

Odontogenic cysts



Definition

- *A cyst is a pathological cavity having fluid, semifluid or gaseous contents & which is not created by the accumulation of pus. It is frequently, but not always, lined by epithelium. (Kramer 1974)*

Classification



CYSTS OF THE JAWS

A. EPITHELIAL

1. Developmental

a) Odontogenic

- i) Odontogenic Keratocyst (Primordial cyst)
- ii) Gingival cyst of infants
- iii) Gingival cyst of adults
- iv) Eruption cyst
- v) Dentigerous (follicular)
- vi) Lateral periodontal cyst
- vi) Botryoid odontogenic Cyst
- vii) Glandular Odontogenic Cyst
- viii) Calcifying Odontogenic Cyst

b) Non-odontogenic

- i) Nasopalatine duct (incisive canal) cyst
- ii) Nasolabial (nasopalveolar) cyst
- iii) Midpalatal raphe cyst of infants
- v) Median palatine, median maxillary and median mandibular cysts
- v) Globulomaxillary cysts

2. Inflammatory

- i. Radicular cyst
- ii. Residual cyst
- iii. Paradental cyst and mandibular infected buccal cyst
- iv. Inflammatory collateral cyst

Non-Epithelial

1. Solitary bone cyst (traumatic, simple, hemorrhagic bone cyst)
2. Anurysmal bone cyst

Odontogenic Keratocyst



- First described by *Mikulicz, 1876* → “Dermoid cyst”

- *Hauer, 1926* → “Cholesteatoma”
- *Robinson, 1945* → “Primordial cyst”
 - The terminology has been discarded
- *Philipsen, 1956* → “Odontogenic Keratocyst”
- Because of its potential aggressive behavior some researchers have suggested that OKC is a benign cystic neoplasm and recently the name “Keratocystic Odontogenic Tumor” has been suggested

Pathogenesis

Robinson, 1945 → derived from enamel organ by degeneration of stellate reticulum before any calcified structure has been laid down → *Primordial cyst*

- Evidence against this theory
 - Frequency of aplasia of teeth is relatively higher than that of keratocysts
 - Site distribution of these cysts and supernumerary teeth is different

□ Remnants of dental lamina

□ Origin from overlying oral epithelium as basal cell hamartias

Clinical features

- Frequency
 - 11.2% of all jaw cysts
- Age
 - Bimodal age distribution
 - 2nd and 3rd decade
 - Second peak in 5th and 6th decade
- Sex
 - Male preponderance

□ Site

- Mandible most frequent (75%)
- Almost half of keratocysts occur at the angle of mandible

Clinical presentation

- Remarkably free of symptoms until the cyst have reached a large size
- Pain, swelling or discharge
- Pathologic fracture
- Maxillary cysts → more likely to become infected → diagnosed earlier
- Displacement of teeth

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- Other
 - Displacement and destruction of the floor of orbit
 - Proptosis of eyeballs
 - Neurological symptoms
 - “Peripheral OKC” → cysts occurring outside the bone
 - Multiple cysts with or without naevoid basal cell carcinoma syndrome

The naevoid basal cell carcinoma syndrome

Gorlin and Goltz (1960) established the association of

- Multiple basal cell epitheliomas
- Jaw cysts
- Bifid ribs

Gorlin-Goltz Syndrome

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- Inherited as autosomal dominant characteristics with strong penetrance

 - Other features include
 - Frontal bossing
 - Ocular hypertelorism
 - CNS and eye lesions

 - Keratocysts → 65-75% cases



Recurrences

- ❑ First pointed by [Pindborg and Hansen, 1963](#)
- ❑ Various studies have shown recurrence rates ranging from 3% to 62%
- ❑ Mostly within first 5 years of surgery
- ❑ Higher recurrence rate when cysts are located in the angle or ascending ramus
- ❑ Recurrences more frequent in patients with Gorlin-Goltz syndrome

