

CYSTS OF THE JAWS

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ORAL AND MAXILLOFACIAL RADIOLOGIST

SENIOR LECTURER

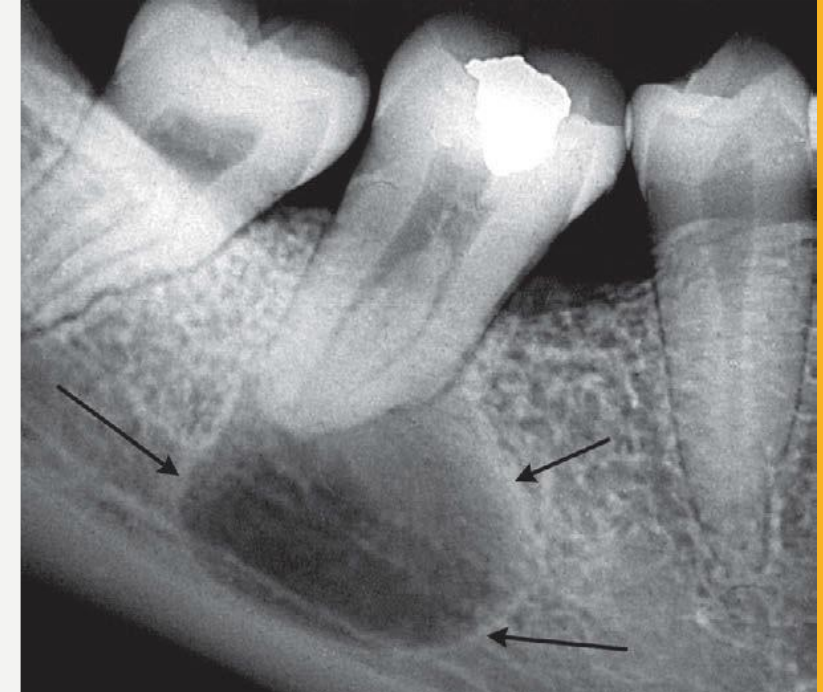
BDSC (HONS) FRACDS (GDP) DCLINDENT (DMFR) MRACDS (DMFR)

WHAT IS A CYST?

- **Definition:** a pathologic cavity filled with fluid, lined by epithelium, and surrounded by a definite connective tissue wall.
- Cysts occur more often in the jaws than in any other bone because most cysts originate from the numerous rests of odontogenic epithelium that remain after tooth formation.
- The cystic fluid either is secreted by the cells lining the cavity or is derived from the surrounding tissue fluid.
- **Clinical Features:** asymptomatic swelling (most common)

GENERAL IMAGING FEATURES

- **Location:**
 - Within bone anywhere in the maxilla or mandible (rare in condyle and coronoid process)
 - Odontogenic cysts occur in tooth-bearing regions of the jaws (above IAC)
- **Periphery/Shape:**
 - Usually spherical/round, but its shape is influenced by adjacent structures
 - Well-defined, corticated
 - If secondarily infected, this may change to a thicker, sclerotic border or make the cortex less apparent

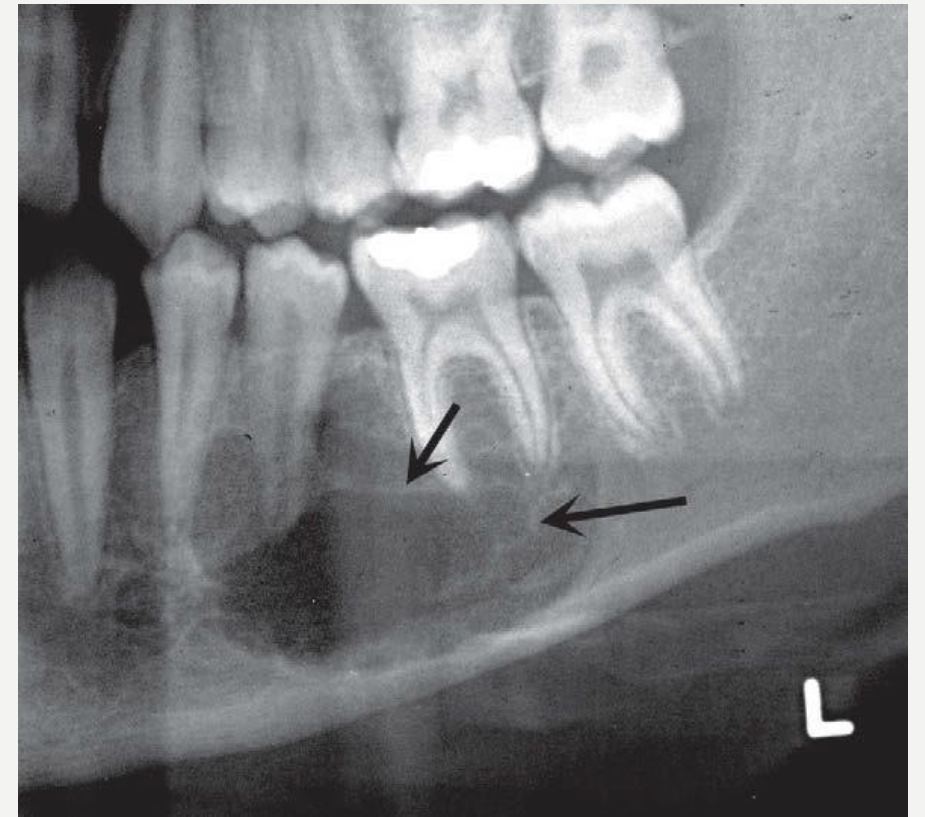


White and Pharoah, 2014



GENERAL IMAGING FEATURES

- **Internal Structure:**
 - Mostly radiolucent
 - Long standing cysts may have dystrophic calcification (gives a sparse particulate appearance)
 - Some cysts have septa
- **Effects on Surrounding Structures:**
 - Displacement and resorption of teeth
 - Expansion and thinning of the jaw cortices
 - Displacement of the inferior alveolar canal (IAC)
 - Elevation of the antral +/- nasal cortical floors



CYSTS OF THE JAWS

1. Radicular cyst
 - a. Residual radicular cyst
2. Dentigerous cyst
3. Odontogenic keratocyst
4. Inflammatory collateral cysts
 - a. Mandibular buccal bifurcation cyst
 - b. Paradental cyst
5. Lateral periodontal cyst and botryoid odontogenic cyst
6. Nasopalatine duct cyst
7. Surgical ciliated cyst
8. Orthokeratinised odontogenic cyst
9. Calcifying odontogenic cyst
10. Glandular odontogenic cyst

1. RADICULAR CYST

- **Definition:** An inflammatory odontogenic cyst associated with the root of a non-vital tooth
- **Related terminology:**
 - Acceptable: periapical cyst, apical cyst
 - Not recommended: (Apical) periodontal cyst, inflammatory dental cyst, dental cyst
- **Subtype:** Residual radicular cyst
- **Epidemiology:** most common cyst in the jaw (60% of all odontogenic cysts)
- **Age:** wide range, peak incidence in 4th – 5th decades of life
- **Gender:** slight male predilection



1. RADICULAR CYST

- **Aetiology:**

- Chronic inflammation at the apex of a non-vital tooth causes proliferation of the epithelial cell rests of Malassez (remnants of Hertwig's epithelial root sheath) in the PDL
 - This forms the epithelial lining of the radicular cyst
- A cyst cavity is formed and enlarges as a result of osmotic pressure and peripheral bone resorption

- **Clinical Features:**

- Always associated with a non-vital tooth
- Asymptomatic, unless secondarily infected
 - There may be a history of dental pain or abscess
- May cause bluish swelling
 - May feel bony and hard (cortex intact), crepitant (bone thinning), rubbery and fluctuant (cortex perforated)

Figure 2. Development of tooth structure.

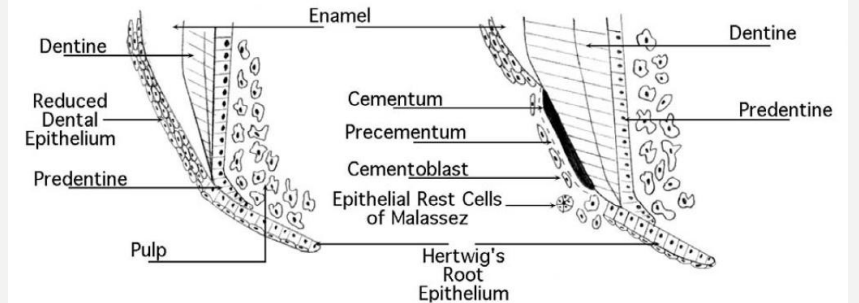


Figure courtesy of Dr T Matias

RACDS Oral Histology Orientation Course Booklet



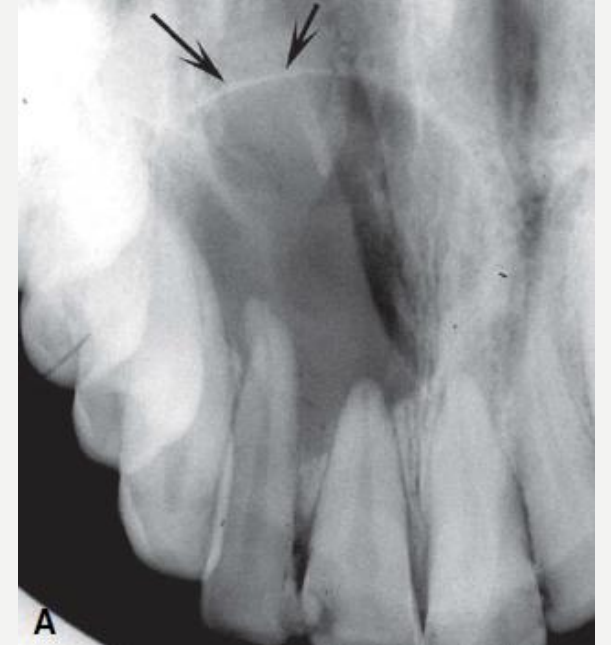
1. RADICULAR CYST – IMAGING FEATURES

- **Location:**

- Maxilla > Mandible
- 40-50% arise in the anterior maxilla, followed by the posterior mandibular region
- Epicentre at tooth apex
 - Unless associated with a lateral root canal (*Lateral radicular cyst*)

- **Periphery/Shape:**

- Well-defined, cortical border
 - Cortex may be sclerotic or lost if cyst is secondarily infected
- Curved or circular
 - Unless influenced by surrounding structures
- >10mm

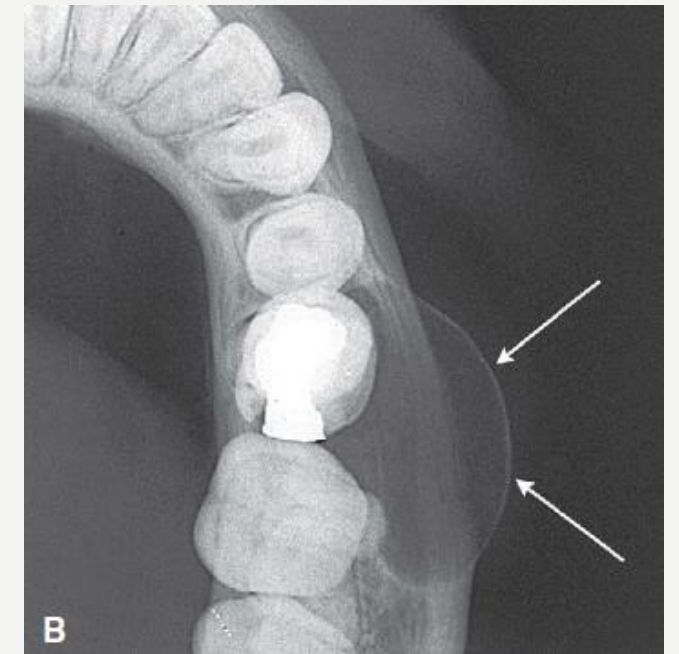
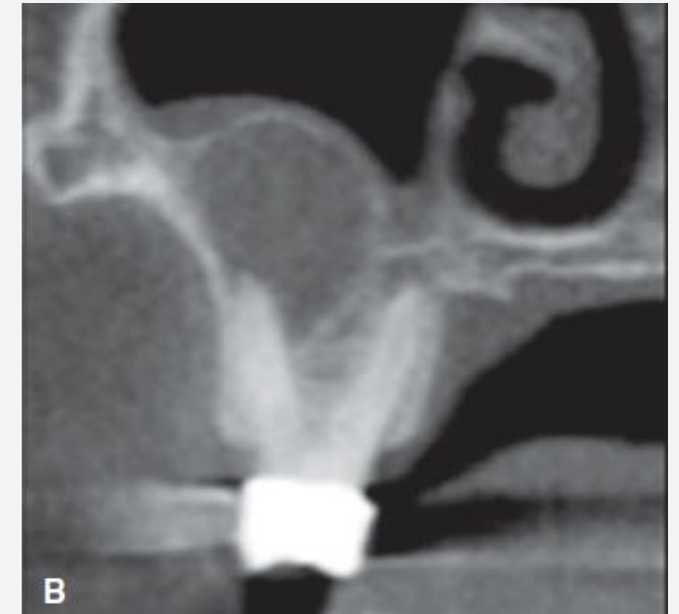


