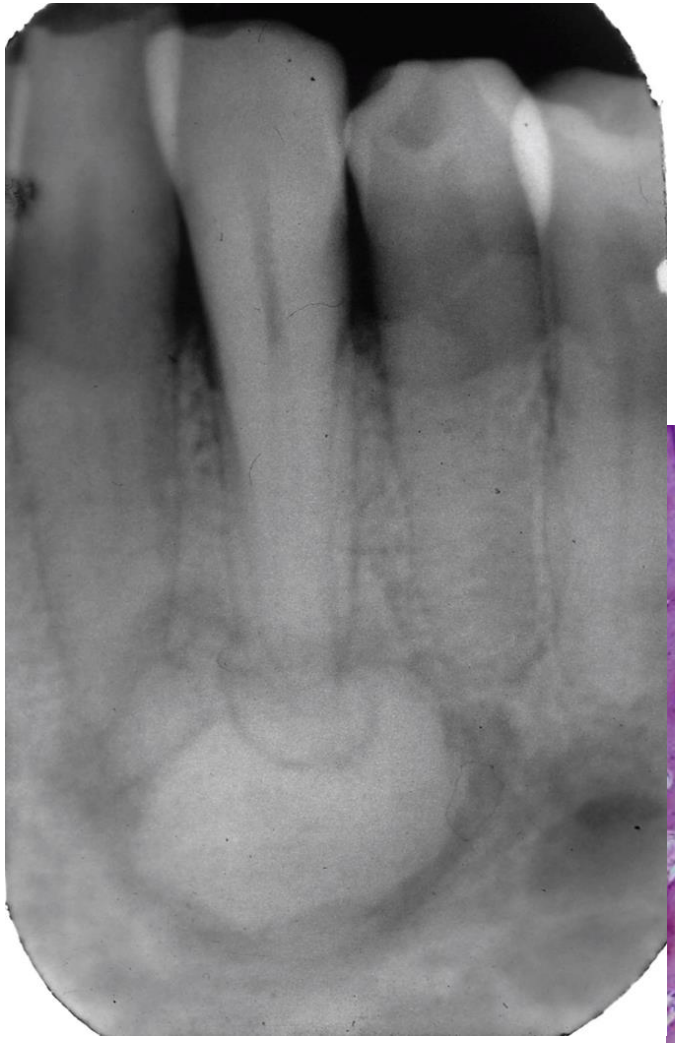


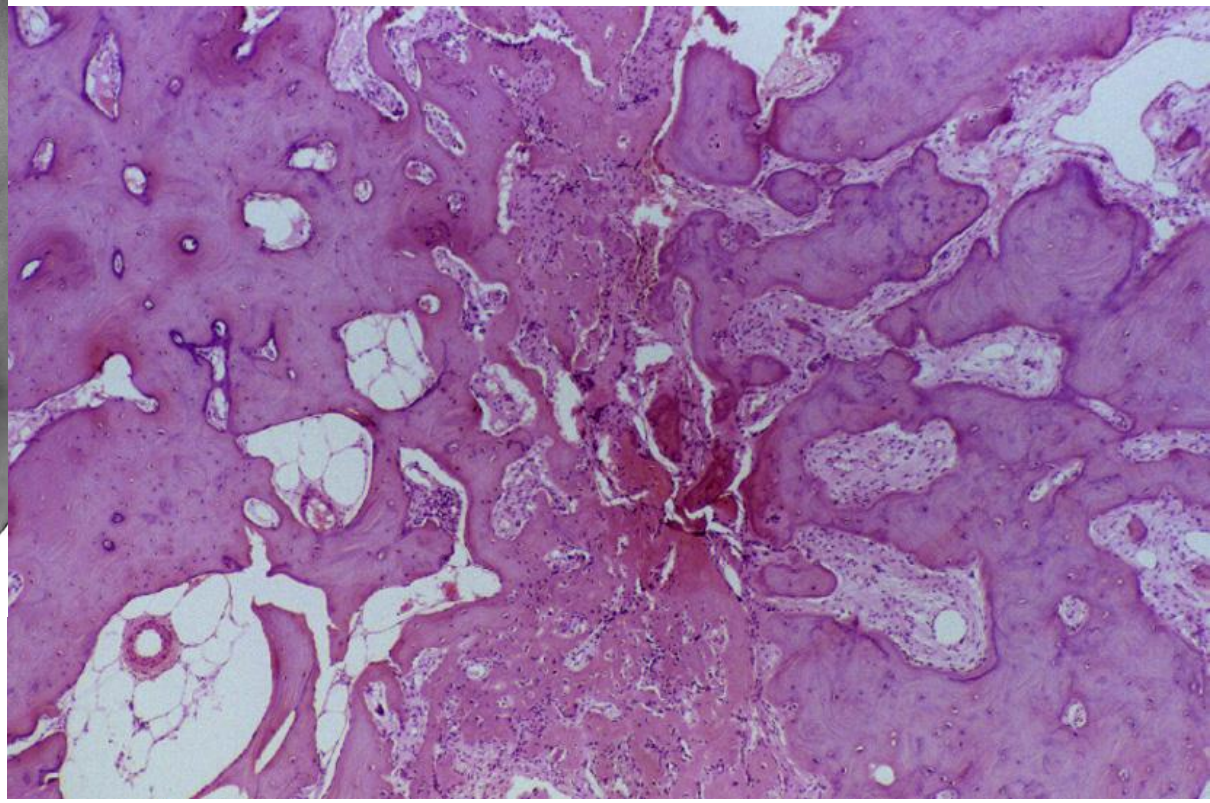




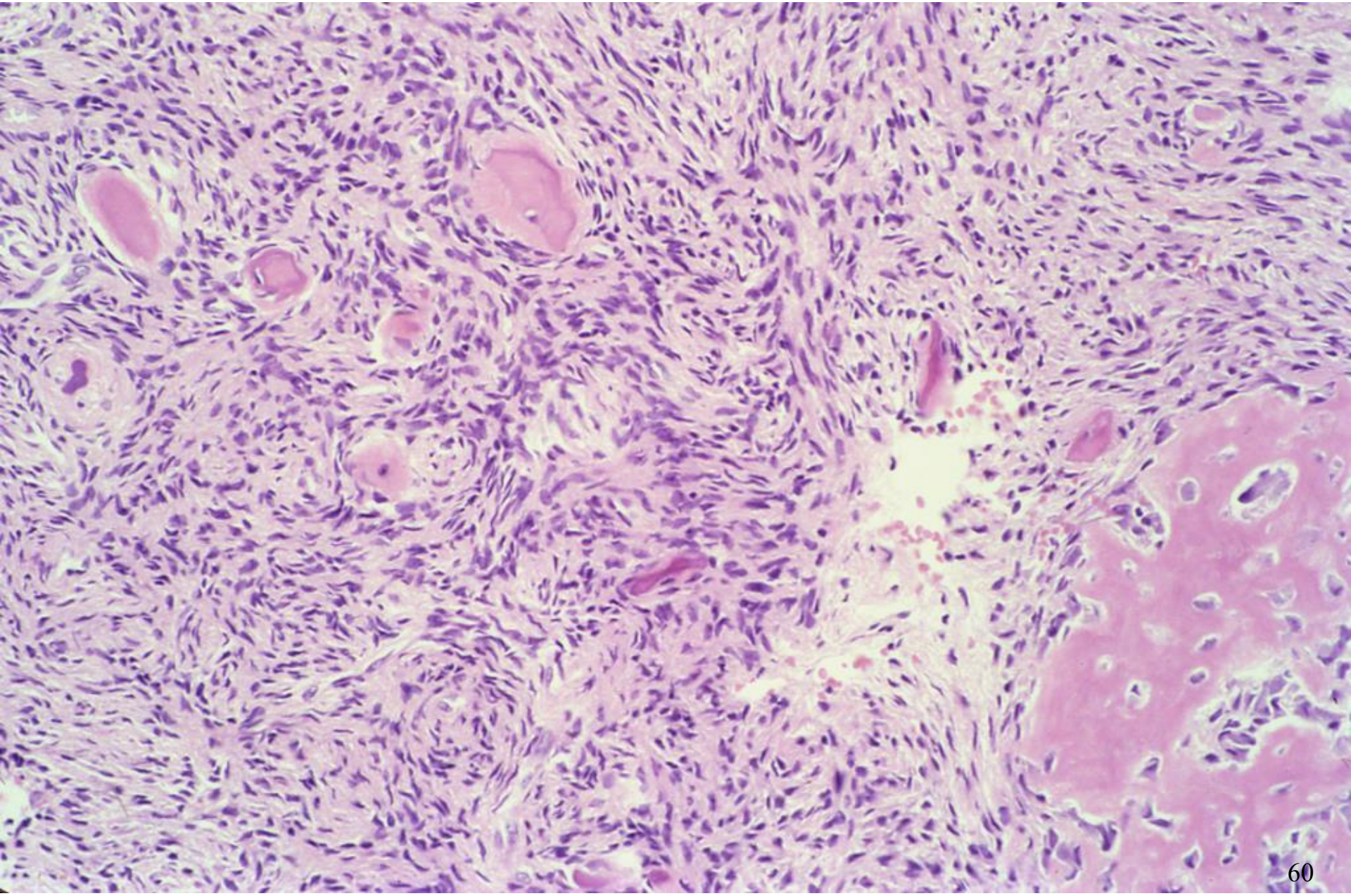
Focal Cemento-Osseous Dysplasia

- Etiology: non-neoplastic – disordered growth of cementum and bone
- Incidence: most common benign fibro-osseous lesion
- Age: 4-5th decade
- Gender: female (80%)
- Race: Caucasian
- Site: posterior mandible
- Asymptomatic
- Solitary
- Edentulous areas
- Size: < 1.5 cm
- Radiographic: mixed radiolucent – opaque, well-defined or irregular borders