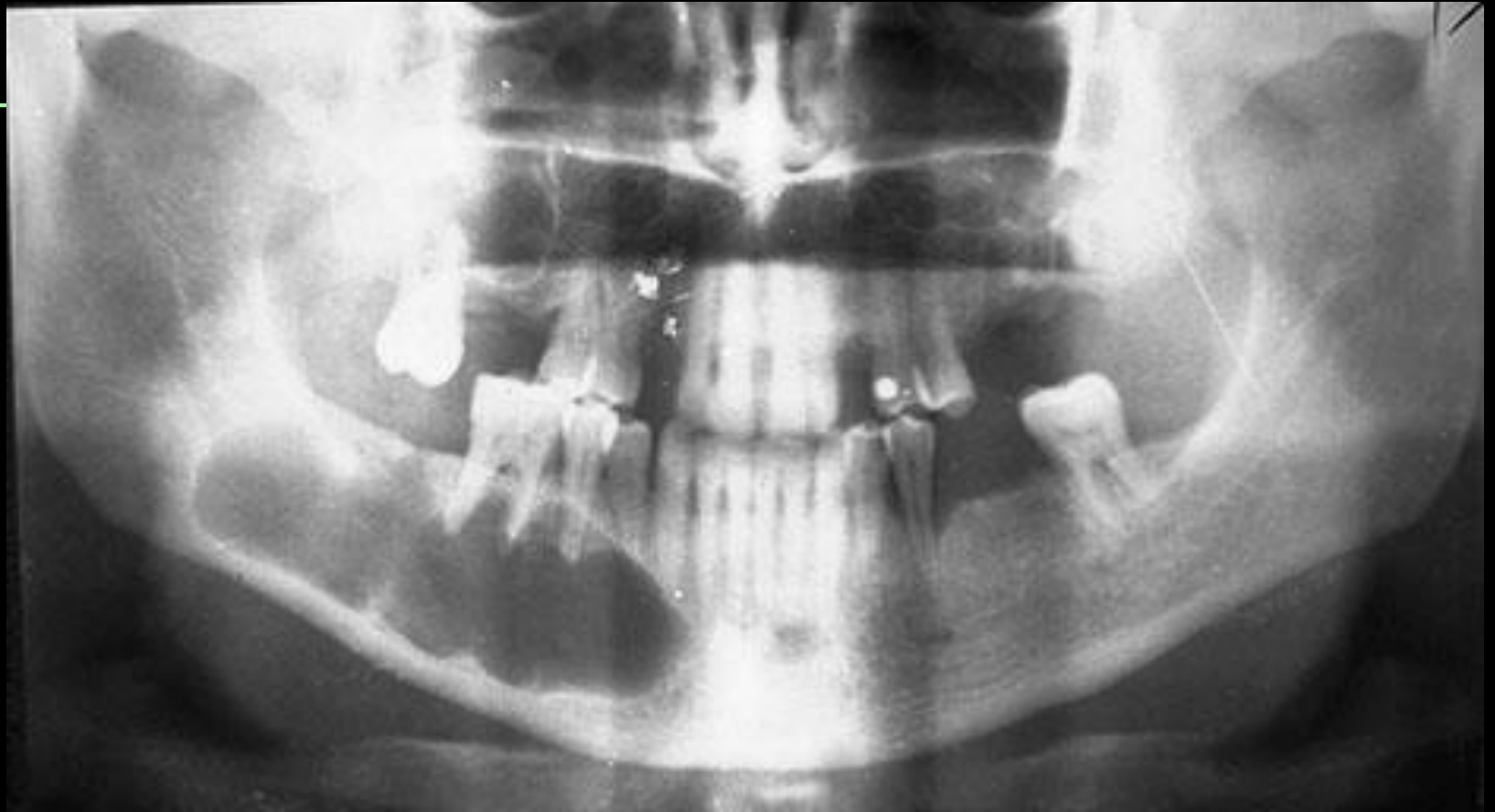
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- ❑ Cyst enucleated in one piece → less recurrence
 - ❑ Infection, fistula formation, bony perforations → more recurrence
 - ❑ Multilocular → higher recurrence

■ Suggested reason for recurrences

- Occurrence of satellite cysts → left behind during enucleation
- Thin and fragile lining → difficult to enucleate in toto
- Epithelial lining of keratocysts have intrinsic growth potential → *benign neoplasm*
- Recurrence from residual basal cell proliferations

Radiological features

- ❑ Small, round or ovoid, radiolucent areas
- ❑ Sometimes more extensive
- ❑ Well demarcated with distinct sclerotic borders
- ❑ Unilocular or multilocular
- ❑ May have scalloped margins
- ❑ Expansion is seen late and may be buccal or lingual