White and Pharoah, 2014



1. RADICULAR CYST – IMAGING FEATURES

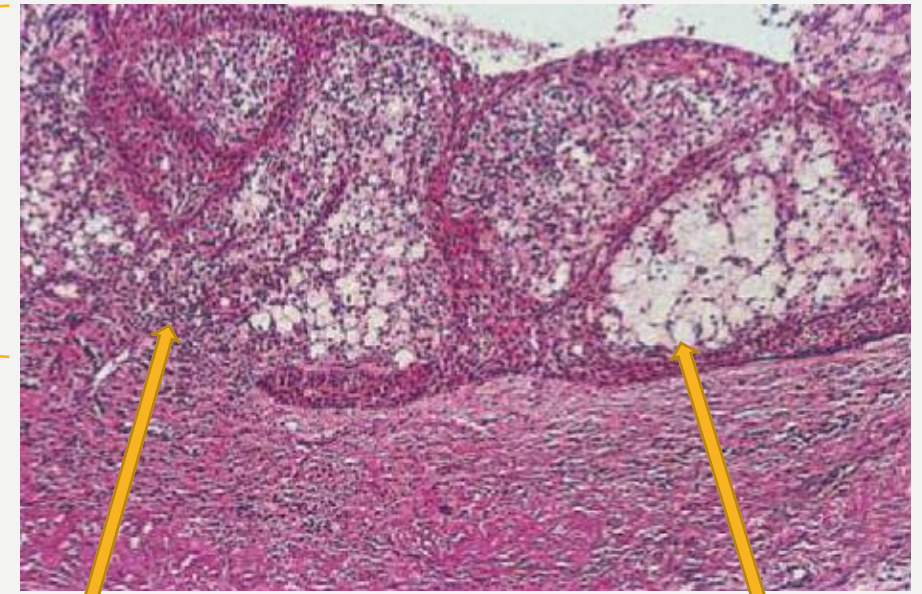
- **Internal Structure:**
 - Radiolucent
 - Dystrophic calcifications may develop in long-standing cysts
 - Sparsely distributed, small particulate radiopacities
- **Surrounding Structures:**
 - Displacement and resorption of roots of adjacent teeth
 - Resorption pattern has curved outline
 - Can resorb the root(s) of the involved non-vital tooth (rare)
 - May extend into the maxillary sinus (sinus floor remains intact but is elevated)
 - Outer cortical plates may expand in curved or circular shape
 - May displace the IAC in an inferior direction



1. RADICULAR CYST

- **Histopathology:**

- **Epithelium:** non-keratinised stratified squamous epithelium that is proliferative with elongated rete pegs in a characteristic arcading pattern
 - +/- hyaline (Rushton) bodies, mucous (goblet) cells, or small areas of keratinisation
- **Cyst wall:** inflamed fibrous tissue, often with foamy histiocytes
- Deposits of cholesterol crystals (clefts) with foreign body giant cells are often seen and may form luminal nodules
- Residual and long-standing cysts are less inflamed and have more regular thin epithelium



Mixed inflammatory infiltrate

Foamy histiocytes

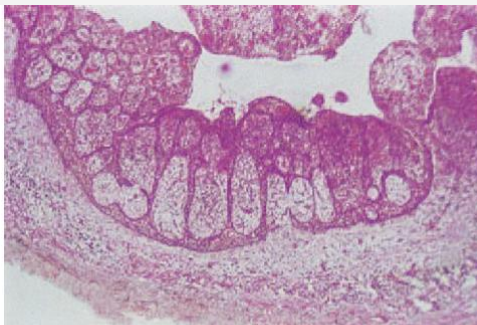


Fig. 7.5 Radicular cyst. The epithelial lining often assumes this arcaded pattern with numerous inflammatory cells beneath its surface.

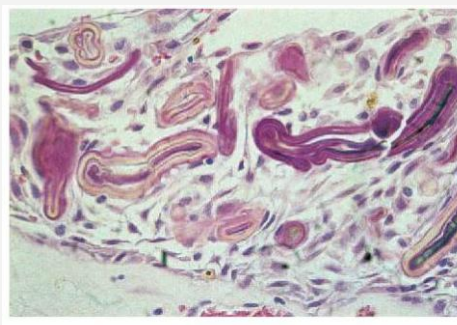


Fig. 7.7 Hyaline or Rushton bodies. These translucent or pink-staining lamellar bodies are formed by the cyst lining epithelium and indicate the odontogenic origin of a cyst.

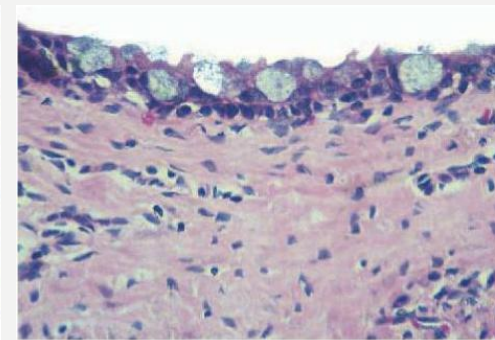


Fig. 7.8 Mucous metaplasia in a radicular cyst. The numerous goblet cells can be seen but are more typical of dentigerous cysts.

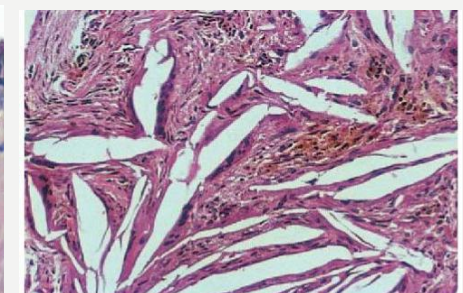


Fig. 7.10 Cholesterol clefts. Cholesterol has been dissolved out during preparation of the section, leaving clefts. The crystals are treated as foreign bodies and flattened multinucleate foreign body giant cells are seen along the edges of several clefts.

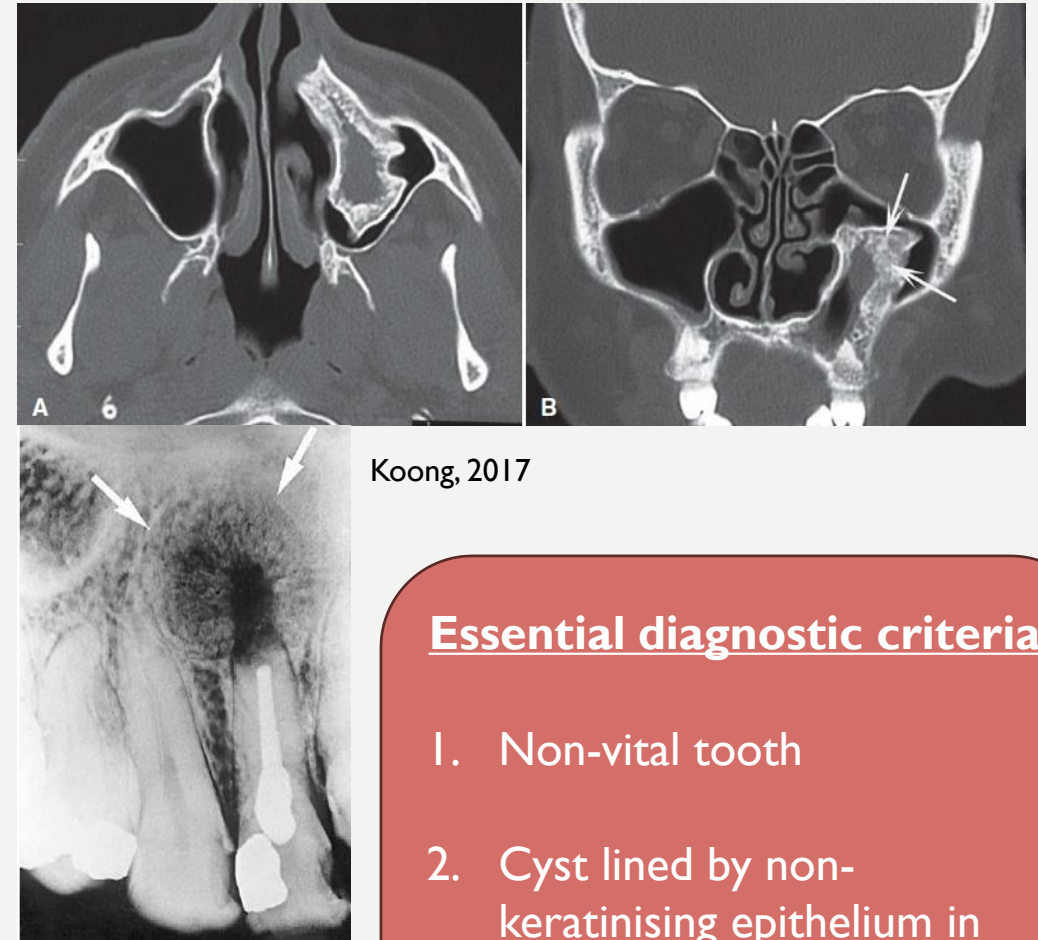
1. RADICULAR CYST

- **Treatment:**

- Extraction or root canal therapy of tooth and enucleation of cyst +/- apicoectomy
- Healing: new bone grows into defect from periphery and may result in a radiating pattern resembling the spokes of a wheel

- **Recurrence:**

- rare, although may persist as residual cysts (may follow extraction or RCT alone)



Koong, 2017

Essential diagnostic criteria:

1. Non-vital tooth
2. Cyst lined by non-keratinising epithelium in characteristic arcading pattern

2. DENTIGEROUS CYST

- **Definition:** A developmental odontogenic cyst of the jaws surrounding the crown of an unerupted tooth, the lining attached to the cementoenamel junction (CEJ).
- **Related terminology:** follicular cyst
- **Subtype:** eruption cyst (a superficial dentigerous cyst over an erupting tooth in a child, usually a deciduous first molar)
- **Epidemiology:** 2nd most common cyst in the jaws (~25% of all jaw cysts)
- **Age:** wide range (5-83 years), peak incidence in 2nd – 3rd decades
- **Gender:** 1.7 times more frequent in males

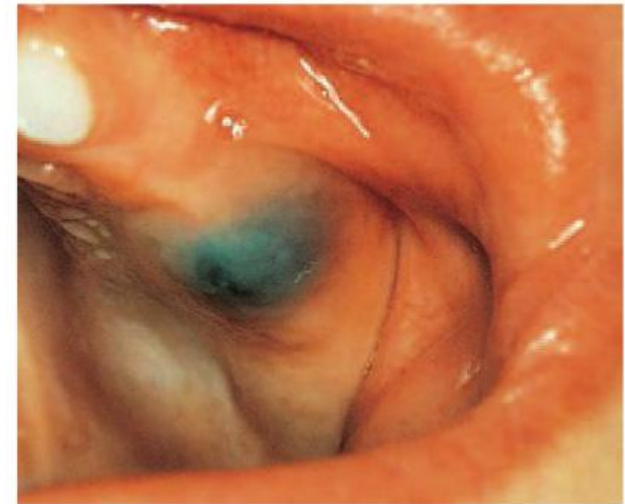


Fig. 7.23 An eruption cyst over an erupting upper molar. There has been bleeding into the cyst cavity as a result of trauma.

2. DC

- **Aetiology:**

- Develops from accumulation of fluid between the reduced enamel epithelium and crown of the unerupted tooth

- **Clinical Features:**

- Asymptomatic and usually discovered on routine dental radiographs or when investigating the failure of a tooth to erupt
- Larger cysts cause slow expansion of jaw (hard swelling)
- Pain and swelling if infected (usually due to communication with oral cavity)



Fig. 7.15 Dentigerous cyst. This cyst has been removed together with its associated tooth. The cyst surrounds the crown and is attached at the cementoenamel junction.