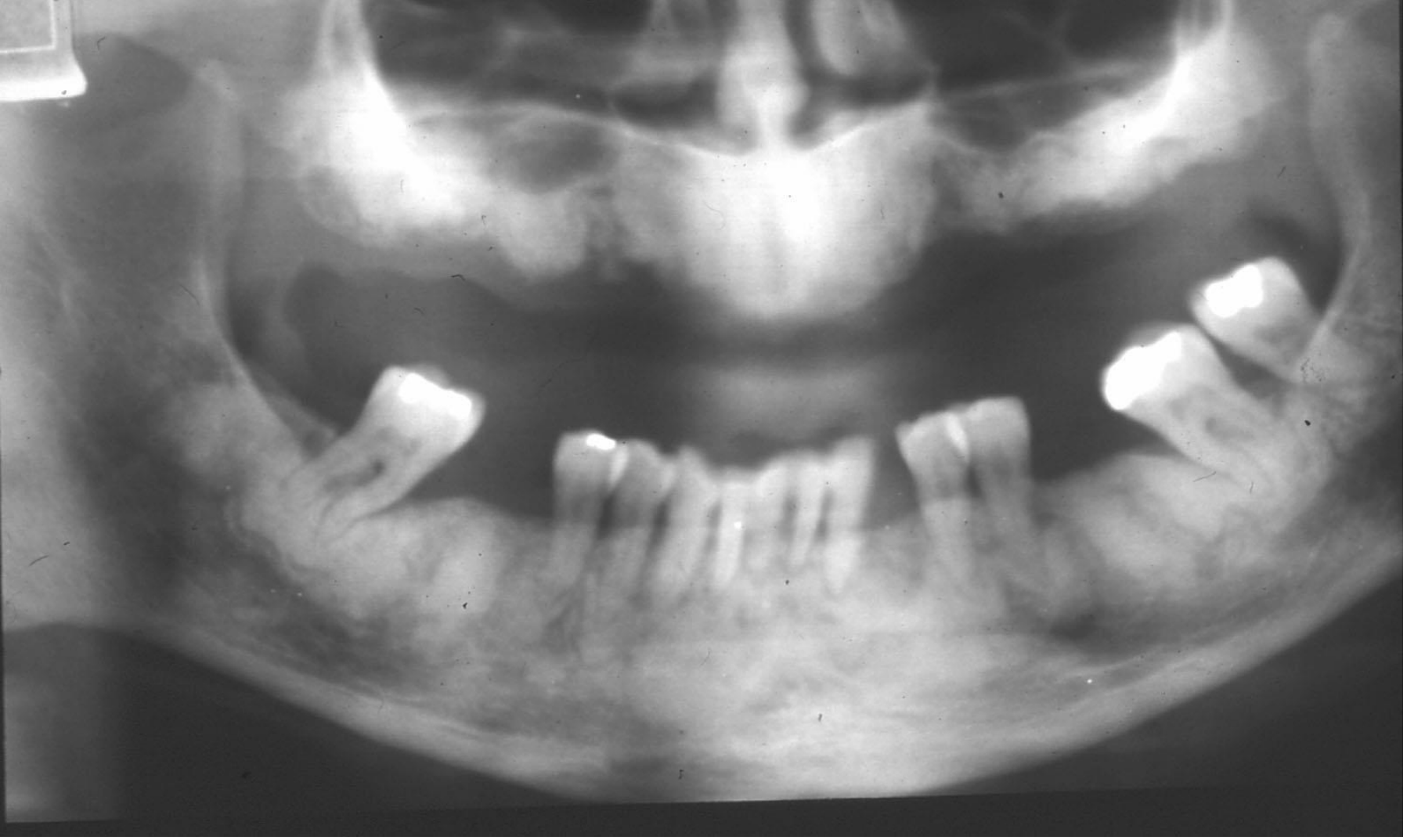


FCOD

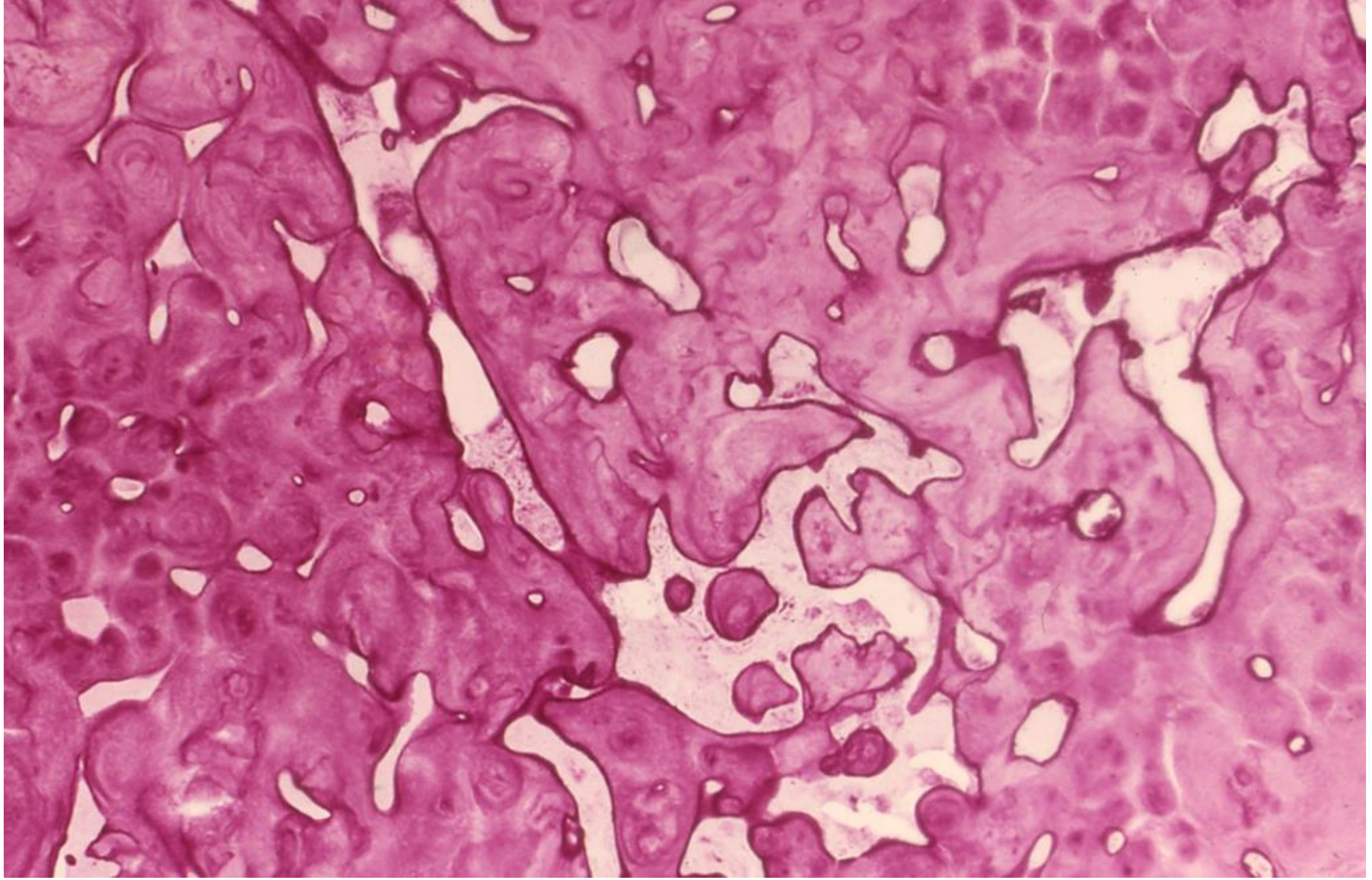


Florid Cemento-Osseous Dysplasia

- Benign non-neoplastic dysplastic process
- Incidence: relatively rare
- Age: middle-aged adults
- Gender: female > male
- Race: black (90%)
- Site: diffuse involvement of jaws
- Asymptomatic, expansion, secondary infection