□ Can mimic

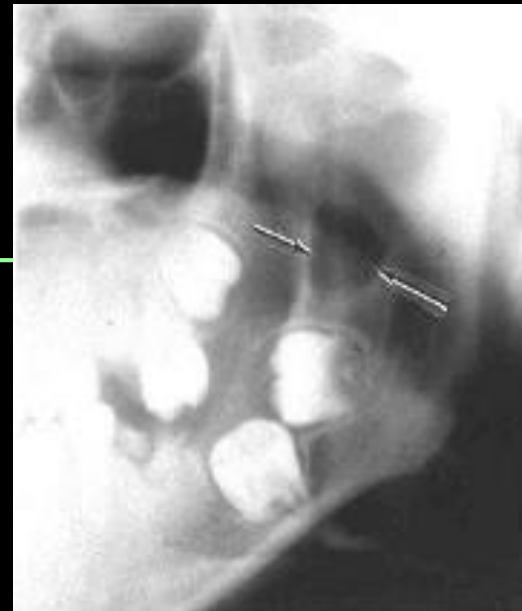
- Radicular cyst
- Dentigerous cyst → follicular primordial cyst
- Lateral periodontal cyst
- Nasopalatine duct cyst

□ Radiographically classified into 4 types (*Main, 1970*)

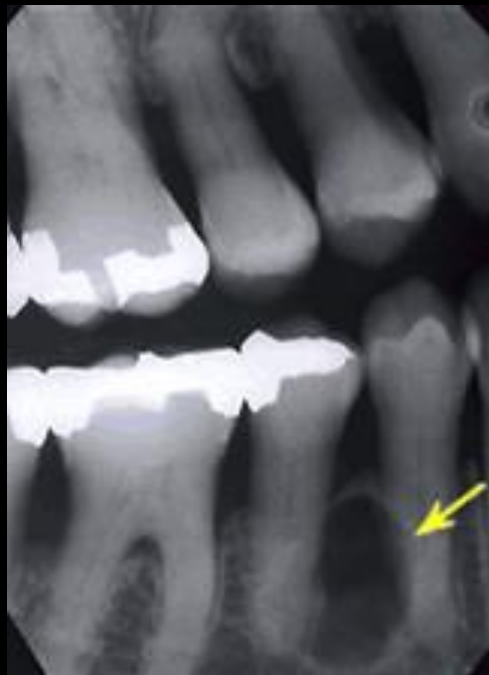
- Replacement
- Envelopmental
- Extraneous
- Collateral