2. DC – IMAGING FEATURES

- **Location:**

- ~75% associated with unerupted mandibular 3rd molar
- Lower 8s > Upper 3s > Upper 8s > Lower 5s
- ~5% around supernumerary teeth (esp. mesiodens in anterior maxilla)
- Epicentre above crown
- Cyst attaches at CEJ

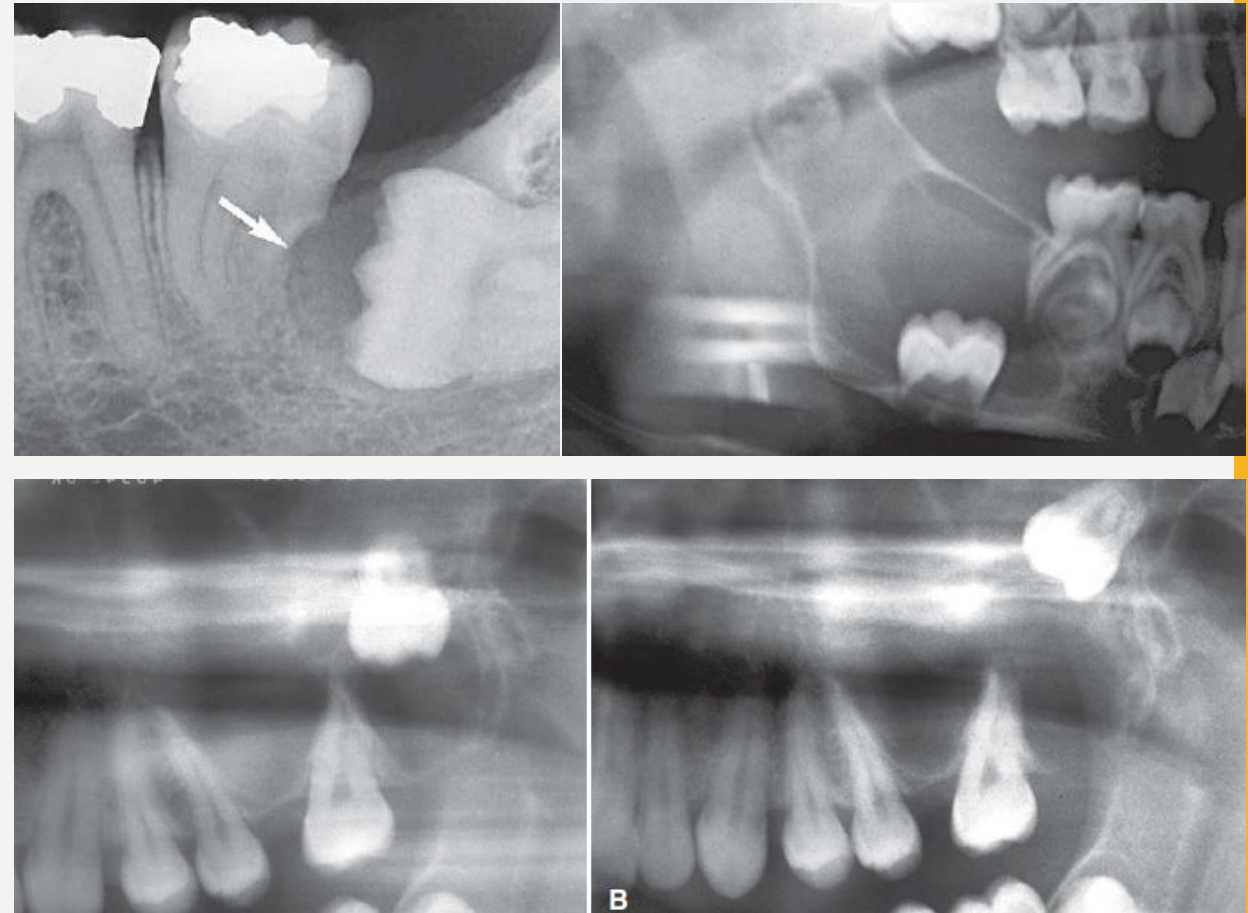
- **Periphery/Shape:**

- Well-defined corticated (may be missing if secondarily infected)
- Curved or circular outline
- More likely cystic if follicular cortex is >5mm from crown surface



2. DC – IMAGING FEATURES

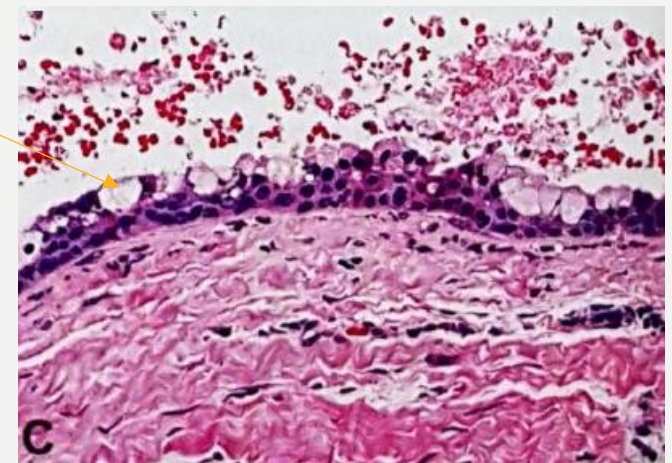
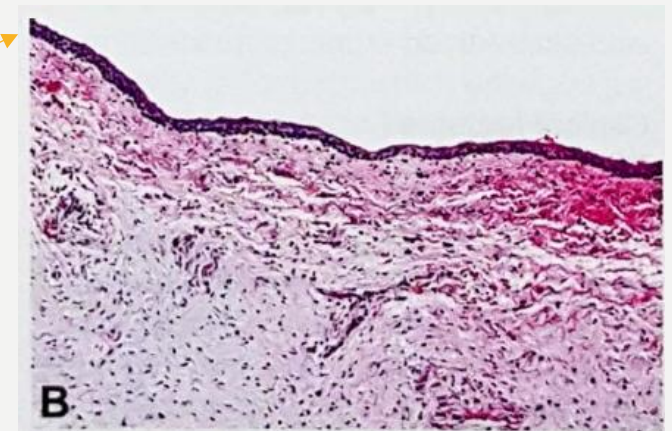
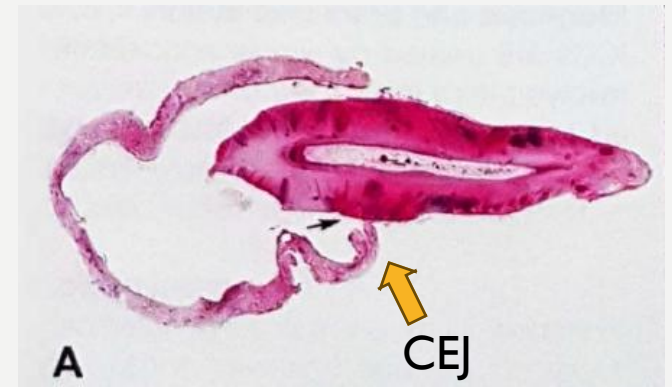
- **Internal Structure:**
 - Radiolucent, except crown of tooth
- **Surrounding Structures:**
 - Displacement and resorption of adjacent teeth
 - Displacement of involved tooth
 - Displacement of maxillary antrum/IAC
 - Expansion of outer cortex of involved jaw



2. DENTIGEROUS CYST

- **Histopathology:**

- **Epithelium:** thin, non-keratinized stratified squamous epithelial lining.
 - +/- cuboidal, columnar and ciliated cells
 - +/- mucous or sebaceous metaplasia
 - +/- Hyaline (Rushton) bodies and focal keratinisation
- **Cyst wall:** loose, often myxoid, fibrous connective tissue and may contain occasional odontogenic epithelial rests



2. DENTIGEROUS CYST

- **Treatment:**

- Surgical enucleation (may include removal of tooth)
- Large cysts may require marsupialisation before removal
- Marsupialisation of eruption cysts to allow affected tooth to erupt normally
- Submit cyst lining for histology as benign/malignant tumours have been reported to arise (e.g. ameloblastomas, SCC, mucoepidermoid carcinoma)

- **Recurrence:**

- Do not recur

Essential diagnostic criteria:

1. Well-defined radiolucency associated with the crown of an unerupted tooth
2. Epithelium and cyst wall attached to the CEJ of the unerupted tooth

3. ODONTOGENIC KERATOCYST

- **Definition:** a developmental odontogenic cyst that is characterized histologically by a thin parakeratinized stratified squamous epithelial lining with palisaded and hyperchromatic basal cells and clinically by a tendency to recur after treatment.
- **Related terminology:** keratocystic odontogenic tumour
- **Epidemiology:** 3rd most common, ~10-20% of odontogenic cysts
 - 5% of all OKCs occur as part of naevoid basal cell carcinoma syndrome (NBCCS) (usually multiple and in younger patients)
- **Age:** all ages, peak incidence 2nd – 3rd decade and smaller peak at 50-70 years
- **Gender:** slight male predilection



3. OKC

- **Aetiology:**

- Arise from remnants of dental lamina
- Mutations in the PTCH1 gene (tumour suppressor gene)
 - In syndromic cases and 80% of sporadic cases

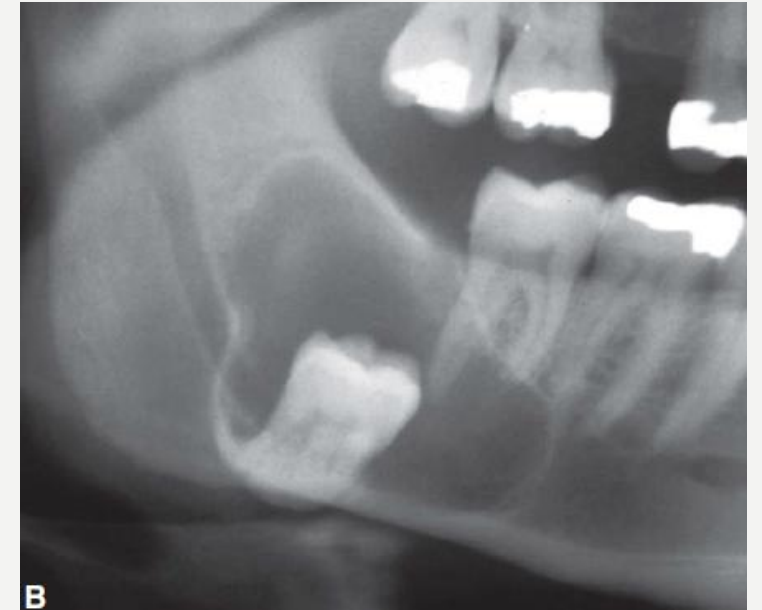
- **Clinical Features:**

- Painless, unless secondarily infected
- Lesions are often large at diagnosis due to insidious growth pattern (significant bone destruction, but minimal bone expansion)
- Tooth displacement if lesion is large
- Pathologic fracture risk
- Aspiration reveals yellow, cheesy material (keratin)