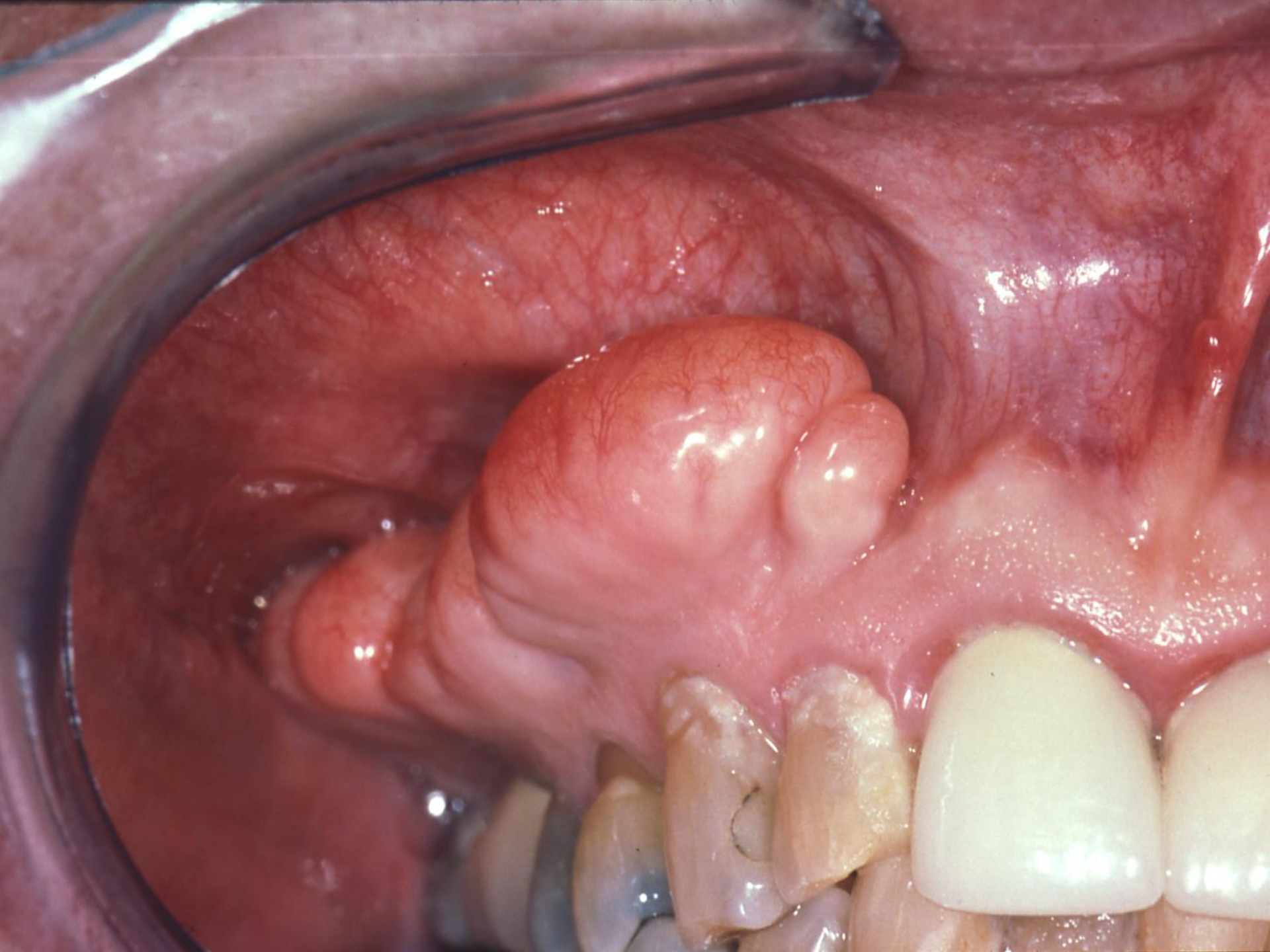
Irregular lobular dense radiopacities
Mixed radiolucent and radiopaque areas
Diffuse involvement of maxilla and mandible
Bilateral
Symmetrical