Envelopmental



Replacement



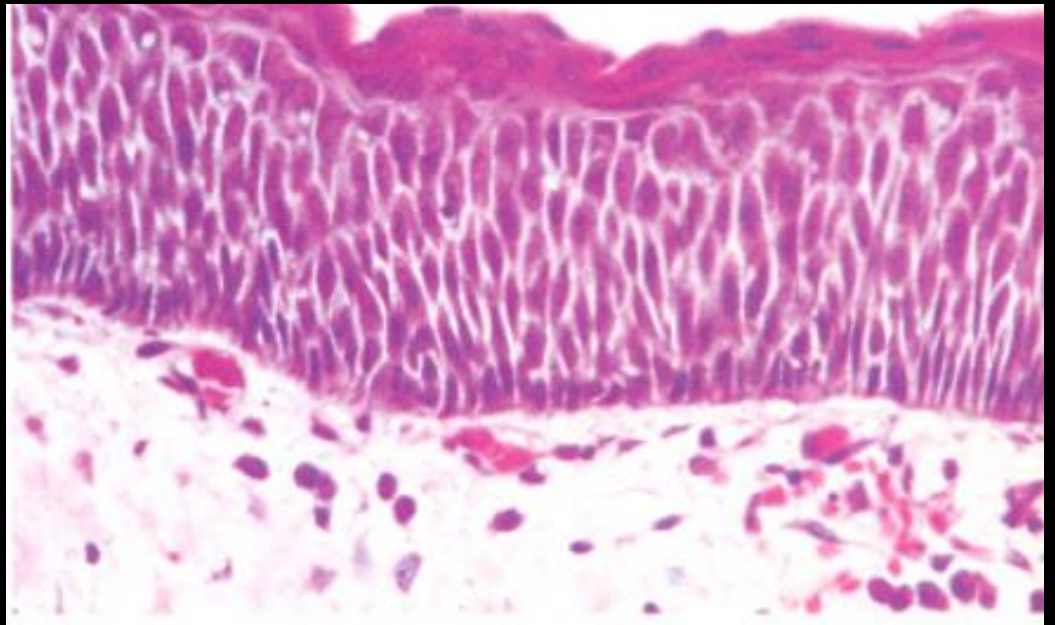
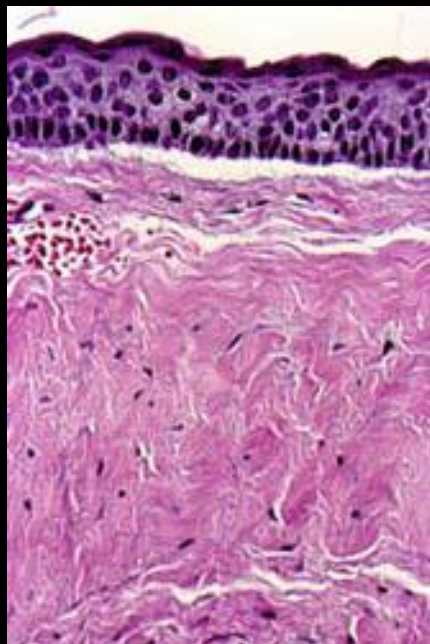
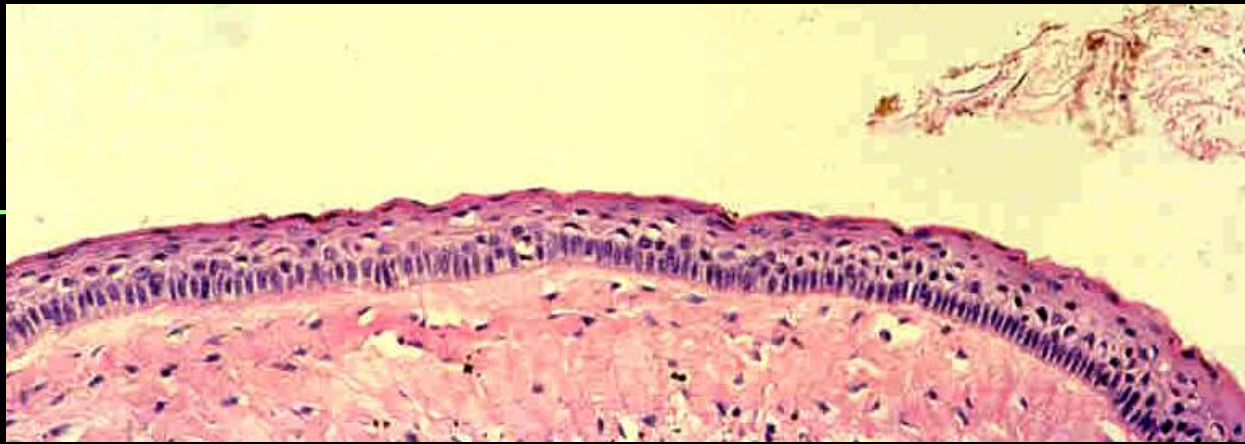
Collateral

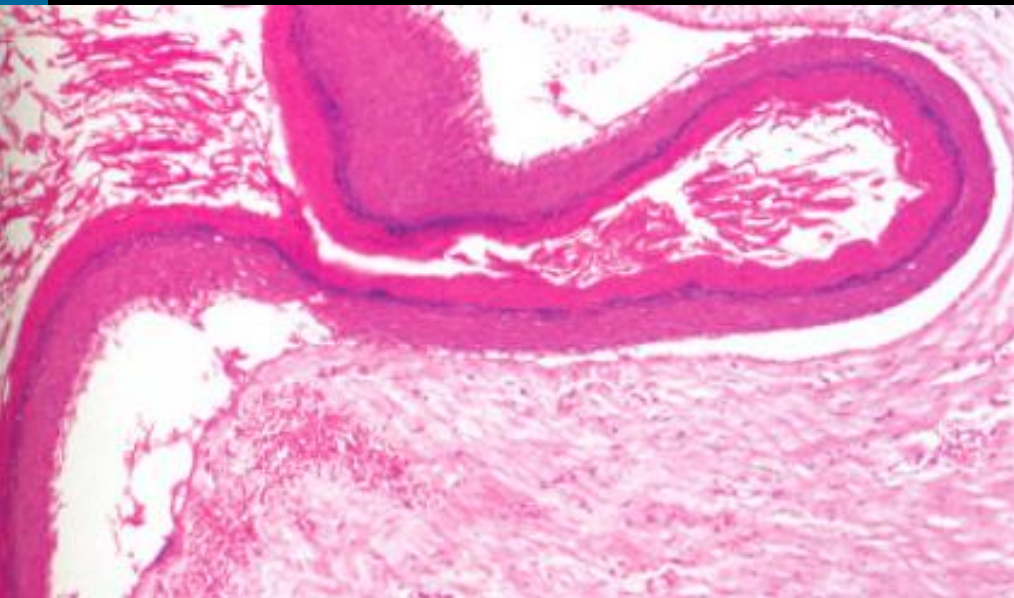


Extraneous

Histopathology

- ❑ Regular keratinized stratified squamous epithelium
- ❑ 5-8 cell layer without rete ridges
- ❑ Corrugated surface
- ❑ Well defined, palisaded basal layer
 - Columnar
 - Nuclei → away from basement membrane and intensely basophilic
- ❑ Suprabasal cells → polyhedral and often show intercellular edema