3. OKC – IMAGING FEATURES

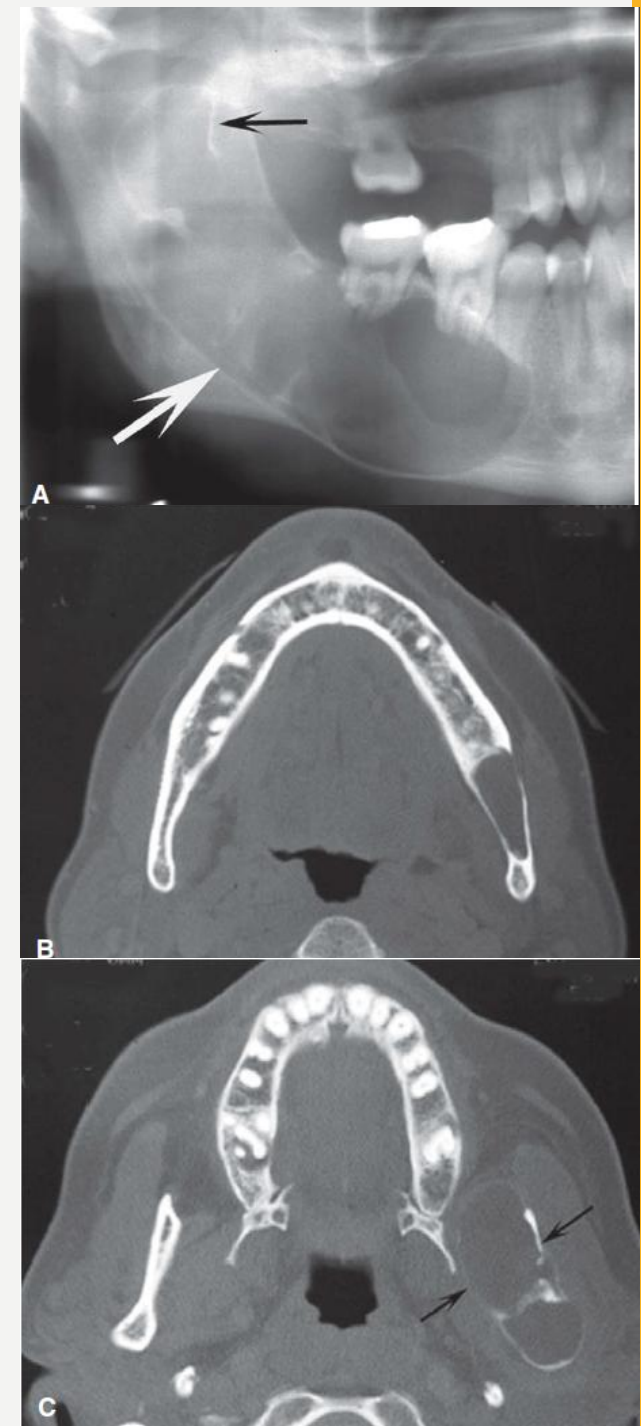
White and Pharoah, 2014

- **Location:**
 - ~80% in mandible
 - Mostly posterior body and ramus
 - Epicentre superior to IAC
 - If found in posterior maxilla, often associated with NBCCS
 - Sometimes form around an unerupted tooth
 - Rarely extraosseous (in the gingiva)
- **Periphery/Shape:**
 - Well-defined and corticated (unless secondarily infected)
 - Smooth, round/oval shape, or scalloped outline



3. OKC – IMAGING FEATURES

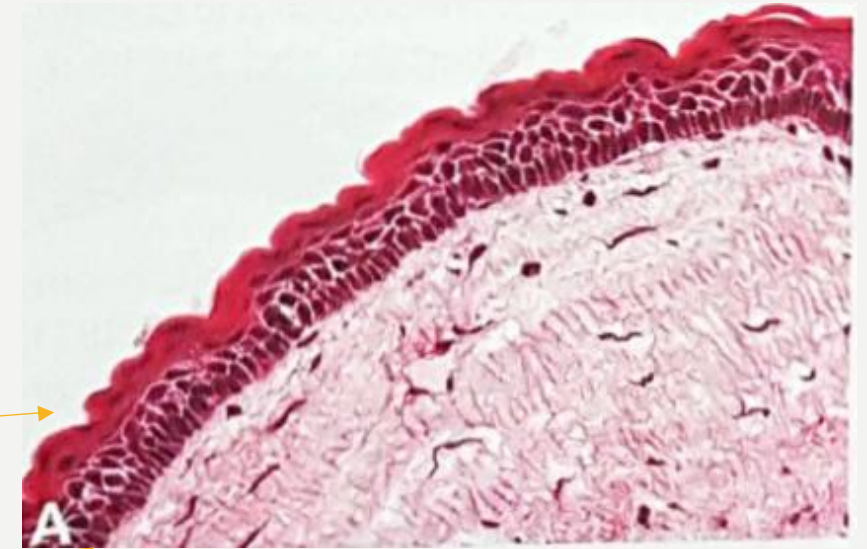
- **Internal Structure:**
 - Radiolucent
 - Curved internal septa may be present = multilocular appearance
- **Surrounding Structures:**
 - Minimal expansion for size
 - Except upper ramus and coronoid process
 - Cystic wall may contact soft tissue peripheral to outer cortex of mandible
 - Occasionally displace and resorb teeth
 - IAC displaced inferiorly
 - May invaginate and occupy the entire maxillary antrum



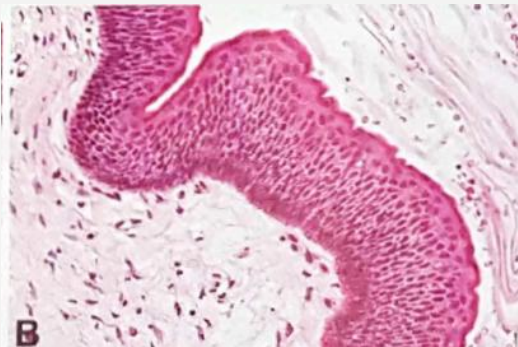
3. OKC

- **Histopathology:**

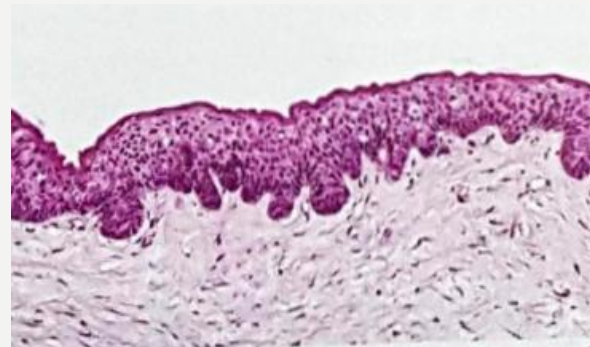
- **Epithelium:** Thin, regular, folded parakeratinised epithelium 4-8 cell layers thick without rete ridges
 - + corrugated with parakeratin
 - +/- focal orthokeratosis
 - Characteristic palisading basal layer with hyperchromatic nuclei
- **Cyst wall:** uninflamed fibrous wall
- Satellite cysts are more common in NBCCS



WHO classification of head and neck tumours, 2017



Reversal of nuclear polarity of basal layer



Basal cell budding



Satellite cysts and islands in the connective tissue wall

3. OKC

- **Treatment:**

- Need CT imaging to determine extent and location of any cortical perforations with soft tissue extension
- Enucleation, marsupialisation or resection
- Periodic post-tx clinical and radiographic examination
- Submit for histopathology – odontogenic carcinoma arising from the epithelial lining of OKCs has been reported

- **Recurrence:**

- High recurrence rate with traditional enucleation (20-30%)
 - Even higher in NBCCS (50%)
 - Recurrence can be reduced by more aggressive or adjunctive treatment including curettage, resection, peripheral ostectomy, cryotherapy or chemical cautery of the cavity, with excision of overlying mucosa
- Usually within first 5 years, but may occur as late as 10 years
- Likely due to small satellite cysts or fragments of epithelium left behind after surgical removal

Essential diagnostic criteria:

1. Located in jaws
2. Stratified squamous epithelial lining with surface parakeratin
3. Palisaded hyperchromatic basal cells

4. INFLAMMATORY COLLATERAL CYSTS

- **Definition:** inflammatory cysts on the buccal or distobuccal aspect of the roots of partially or recently erupted teeth.
- Two main types:
 - Paradental cysts (PC) (60%)
 - Mandibular buccal bifurcation cysts (MBBC) (40%)



White and Pharoah, 2014

- **Epidemiology:** 5% of all odontogenic cysts
- **Average age:** 30 years (PC); 9 years (1st molar MBBC); 17 years (2nd molar MBBC)
- **Gender:** more common in males (70%)

4. ICC

- **Aetiology:**

- Inflammation and dilation of the pericoronal tissues and lined by sulcular/junctional epithelium (derived from reduced enamel epithelium)
- Cyst formation may be exacerbated by food impaction or enamel cervical projections

- **Clinical Features:**

Paradental Cysts	Mandibular Buccal Bifurcation Cysts
• History of longstanding pericoronitis, but often asymptomatic at presentation • Pain, swelling, and trismus • Tooth is vital	• May be infected with pain, tenderness, and suppuration • Tooth is tilted buccally • Deep periodontal pockets • Delayed eruption of associated molar • Tooth is vital

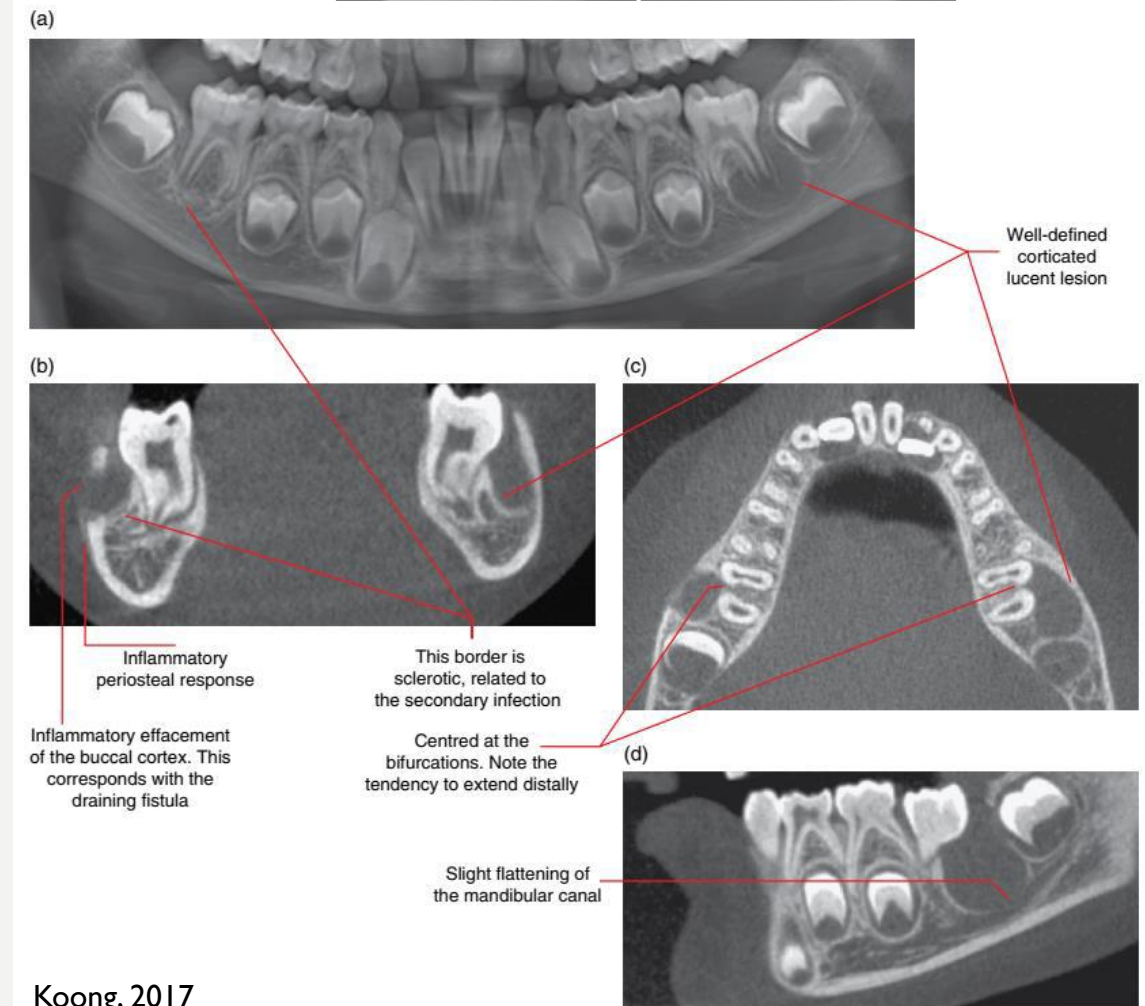
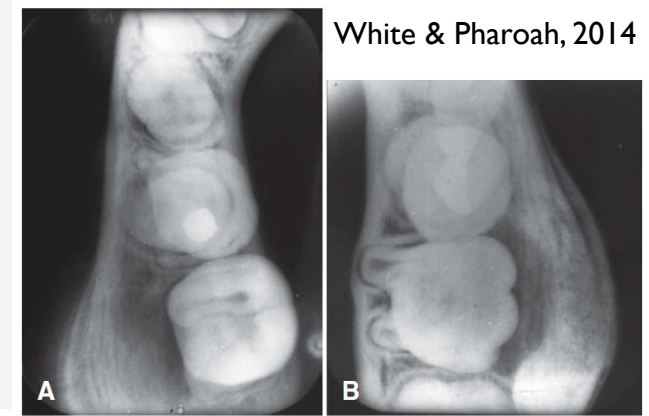
4. ICC – IMAGING FEATURES