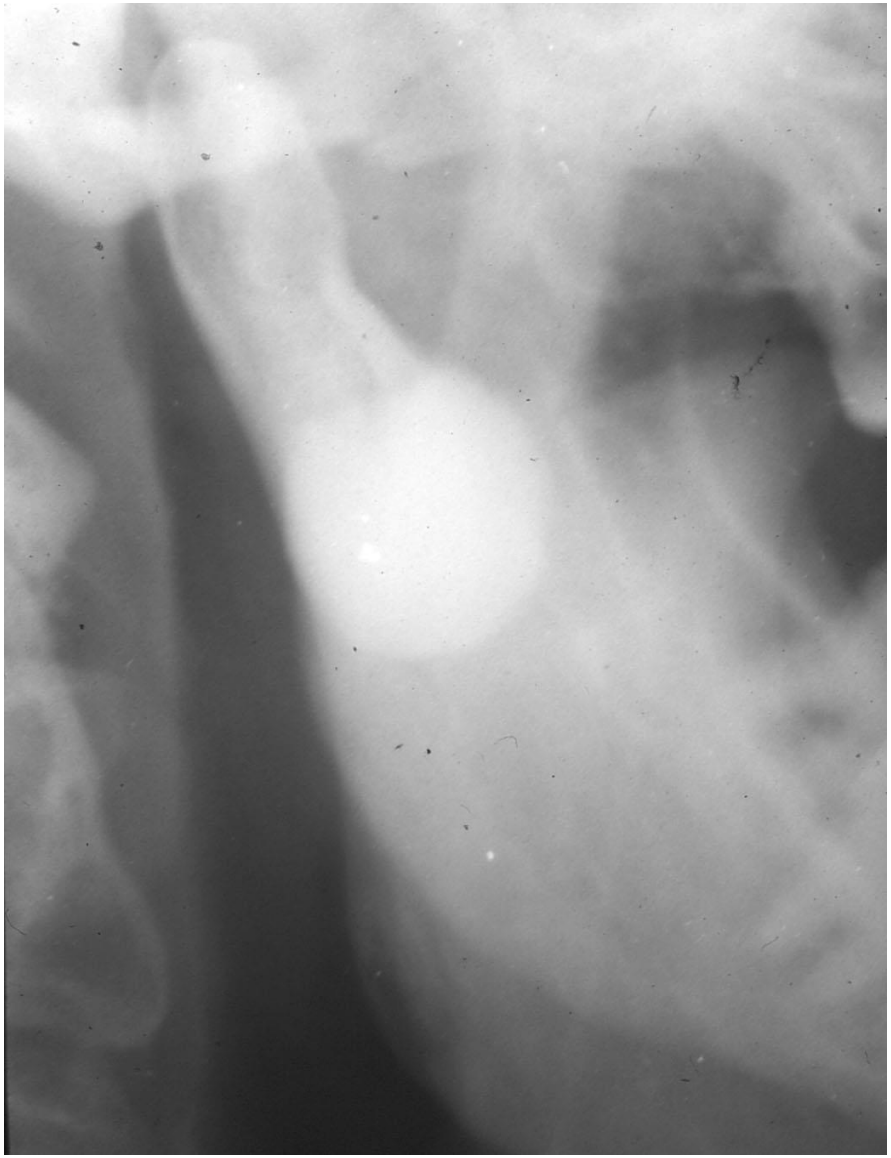


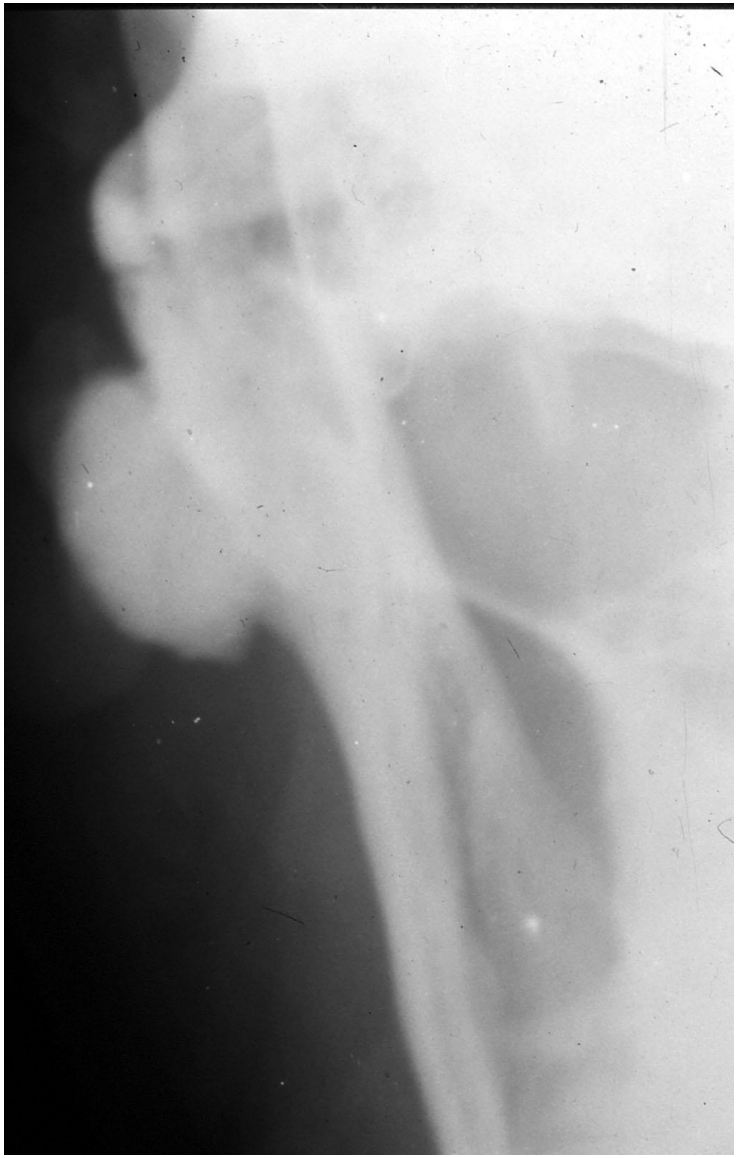
Fibroblastic proliferation
Dense sclerotic calcific masses
Cementum matrix
Woven bone
Inflammatory infiltrate

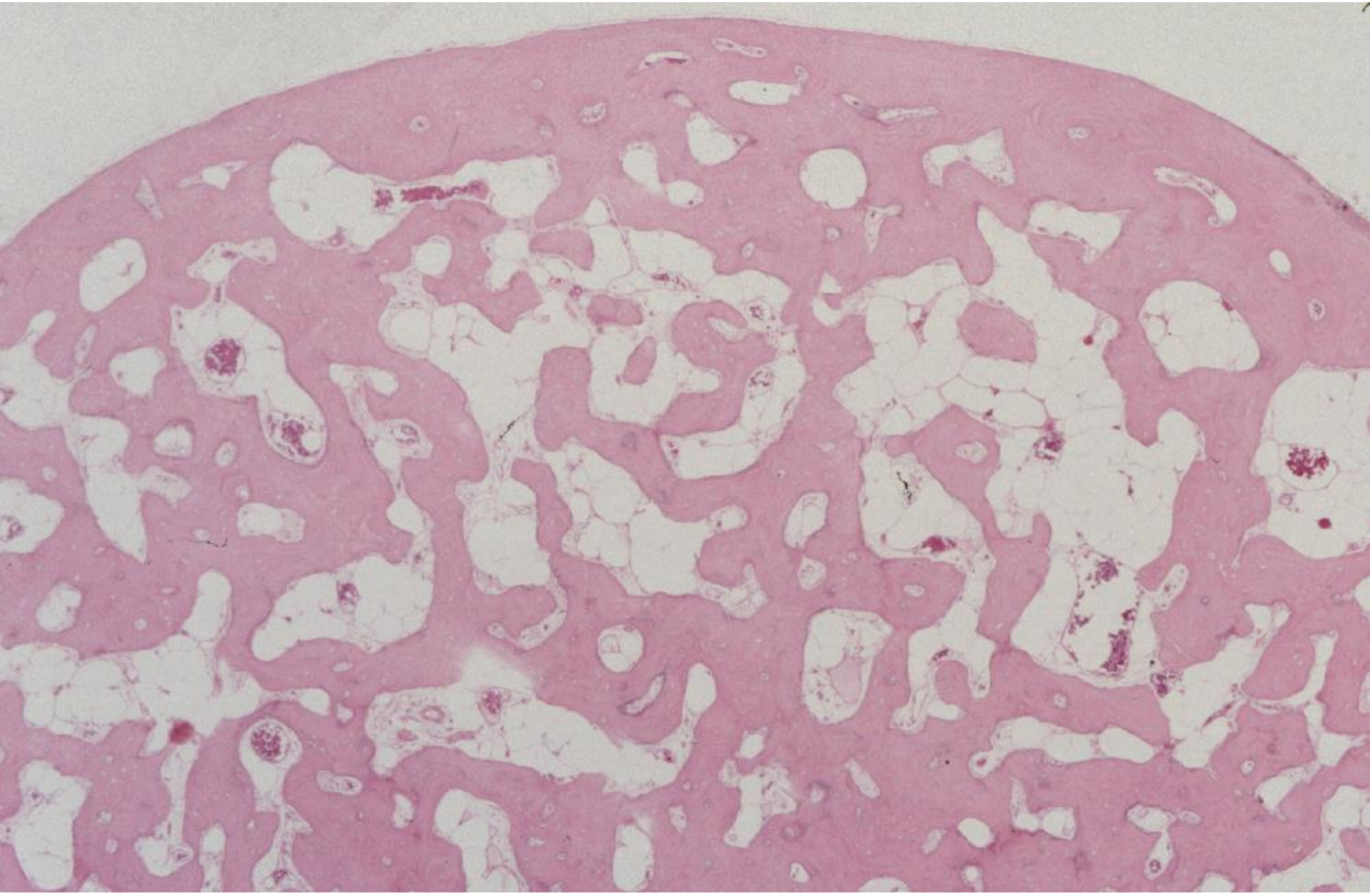
Osteoma

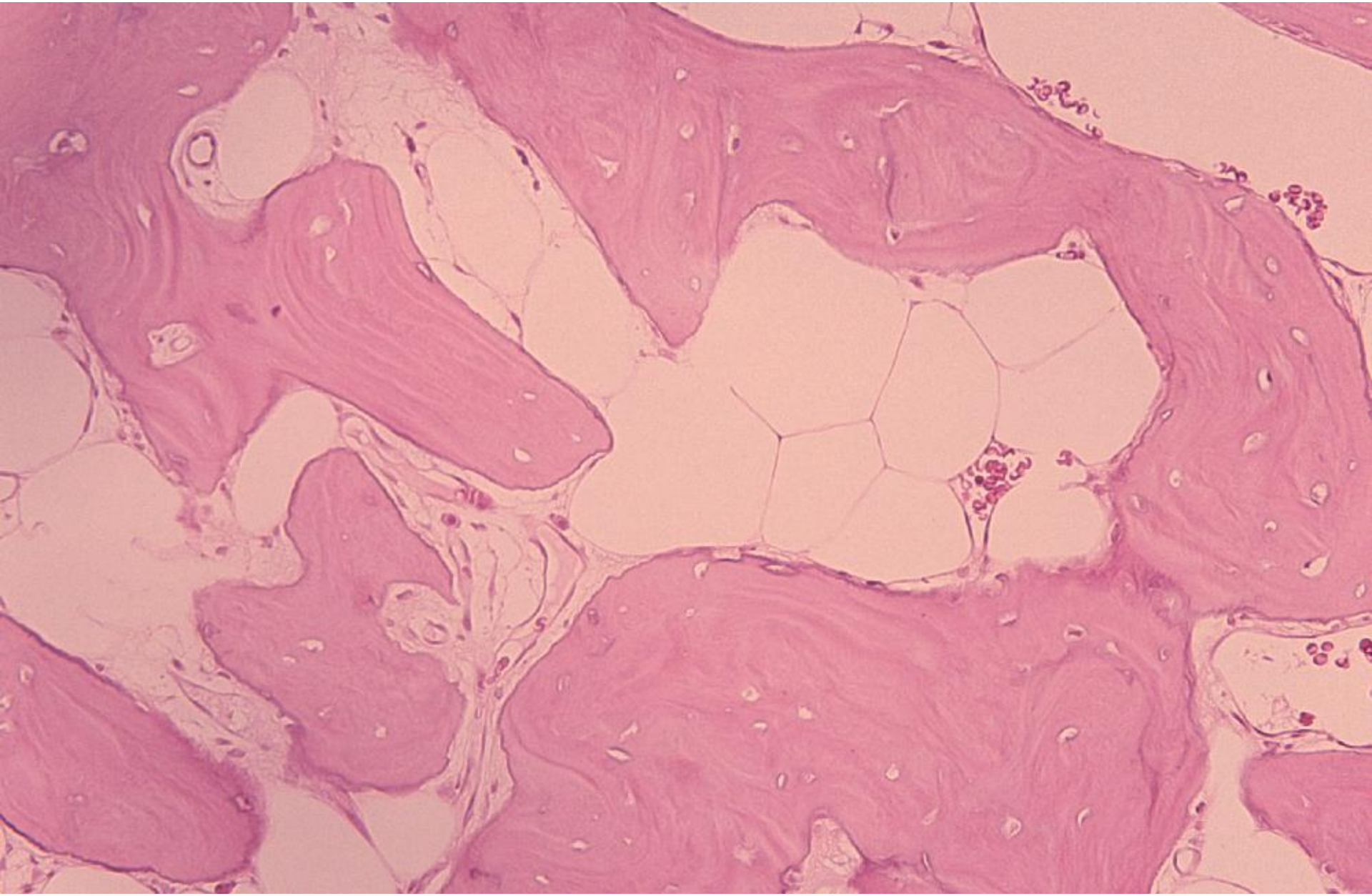
- Benign bone forming tumor
- Reactive – developmental (non-neoplastic)
- Site: craniofacial bones: skull, paranasal sinuses
- Solitary exophytic mass of dense bone arising from periosteal or endosteal surface
- Asymptomatic
- Non-aggressive, no malignant transformation