Desquamated keratin in cyst cavity

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- Mitotic activity → more in suprabasal layer
 - Higher in patients with syndrome
 - Epithelial dysplasia
 - Fibrous capsule
 - usually thin with relatively few cells
 - stroma rich in mucopolysaccharide and resembles mesenchymal connective tissue

□ Inflammatory cells

- infrequent
- mild infiltration of lymphocytes and monocytes

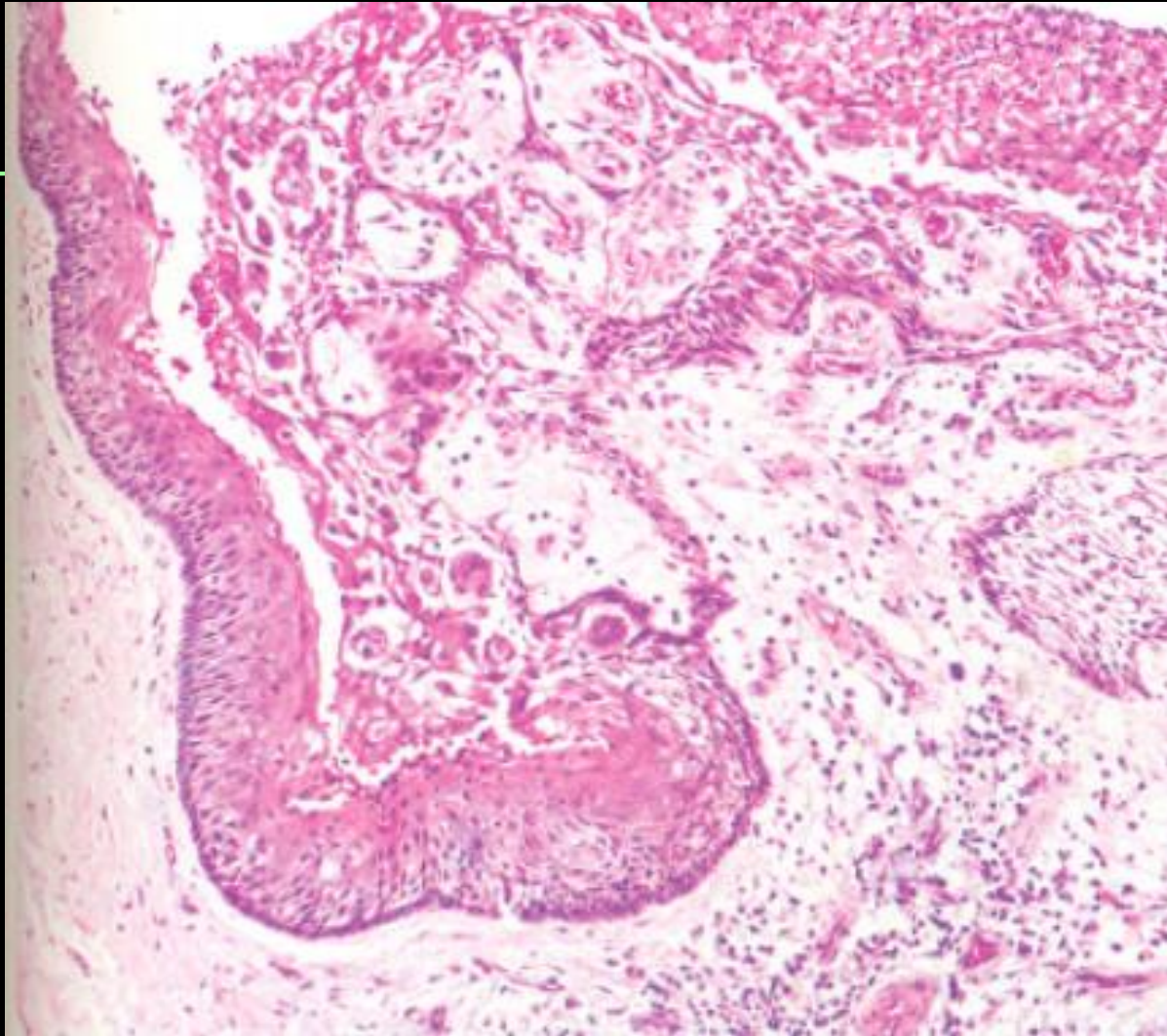
intense inflammation



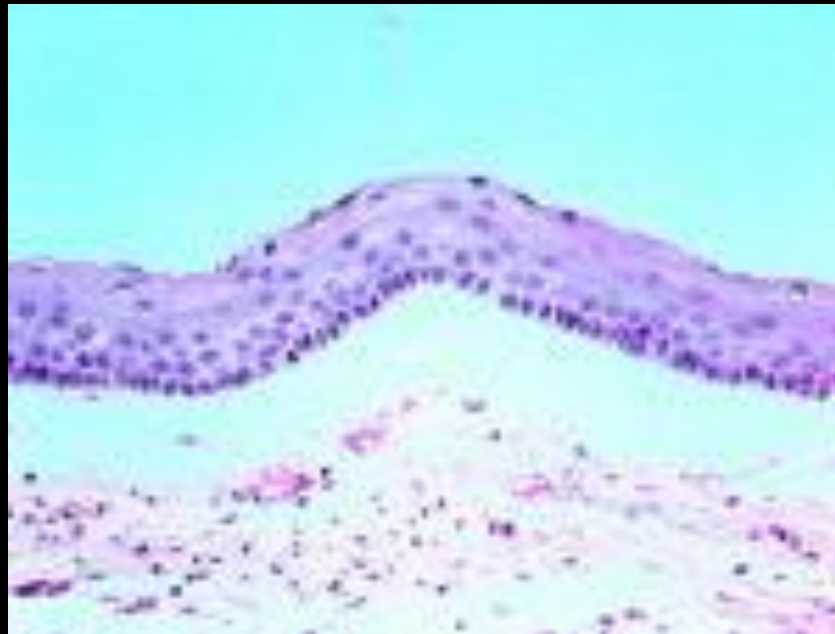
epithelium loses its keratinised surface



thicken & develop rete processes or may ulcerate



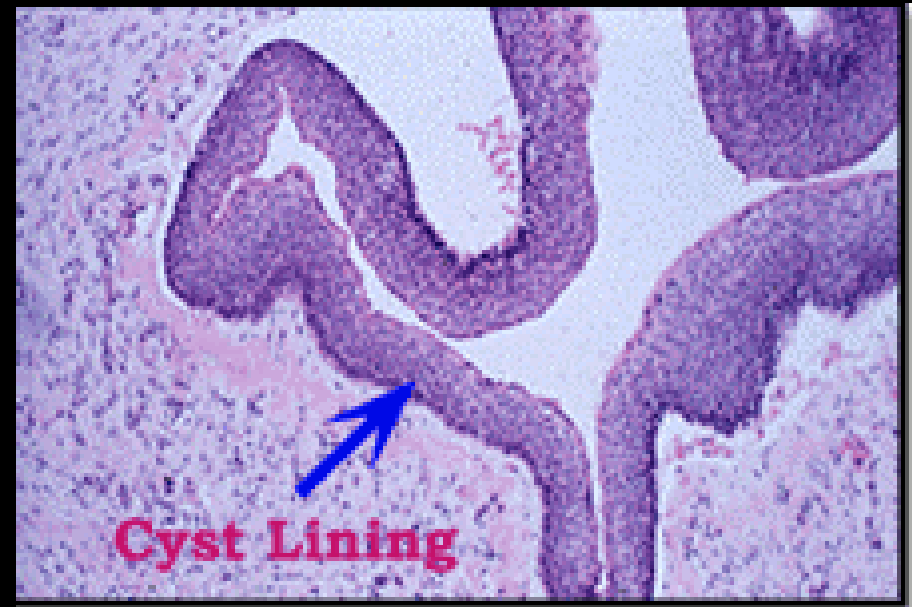
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- Attachment between epithelium and the connective tissue capsule tends to be weak and in many areas separation occurs