- **Location:**
 - PC: typically distobuccal aspect of mandibular 3rd molars (depending on angle of impaction)
 - MBBC: at the buccal aspect of mandibular 1st or 2nd molars and are often bilateral
 - Other sites: rare (4%)
- **Periphery and Shape:**
 - May not be readily apparent with very subtle radiolucent region superimposed over the roots
 - Circular shape with well-defined cortical border
 - Can become quite large



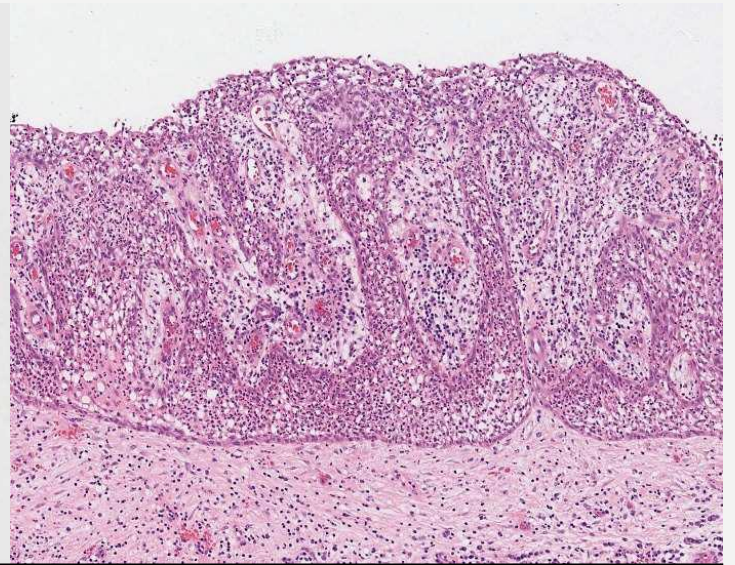
4. ICC – IMAGING FEATURES

- **Internal Structure:**
 - Radiolucent
- **Surrounding Structures:**
 - Tipping of involved molar so root tips are pushed into the lingual cortical plate of mandible and occlusal surface tipped toward buccal aspect
 - May displace and resorb adjacent teeth
 - May cause considerable amount of smooth expansion of the buccal cortical plate
 - If secondarily infected, periosteal new bone formation may be seen on the buccal cortex adjacent to involved tooth



4. ICC

- **Histopathology:**
 - Resembles radicular cyst
- **Treatment:**
 - Resolution without intervention
 - Curettage and enucleation
 - 3rd molars associated with PC are often removed
 - 1st and 2nd molars with MBBC can be conserved and erupt normally
- **Recurrence:**
 - Does not recur



This paradental cyst is composed of an inflamed fibrous wall lined by hyperplastic epithelium. The cyst appears as an open pocket. (WHO, 2022)

Essential diagnostic criteria:

1. Associated with partially or recently erupted vital tooth
2. Radiolucency distinct from dental follicle
3. Intact lamina dura
4. Non keratinised epithelium

5. NASOPALATINE DUCT CYST

- **Definition:** a developmental non-odontogenic cyst arising in the incisive canal.
- **Related terminology:** Incisive canal cyst
- **Epidemiology:** 5% of all cysts in the jaws; 80% of all non-odontogenic cysts
- **Age:** 30-60 years
- **Gender:** M>F; 3:1

5. NPDC

- **Aetiology:**

- Arises from respiratory and squamous epithelial vestigial remnants of an embryonic nasopalatine duct present in some individuals
- In one third of cases, inflammation from non-vital teeth or periodontal ligament may be a factor by stimulating the epithelial remnants to proliferate

- **Clinical Features:**

- Sessile swelling just posterior to maxillary incisors OR asymptomatic
- May arise deeper and present as swelling on labial alveolus or bulging of nasal floor
- Often traumatised and may become infected

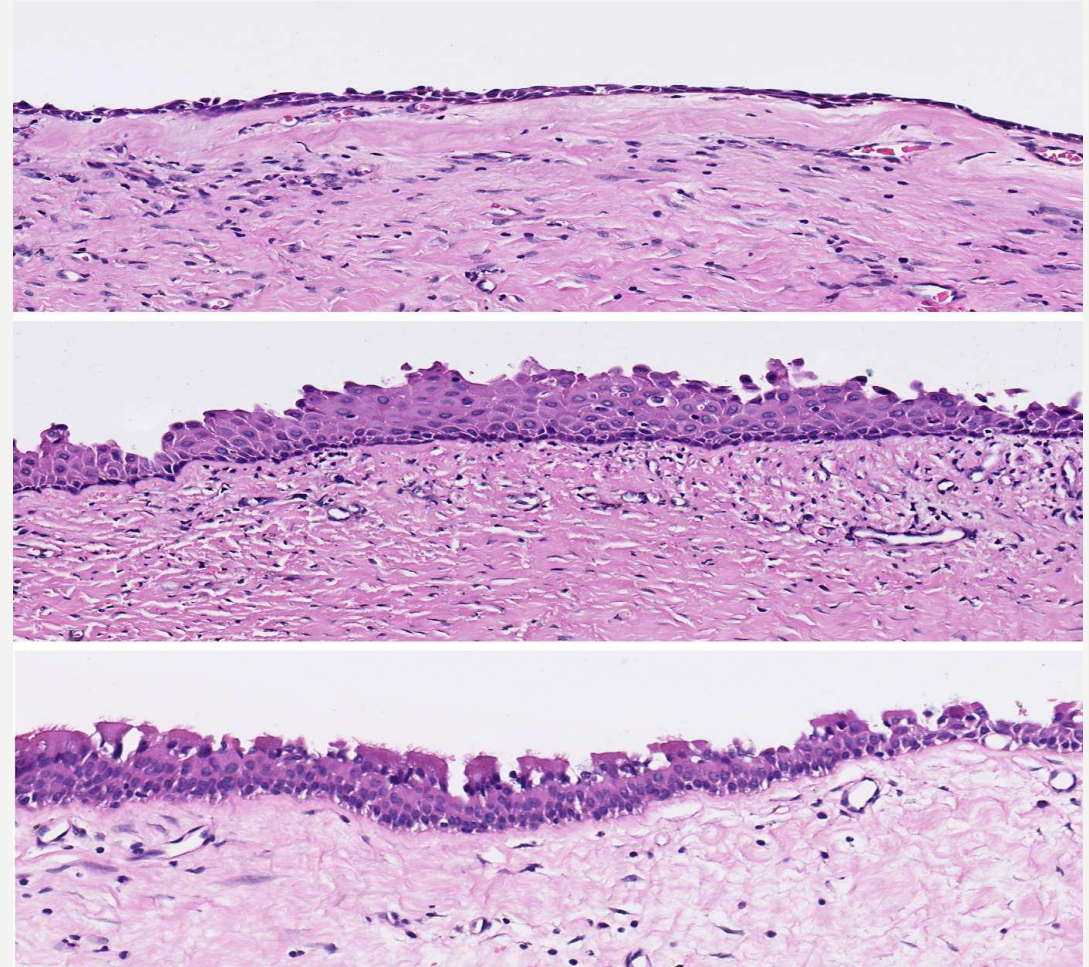
5. NPDC

- **Location:**
 - Found only in the midline of anterior hard palate
 - Between roots of incisors
- **Periphery/Shape:**
 - Well-defined
 - Often corticated
 - May have characteristic heart shape
 - Size: incisive canal >6mm considered to be cyst (average diameter 18mm)
- **Internal Structures:**
 - Radiolucency
- **Surrounding Structures:**
 - Incisor roots may be displaced, but are vital
 - Lamina dura is intact



5. NPDC

- **Histopathology:**
 - **Epithelium:** 90% lined by stratified squamous epithelium with focal areas of cuboidal, columnar, ciliated change
 - 50% of cases contain respiratory epithelium (but <10% are lined entirely by respiratory epithelium)
 - **Cyst wall:** Prominent neurovascular bundles with occasional small mucous glands or cartilage
 - Traumatized cysts are inflamed



Three areas of the wall from the same cyst showing a range of lining epithelium, from bilaminar cuboidal to low squamous and respiratory, intermediate appearances are often seen. (WHO, 2022)

5. NPDC

- **Treatment:**
 - Enucleation
- **Recurrence:**
 - Do not normally recur

Essential diagnostic criteria:

1. Epicentre at incisive canal
2. Lining of non-keratinised squamous or respiratory epithelium
3. +/- Neurovascular bundle in the cyst wall

6. LATERAL PERIODONTAL AND BOTRYOID ODONTOGENIC CYST

- **Definition:**
 - Lateral periodontal cyst (LPC): a developmental odontogenic cyst lined by non-keratinized epithelium with characteristic thickenings.
 - Botryoid odontogenic cyst (BOC): a less common multilocular subtype of LPC.
- **Epidemiology:** rare, <1% odontogenic cysts
- **Age:** wide range, peak incidence 5th – 7th decades
- **Gender:** slight male predilection

6. LPC AND BOC

- **Aetiology:**

- Unknown, thought to arise from odontogenic epithelial remnants, however source is controversial (either the dental lamina, reduced enamel epithelium, or epithelial rests of Malassez)

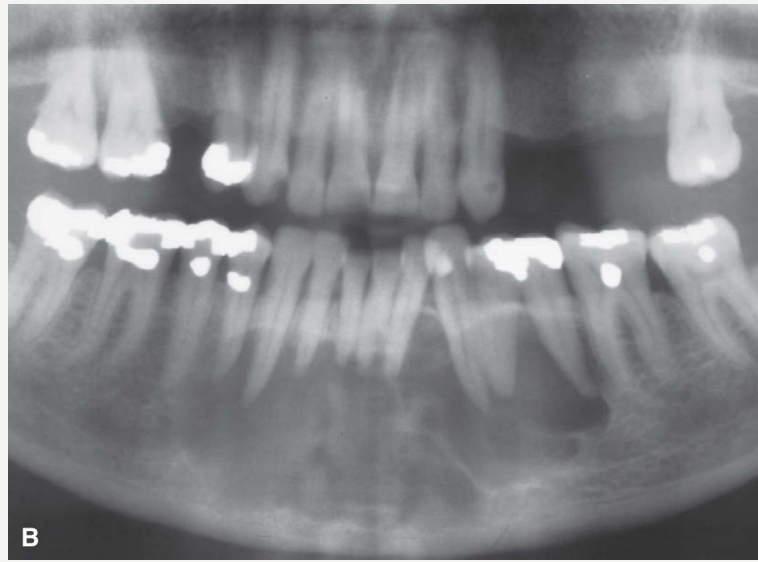
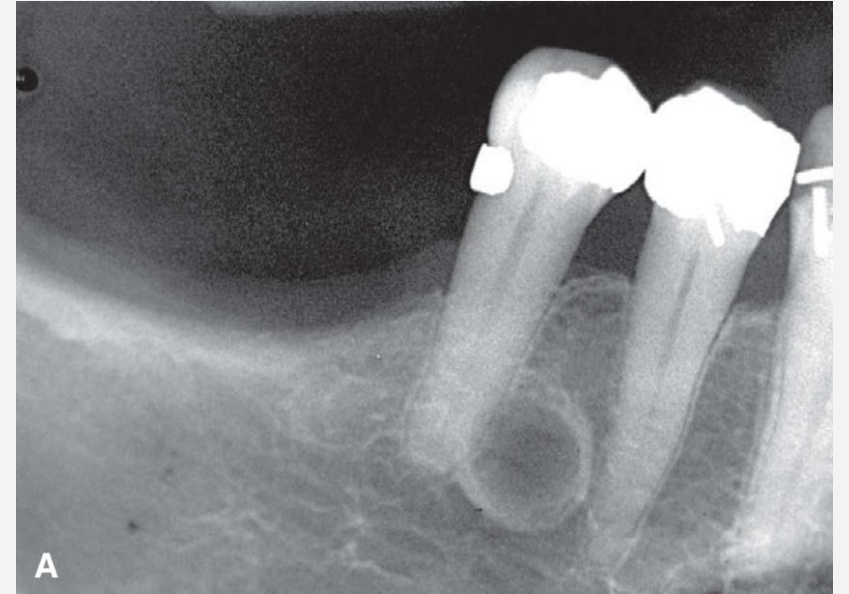
- **Clinical Features:**