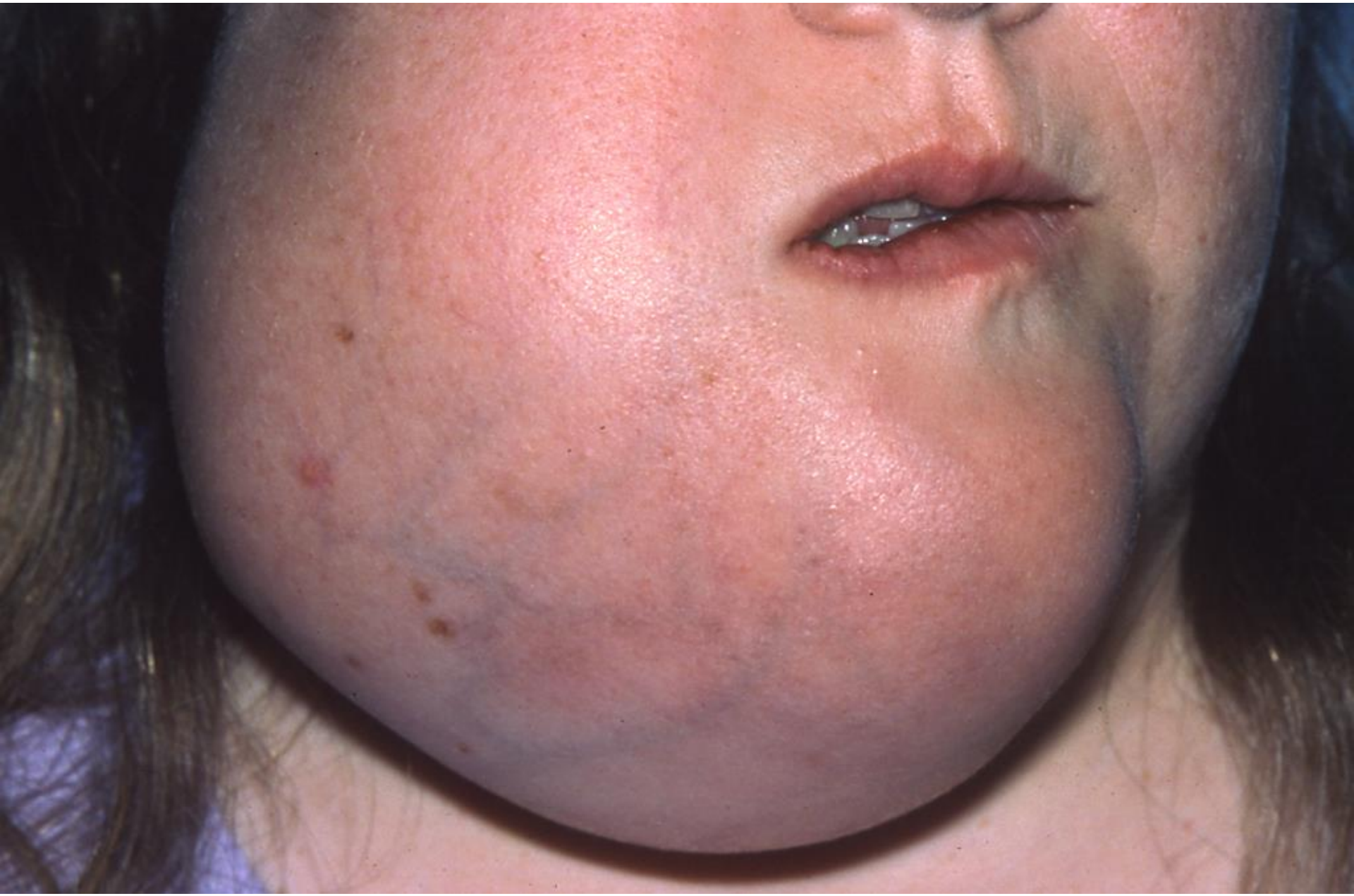


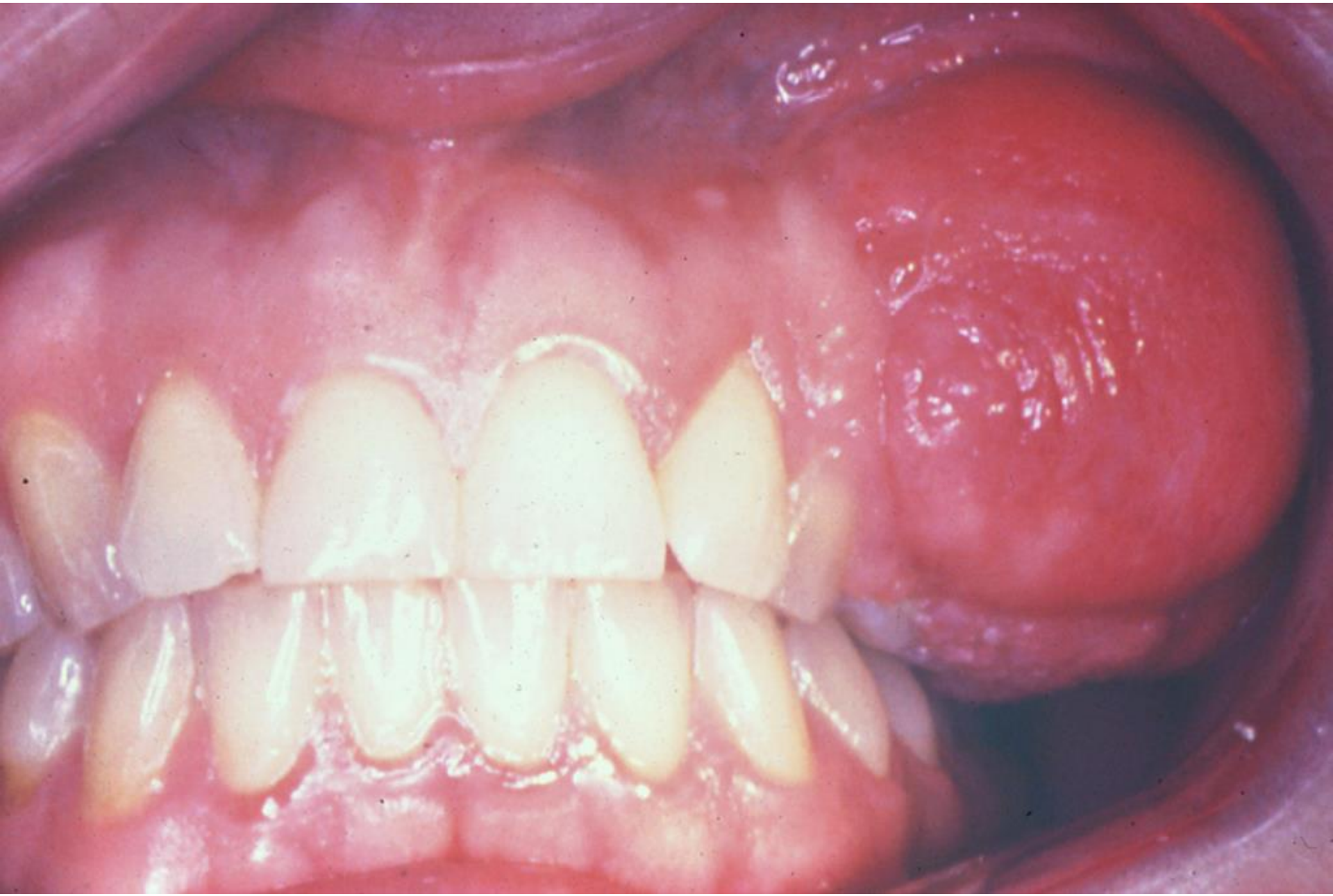


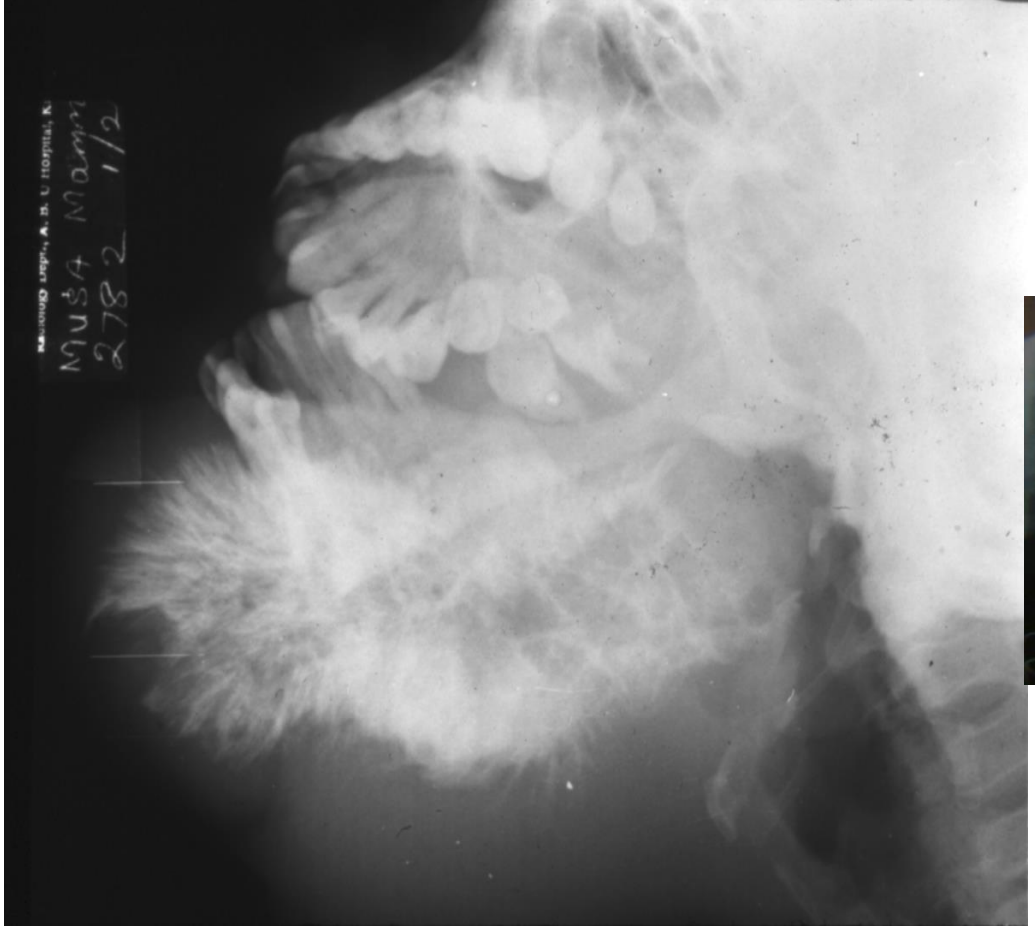


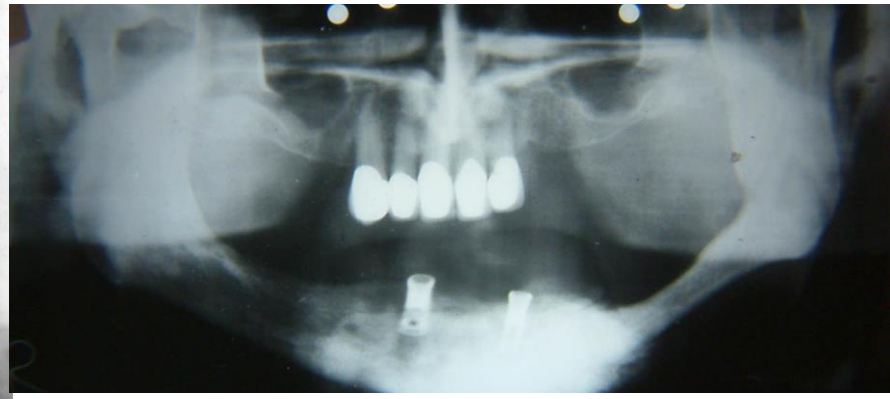
Osteosarcoma of Head & Neck

- Incidence: rare in the jaws
- 6-8% occur in the gnathic skeleton
- Age: 3-4th decade (mean age 33 years)
- Gender: male > female
- Site: mandible = maxilla, paranasal sinuses, skull
- Symptoms: painful swelling, paresthesia, loose teeth