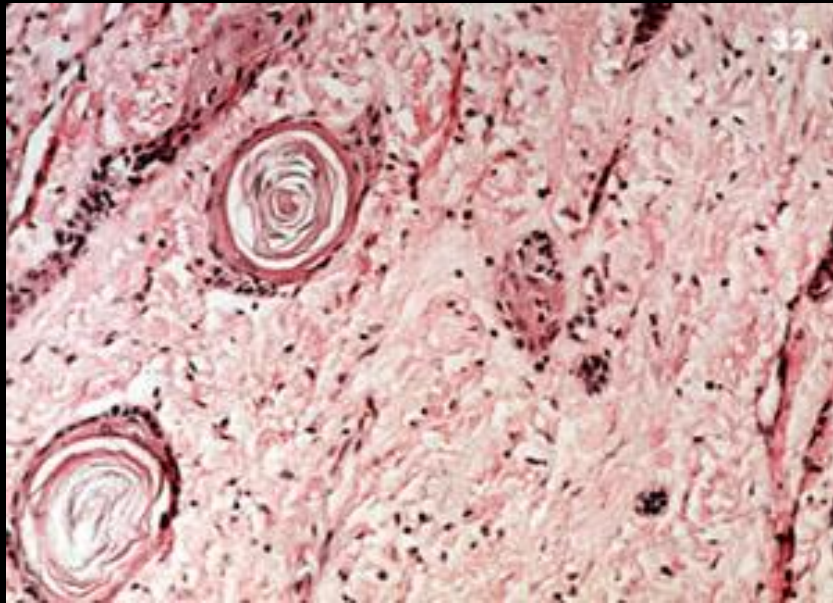
collapsed and folded thin-walled cysts



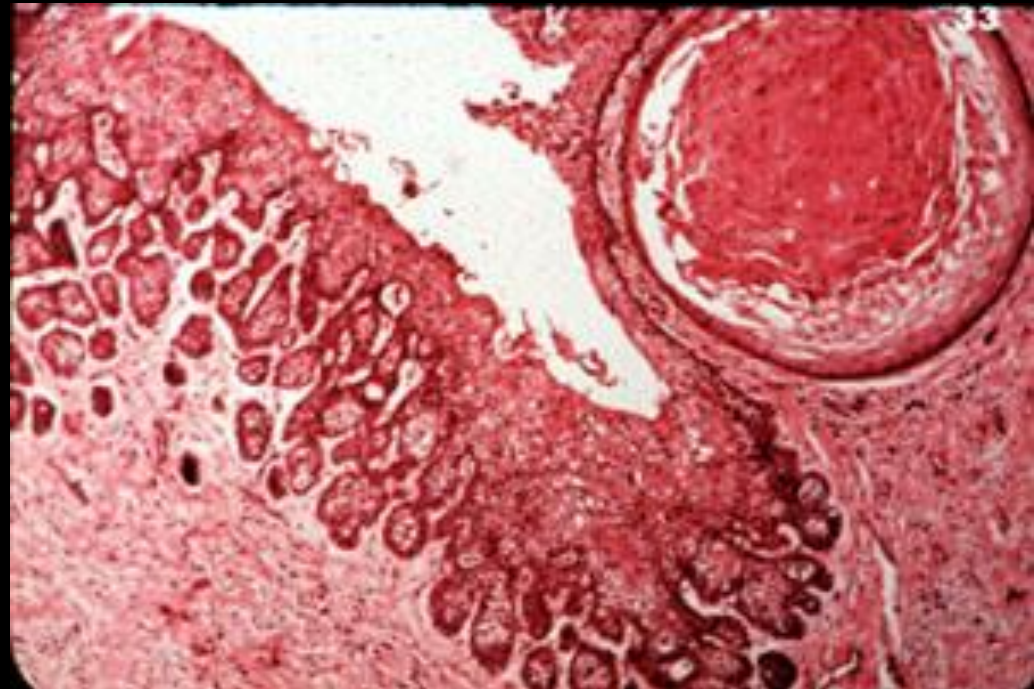
erroneous impression of multilocularities in histological section



- Satellite cysts or daughter cysts



- Epithelial rests and proliferating dental lamina



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- Orthokeratinized variant
 - Previously thought to be a type of OKC
 - Due to characteristic histological differences and a less aggressive clinical course it is now thought to be a separate entity → “Orthokeratinized Odontogenic Cyst(OOC)”