- Asymptomatic in 90% of cases
- Can mimic lateral periodontal abscess if secondarily infected
- Expansion of buccal bone (50% of cases)
- Usually small, (<1 cm), but can attain considerable size

6. LPC AND BOC – IMAGING FEATURES

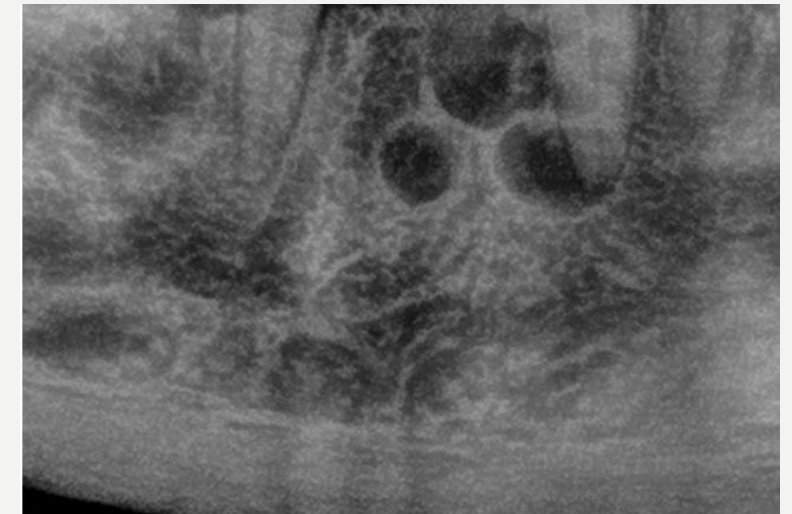
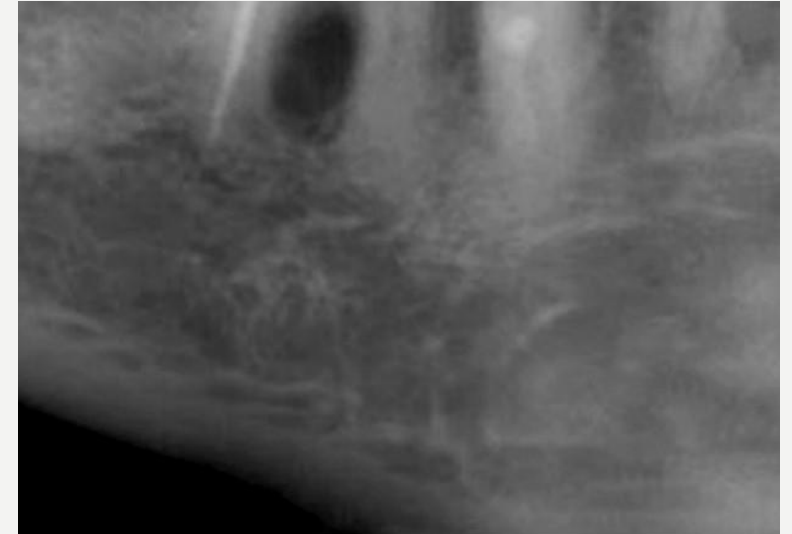
- **Location:**
 - Mandible > Maxilla
 - Anterior to molars (particularly premolar region)
 - Multifocal occurrence has been reported
 - Centred upon lateral surface of root
- **Periphery/Shape:**
 - Well-defined with prominent cortical boundary
 - Round/oval shape
 - LPC: unilocular
 - BOC: multilocular

White and Pharoah, 2014



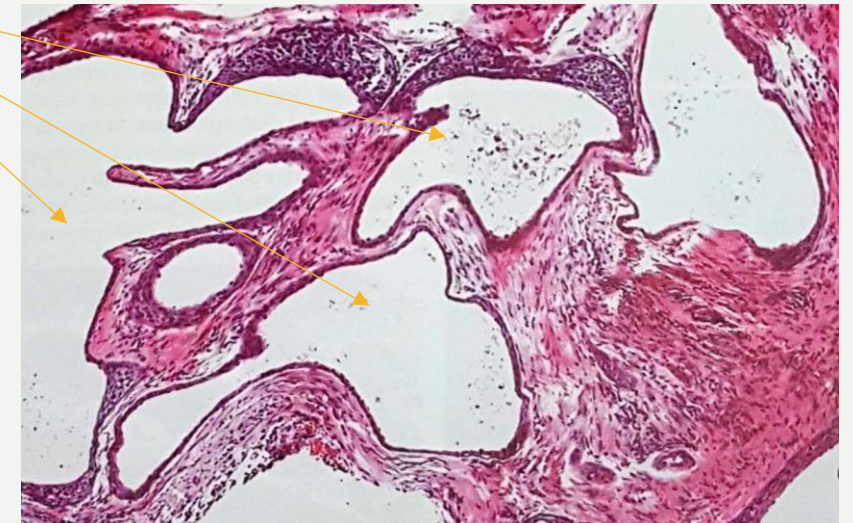
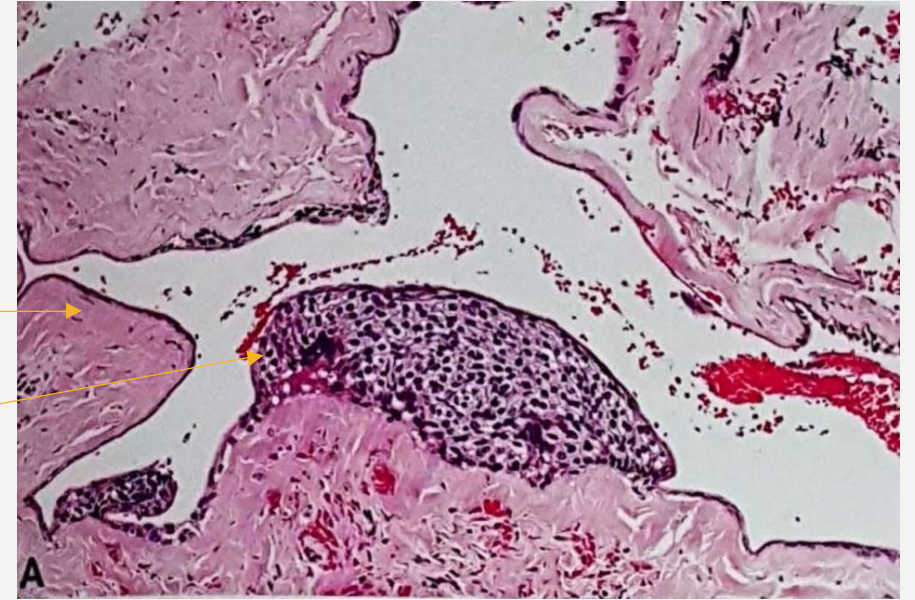
6. LPC AND BOC – IMAGING FEATURES

- **Internal Structure:**
 - Radiolucent
 - BOC may have multilocular appearance (related more to histologic appearance)
- **Surrounding Structures:**
 - Small cysts may efface the lamina dura of adjacent roots (but tooth roots are rarely resorbed)
 - Large cysts may displace adjacent teeth and cause expansion
 - May have similar growth pattern to OKCs with minimum expansion of the involved bone



6. LPC AND BOC

- **Histopathology:**
 - **Epithelium:** thin, non-keratinised squamous or cuboidal epithelium 1-3 cells thick with focal, whorled, plaque-like epithelial thickenings
 - **Cyst wall:** uninfamed fibrous wall
 - **BOC:** same appearance, but multicystic spaces



6. LPC AND BOC

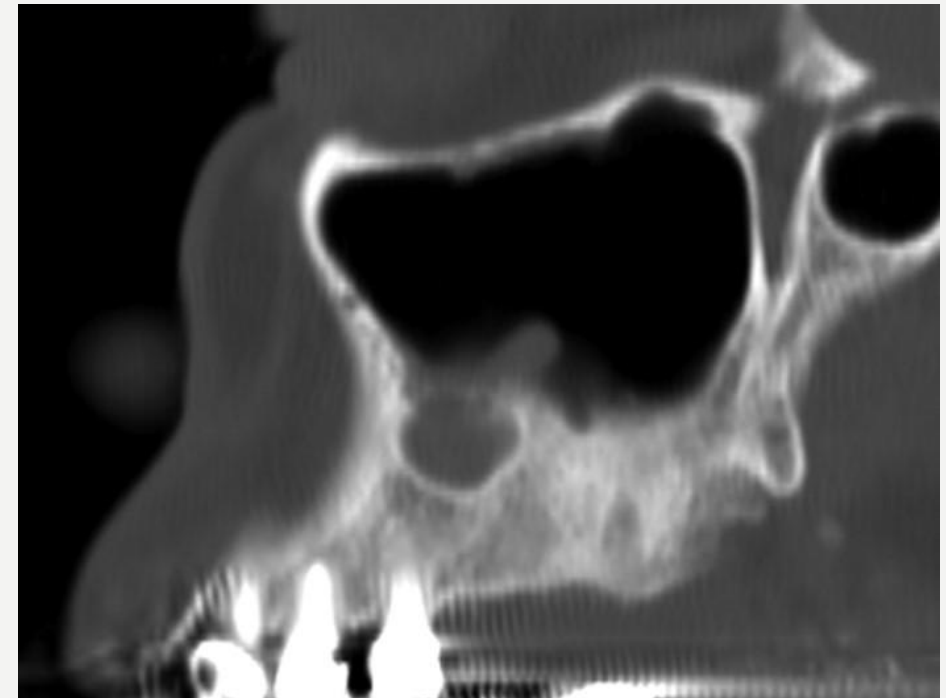
- **Treatment:**
 - Enucleation, without removal of adjacent tooth/teeth
- **Recurrence:**
 - Rare for simple unilocular cysts
 - Approx 22% for BOCs
 - Likely due to multicystic nature of the lesion

Essential diagnostic criteria:

1. Located in on lateral aspect or between the roots of vital erupted teeth
2. Characteristic whorled epithelial plaques
3. Multilocular (BOC only)

7. SURGICAL CILIATED CYST

- **Definition:** a benign cyst caused by the traumatic implantation, usually surgical, of respiratory epithelium in the gnathic bones.
- **Related terminology:**
 - Acceptable: surgical ciliated cyst of the maxilla; postoperative maxillary cyst (if maxillary location); (Respiratory) implantation cyst
- **Epidemiology:** rare
- **Age:** 5th to 6th decade
- **Gender:** no gender predilection



7. SURGICAL CILIATED CYST

- **Aetiology:**

- Cysts develop from entrapped sinus or nasal mucosa in the jaw bones following trauma or surgery (e.g. Calwell-Luc or Le Fort I procedures, sinus surgery, maxillary fracture, midface osteotomy, or traumatic tooth extraction)
- Mandibular cases are generally caused by implantation of sinus epithelium by contaminated instruments, or, transfer of epithelium with autologous nasal osteocartilagenous grafts for chin augmentation
- The cyst usually develops after a long latent period, the reported delay being up to 20 years after the causative surgery. It is thought that the cyst cavity forms due to persistent mucous secretion.