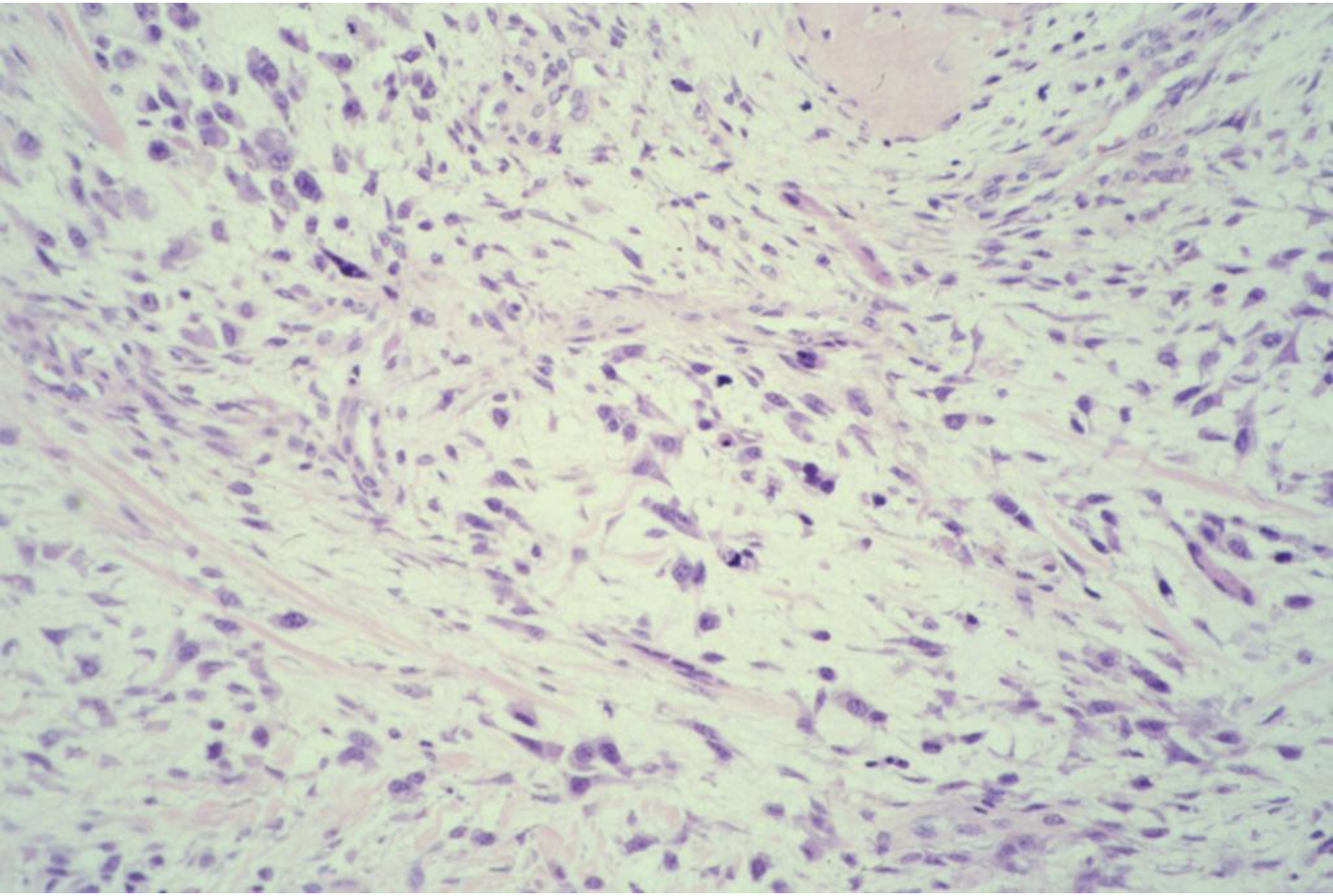


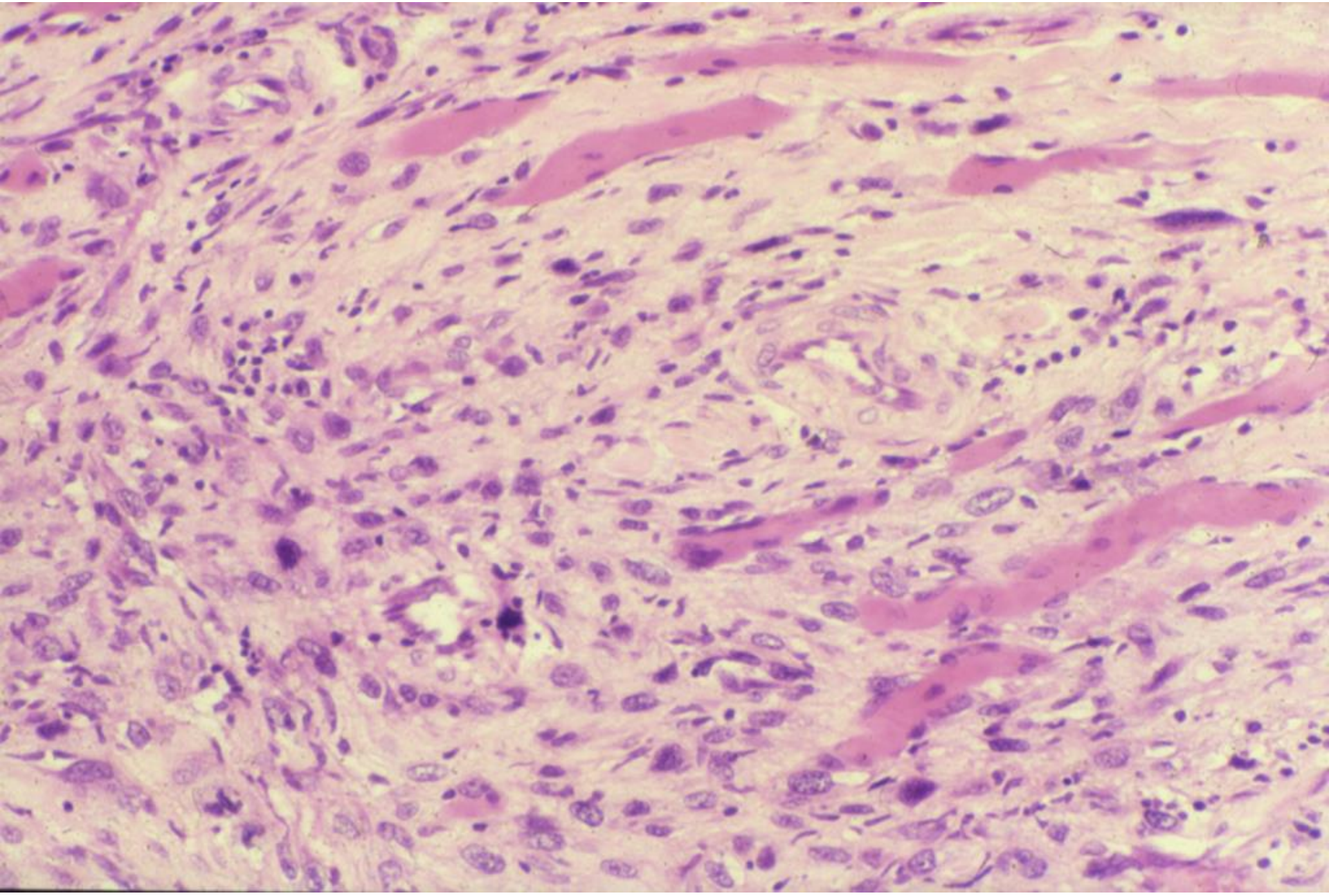






- Mixed radiolucent – radiopaque
- Destructive
- Poorly defined infiltrative borders
- Sunburst pattern (25%)
- Symmetric widening of periodontal ligament
- Calcification above level of alveolar crest
- Spiking root resorption