- **Clinical Features:**

- May be asymptomatic or present with swelling, pain, or tenderness

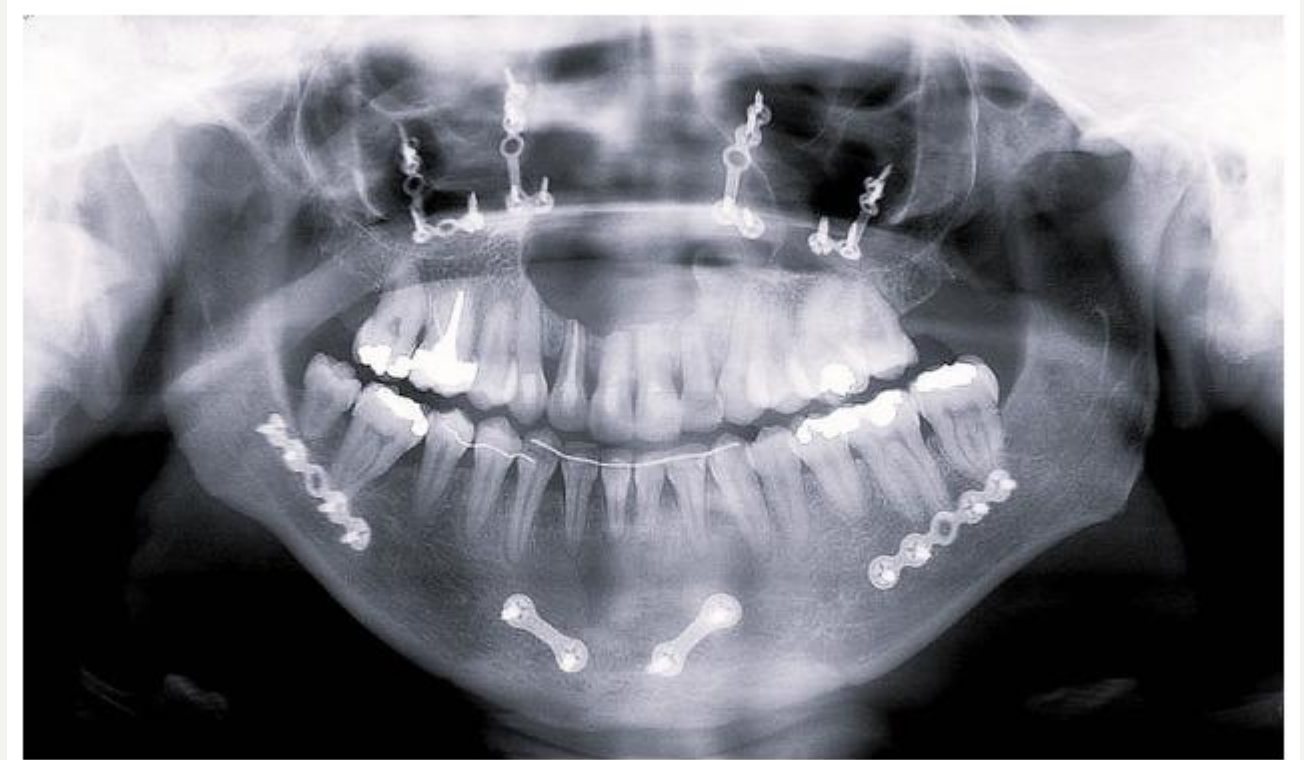
7. SURGICAL CILIATED CYST

- **Location:**

- The gnathic bones, most common in posterior maxilla
- Very rare in the mandible

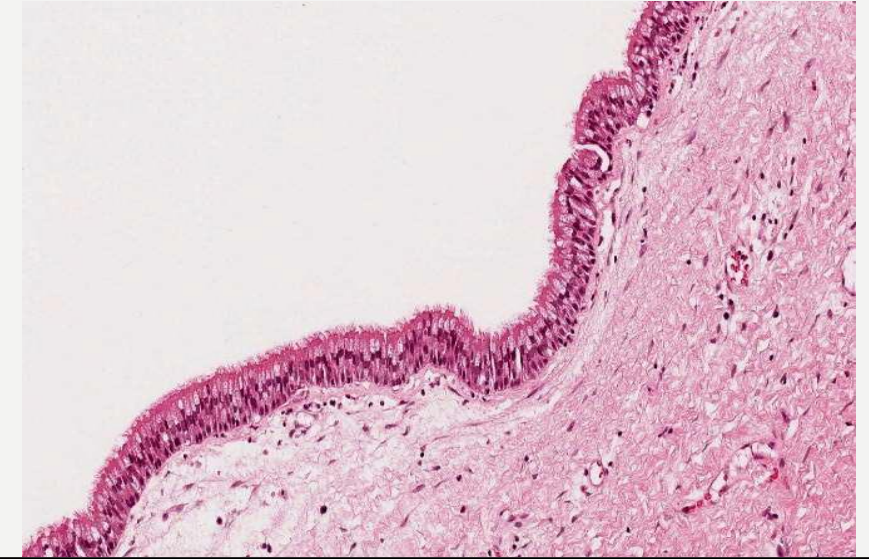
- **Radiographic features:**

- Radiographs show a well-demarcated unilocular radiolucency of the jaws.
- Approximately 60% of cases are at least partially surrounded by a corticated margin.
- Occasional large lesions in the maxilla may fill the sinus or be multilocular



7. SURGICAL CILIATED CYST

- **Histopathology:**
 - **Epithelium:** Pseudostratified ciliated columnar respiratory epithelium
 - +/- squamous metaplasia or simple cuboidal cells
 - +/- mucous (goblet) cells
 - **Cyst wall:** loose fibrous connective tissue, which may be inflamed
 - +/- subepithelial fibrosis or hyalinisation
- **Treatment:**
 - Simple enucleation
- **Recurrence:**
 - Rare



Cyst lined by bilaminar cuboidal epithelium with focal cilia. (WHO, 2022)

Essential diagnostic criteria:

1. A history of previous surgery
2. Radiolucent well demarcated cyst
3. Respiratory epithelial lining

8. ORTHOKERATINISED ODONTOGENIC CYST

- **Definition:** a developmental cyst lined by orthokeratinised stratified squamous epithelium
- **Related terminology:**
 - Not recommended: Orthokeratinized variant of odontogenic keratocyst
- **Epidemiology:** rare (<1% of odontogenic cysts)
- **Age:** wide range, average age 35 years; peak incidence in 3rd – 4th decades
- **Gender:** 65% occur in males

8. OOC

- **Aetiology:**

- Unknown, but most likely arises from the remnants of dental lamina

- **Clinical Features:**

- Painless swelling, but many are incidental findings during radiographic examination
- Rare cases of multiple or bilateral OOC have been reported, but no evidence of association with Gorlin Syndrome (naevoid basal cell carcinoma)

8.00C

- **Location:**

- Mandible (80%)
 - 65% in angle/ramus region

- **Radiographic features:**

- Well-demarcated, spherical unilocular radiolucent lesions, often with a corticated margin
- Occasional cases (<10%) are multilocular
- Up to 70% of all lesions are associated with an impacted tooth, with a radiological similarity to dentigerous cysts



WHO, 2022

8.00C

- **Histopathology:**

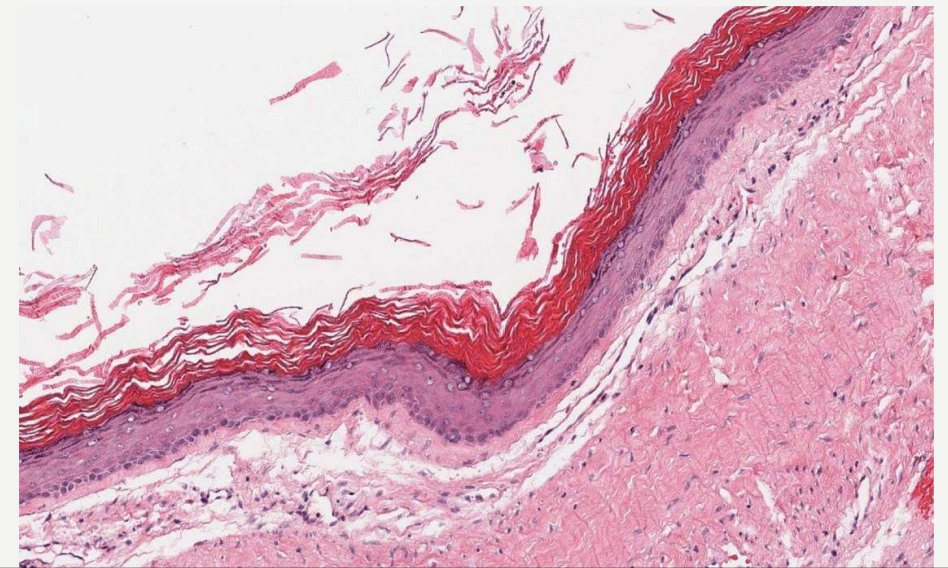
- **Epithelium:** thin regular orthokeratinized stratified squamous epithelium with a prominent granular cell layer and inconspicuous or low cuboidal basal cells. It is heavily keratinized, often with lamellae of keratin filling the lumen
- **Cyst wall:** fibrous and may show areas of inflammation
 - +/- parakeratinized or non-keratinized areas, but these form a small part of the lining and are often associated with inflammation
 - Rare examples include sebaceous glands in the lining
 - Microcysts may be seen in the wall in 5% of cases

- **Treatment:**

- Enucleation

- **Recurrence:**

- Rare (less than 5%)



A thin regular lining of orthokeratinized stratified squamous epithelium. The keratin is lamellated and extends into the lumen (WHO, 2022)

Essential diagnostic criteria:

1. Located in tooth bearing areas of jaw
2. Thin, regular epithelial lining with orthokeratinization

9. CALCIFYING ODONTOGENIC CYST

- **Definition:** A developmental odontogenic cyst characterized histologically by ghost cells, which often calcify.
- **Related terminology:** calcifying cystic odontogenic tumour, Gorlin cyst
- **Epidemiology:** rare, <1% odontogenic cysts
- **Age:** peak incidence 2nd – 3rd decade
- **Gender:** no gender predilection

9. COC

- **Aetiology:**

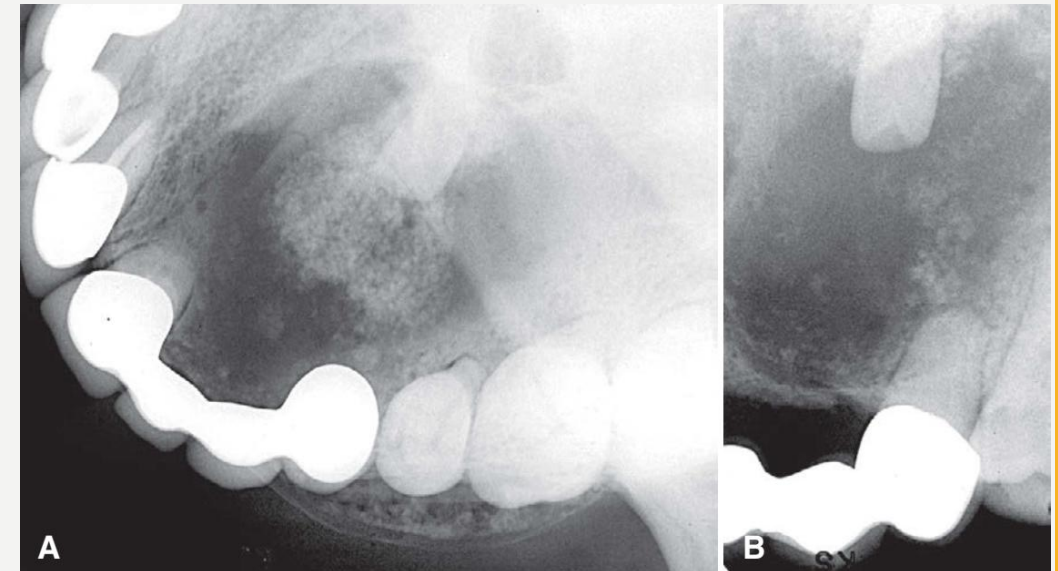
- Unknown
- Has mutations in CTNNB1 gene which implicate the Wnt pathway. This pathway is also involved in odontomas, with which COC is often associated.

- **Clinical Features:**

- Asymptomatic in most cases
- Painless swelling of jaws
- Extraosseous lesions present as gingival swellings, sometimes with pain and tenderness

9. COC – IMAGING FEATURES

- **Location:**
 - Maxilla = Mandible
 - Anterior > Posterior (esp. with cuspids and incisors)
 - Association with odontomas (more common in maxilla)
 - Central > Peripheral
 - Up to 10% are extraosseous (anterior regions of jaw)
- **Periphery/Shape:**
 - Variable
 - Well-defined, corticated with curved, cyst-like shape
 - Ill-defined and irregular



9. COC – IMAGING FEATURES

- **Internal Structure:**

- Variable
 - Completely radiolucent
 - Evidence of small foci of calcified material – white flecks or small smooth pebbles
 - Larger, solid, amorphous masses
 - Rarely appear multilocular

- **Surrounding Structures:**

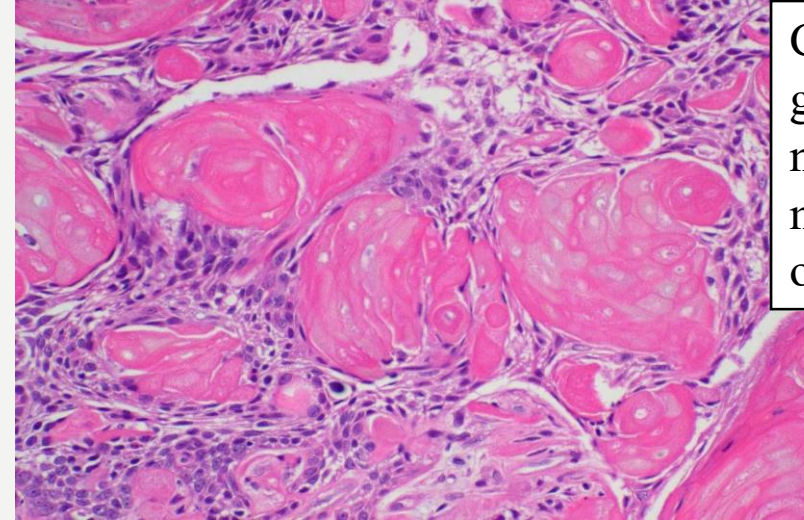
- Impedes eruption of associated tooth
- Tooth displacement and root resorption
- Expansion and perforation of cortical plates



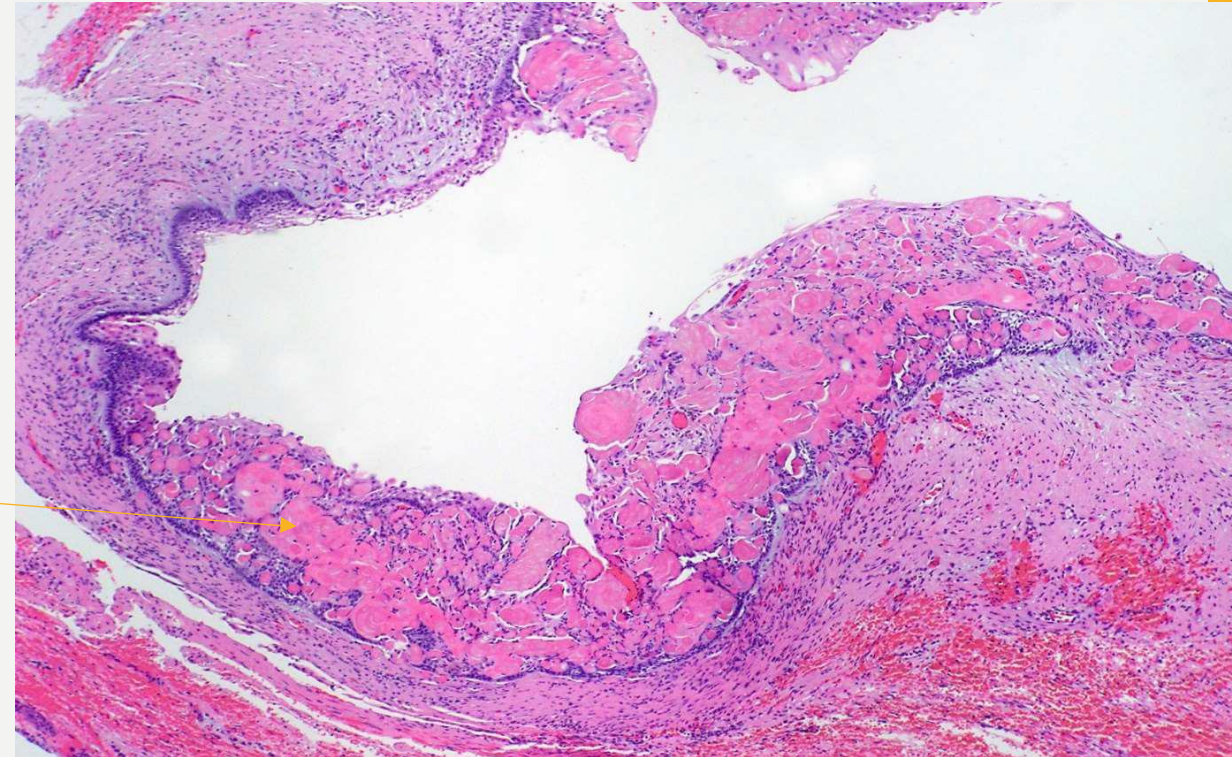
9. COC

- **Histopathology:**

- Unilocular cyst
- **Epithelium:** stratified epithelial lining of varying thickness resembling stellate reticulum and with palisaded and hyperchromatic columnar ameloblast-like basal cells.
 - + Ghosts cells are characteristic
 - Rounded or stacked flattened pale eosinophilic cells within the epithelium with distinct outlines and karyolysis resulting in a 'ghost like appearance'
 - Variable in number and often pass into the connective tissue of the cyst wall, eliciting a foreign body reaction and inducing dentinoid.
 - Although characteristic, ghost cells also occur in other odontogenic tumours and do not alone justify a diagnosis of COC
 - +/- intraluminal and/or mural epithelial proliferation producing ameloblastoma-like areas



Cytologic detail of ghost cells devoid of nuclei but with maintenance of cell outlines. (WHO, 2022)



Cystic architecture with prominent basal cells and numerous homogeneous eosinophilic ghost cells. (WHO, 2022)

9. COC

- **Treatment:**

- Conservative surgical removal, enucleation and/or curettage

- **Recurrence:**

- Post-tx follow up required
- 8% recurrence rate

Essential diagnostic criteria:

1. Cystic architecture
2. Numerous ghost cells

10. GLANDULAR ODONTOGENIC CYST

- **Definition:** a developmental cyst in which the epithelial lining resembles glandular tissue.
- **Related terminology:**
 - Not recommended: sialo-odontogenic cyst; mucoepidermoid odontogenic cyst
- **Epidemiology:** rare, <0.5% odontogenic cysts
- **Age:** average age = 50 years, peak incidence 5th – 7th decades
- **Gender:** no gender predilection

10. GOC

- **Aetiology:**

- Unknown
- Thought to arise from remnants of dental lamina

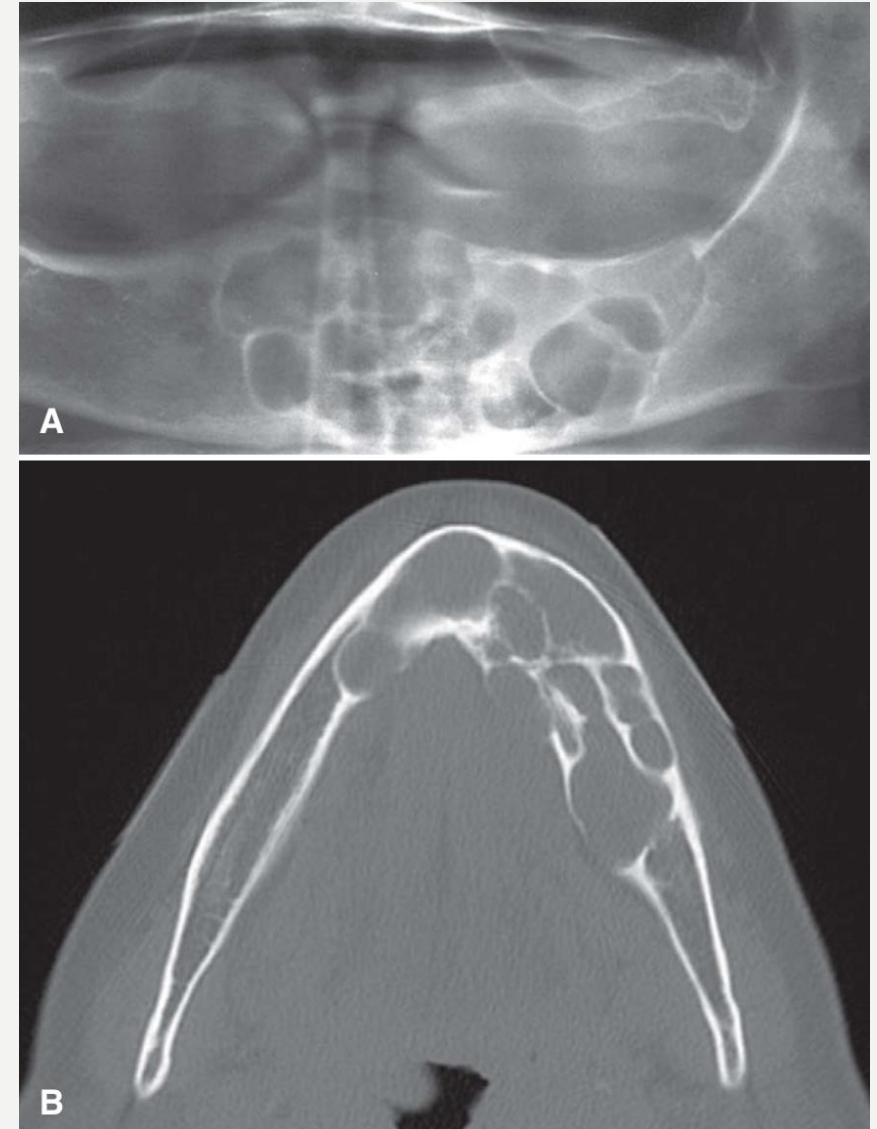
- **Clinical Features:**

- Slowly expanding, painless swelling
- Association with impacted tooth is extremely rare
- Mandibular lesions may reach a large size and cross the midline

10. GOC – IMAGING FEATURES

White and Pharoah, 2014

- **Location:**
 - Exclusively in the jaws
 - Mandible > Maxilla
 - Anterior > Posterior
- **Periphery/Shape:**
 - Well-defined cortical boundary
 - Smooth or scalloped
- **Internal Structure:**
 - Unilocular or multilocular
- **Surrounding Structures:**
 - Expansion of outer cortical plate of jaws
 - Regions of perforation
 - Displacement +/- resorption (25%) of teeth



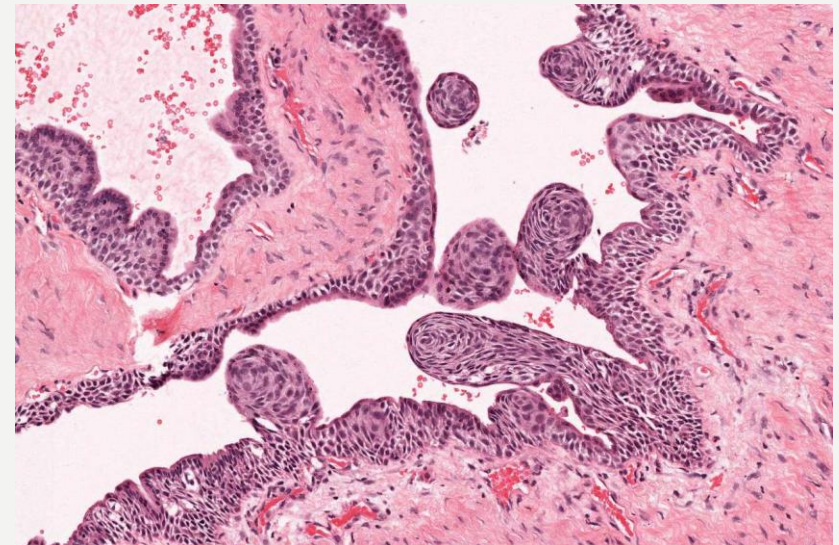
10. GOC

- **Histopathology:**

- Often multilocular cysts
- Epithelium: of variable thickness, ranging from a thin layer of flattened squamous or cuboidal cells to stratified squamous epithelium
 - + Hobnail cells in all cases (Cuboidal or low columnar cells on the luminal surface)
 - +/- whorled epithelial thickenings, or plaques similar to those in lateral periodontal cyst.
 - +/- intraepithelial microcysts, apocrine metaplasia, clear cells, papillary projections (tufting), cilia and mucous cells
 - (Not all features are present in every case and a higher number of features allows more confident diagnosis)



The epithelial lining shows microcysts and duct-like structures. There is a superficial layer of columnar cells, in places with cilia. (WHO, 2022)



The lining shows whorled epithelial thickenings and papillary projections. Superficial columnar cells can also be seen. (WHO, 2022)

10. GOC

- **Treatment:**

- Enucleation
- Resection has been advocated due to high recurrence
 - particularly for large or multilocular lesions

- **Recurrence:**

- Recur in 22% of cases after enucleation (esp. large and multilocular lesions)
- Post-tx radiological review
- May occur up to 8 years later

Essential diagnostic criteria:

1. Radiolucent cystic lesion of tooth-bearing area of the jaw
2. Often multilocular
3. Lining of variable thickness with epithelial thickenings, plaques or papillary projections + Hobnail cells +/- microcysts or duct-like structures +/- mucous or clear cells.

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