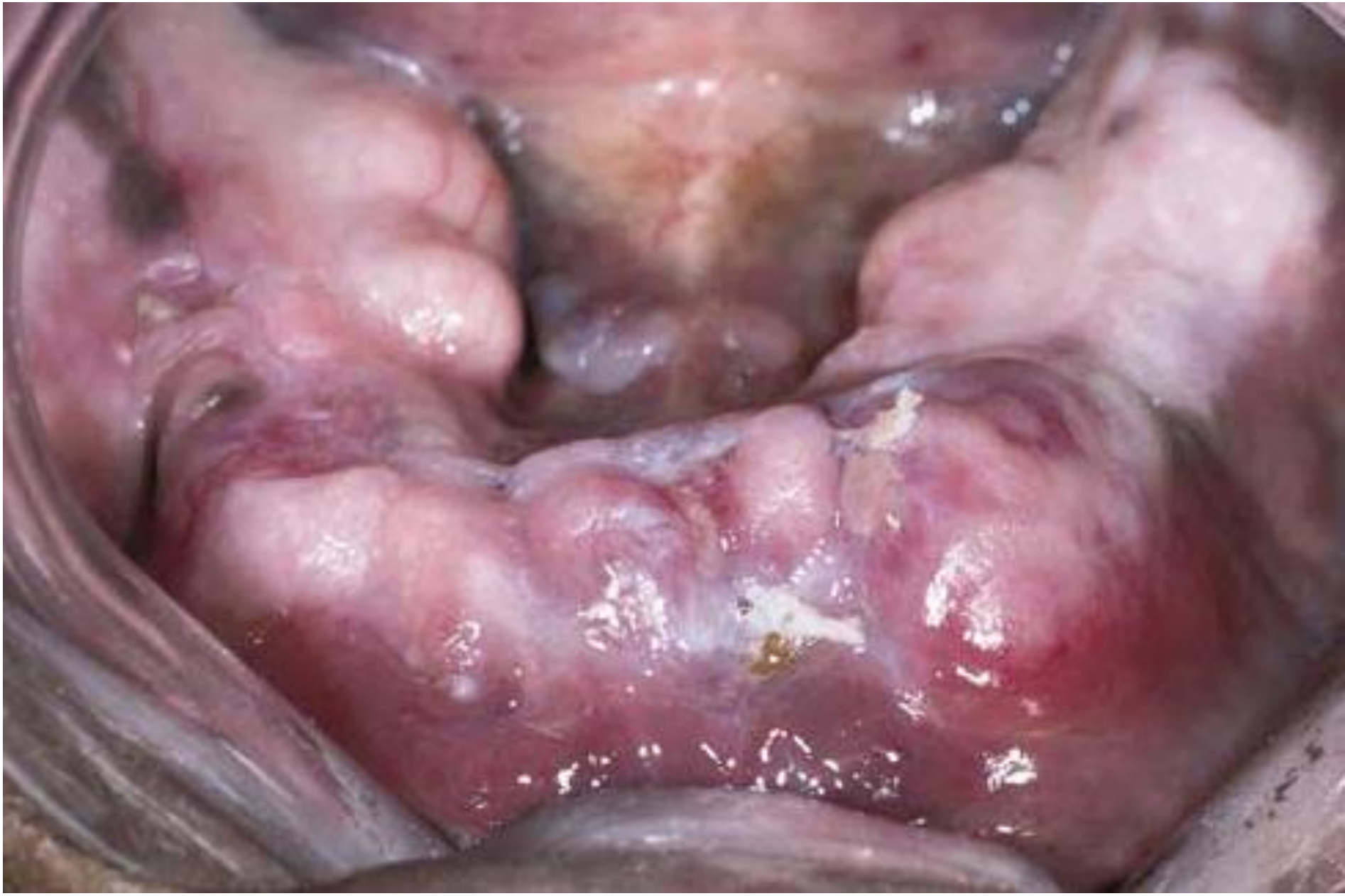


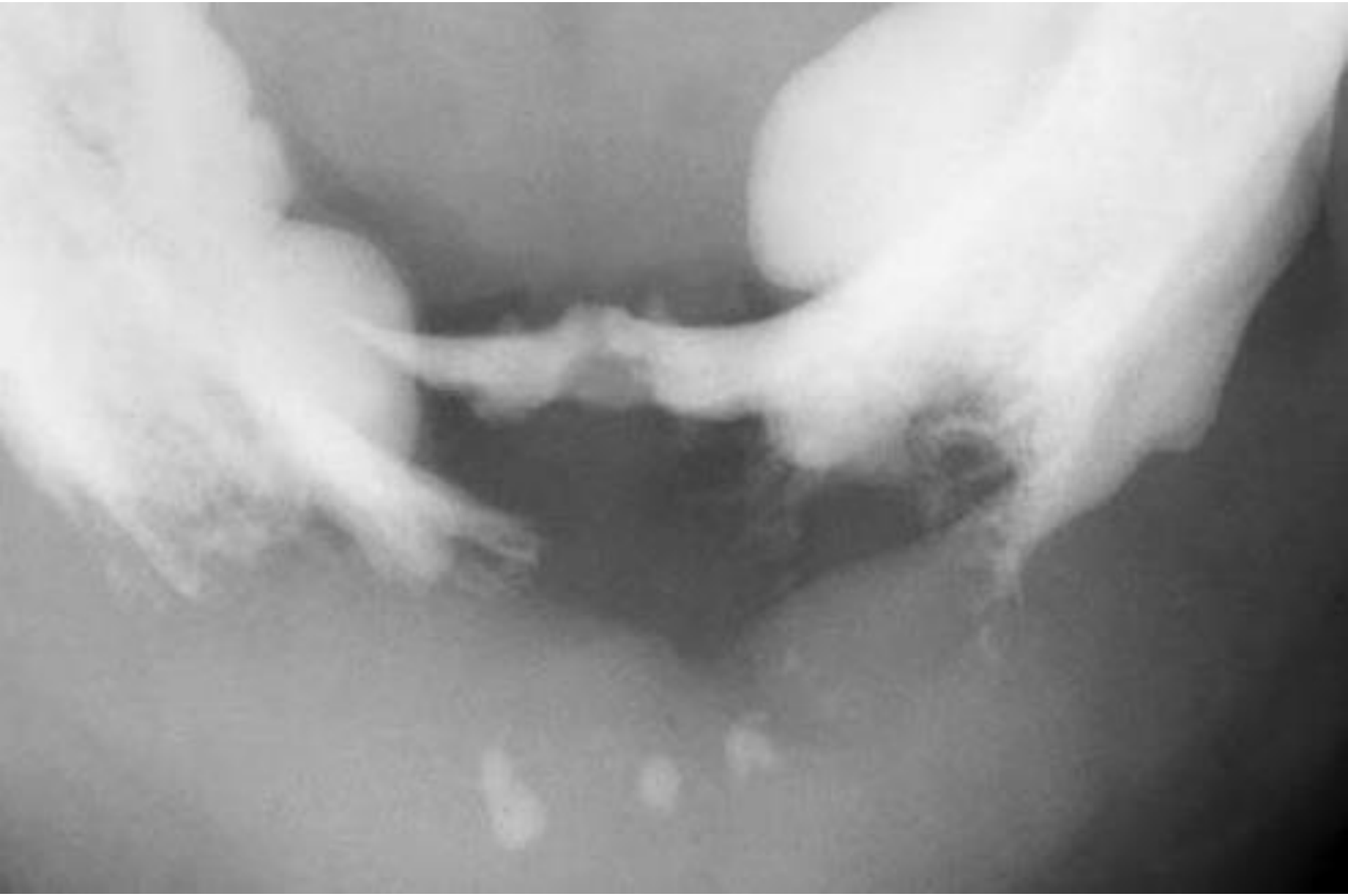
Metastatic Tumours to Bone

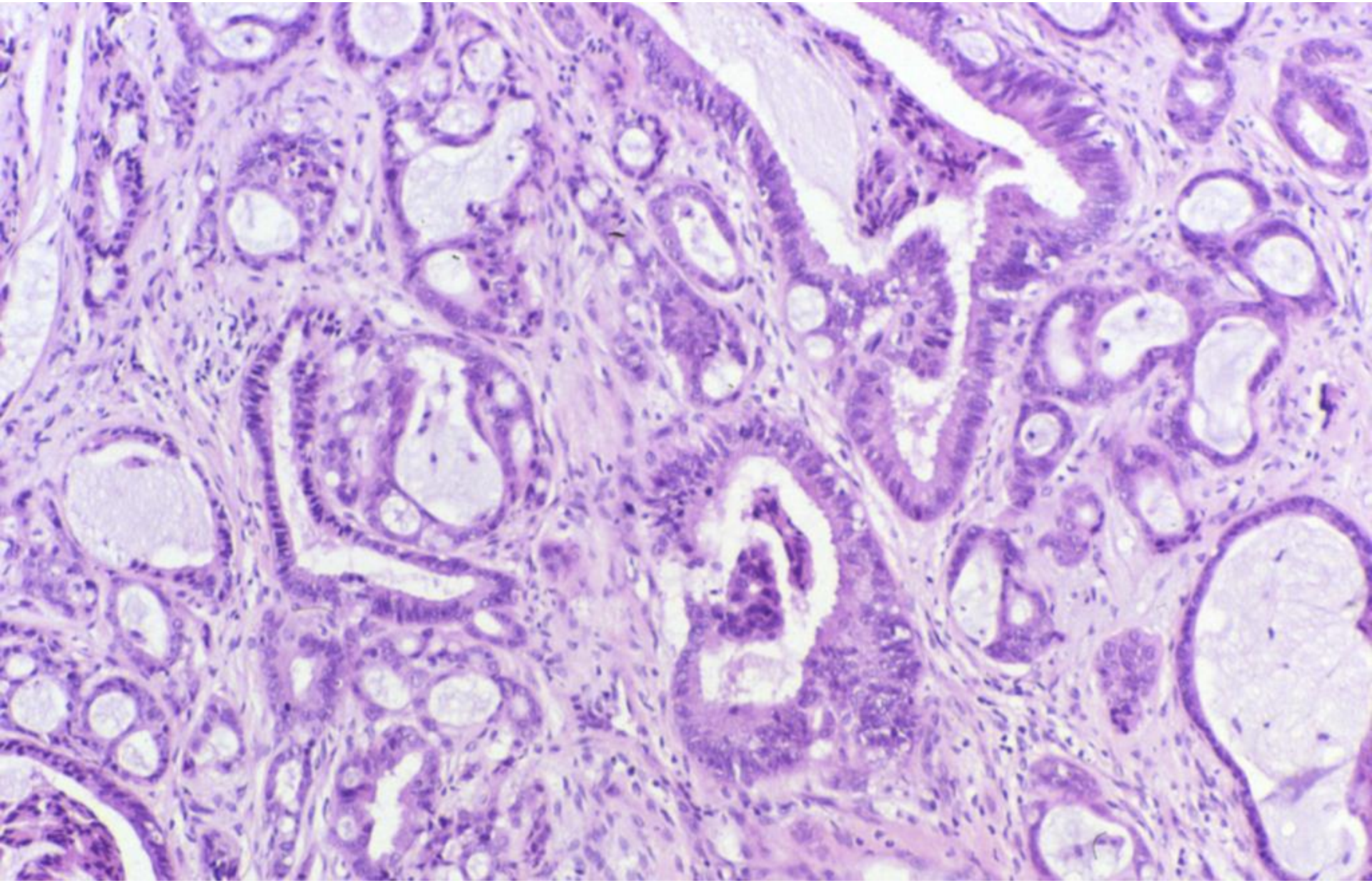
- Most common form of cancer involving bone
- Carcinomas
- Breast, prostate, lung, kidney, thyroid
- Site: vertebral column, pelvis, ribs, skull
- Poor prognosis

Metastatic Tumours to the Jaws

- Radiographic features:
  - osteolytic: ill-defined destructive radiolucency
  - osteoblastic: radiopaque or mixed lesion
- May simulate periapical or periodontal disease
- Histology: infiltrating nests and cords of pleomorphic epithelial cells with fibrous stroma
- Prognosis: poor, widely disseminated disease
- Survival: less than one year







Quiz

Join at

slido.com

#2547 150

Questions