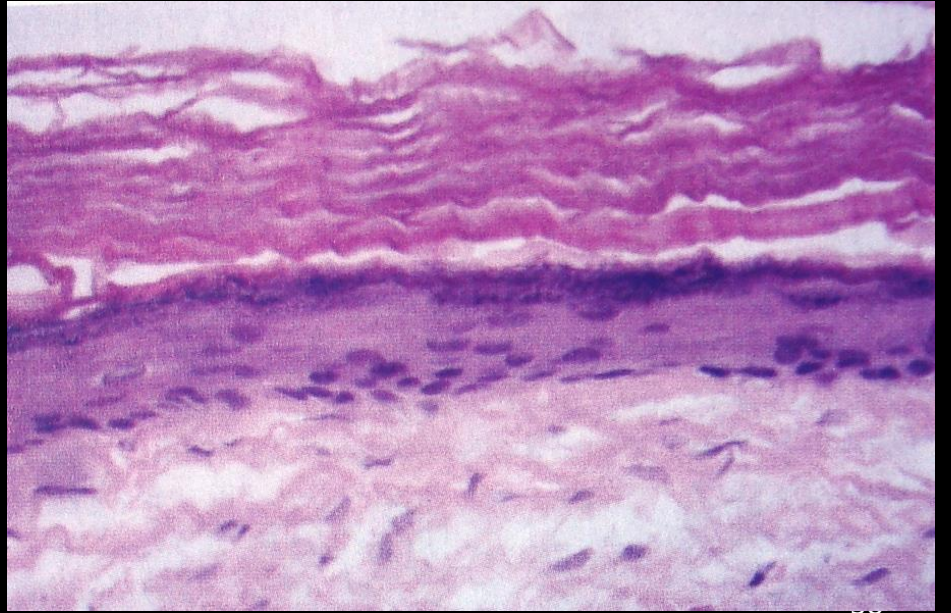
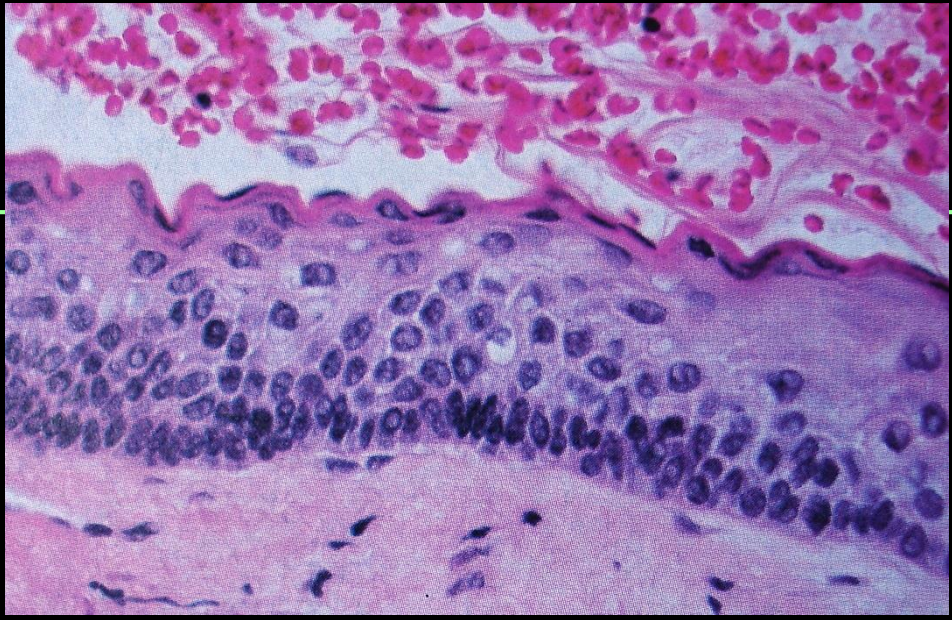
Histological differences between OKC and OOC

OKC

- ❑ Predominantly parakeratinized lining
- ❑ Basal cells cuboidal or columnar
- ❑ Palisading of basal layer
- ❑ Nuclei of basal cells show hyperchromatism
- ❑ Corrugated surface of the epithelial lining
- ❑ No hypergranulosis

OOC

- ❑ Predominantly orthokeratinized lining
- ❑ Basal cells flat or low cuboidal
- ❑ No palisading of basal cells
- ❑ Basal cells do not show hyperchromatism
- ❑ Surface epithelium is flat with no corrugations
- ❑ Accentuated granular layer



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- Fluids from keratinising cysts have soluble protein levels below 3.5gm / 100 ml
 - Values for non - keratinising cysts → 5.0-11.09gm per 100ml
 - Protein level of less than 4.0 gm / 100 ml indicate a diagnosis of keratocyst

Gingival cyst and midpalatal cyst of infants



Clinical features

- Frequently seen in new born infants
- Rare after 3 months of age
 - Undergo involution and disappear
 - Rupture through the surface epithelium and exfoliate
- Along the mid palatine raphe → *Epstein's pearls*
- Buccal or lingual aspect of dental ridges → *Bohn's nodules*

□ 2-3 mm in diameter

□ White or cream coloured

□ Single or multiple (usually 5 or 6)



Pathogenesis

Gingival cyst of infants

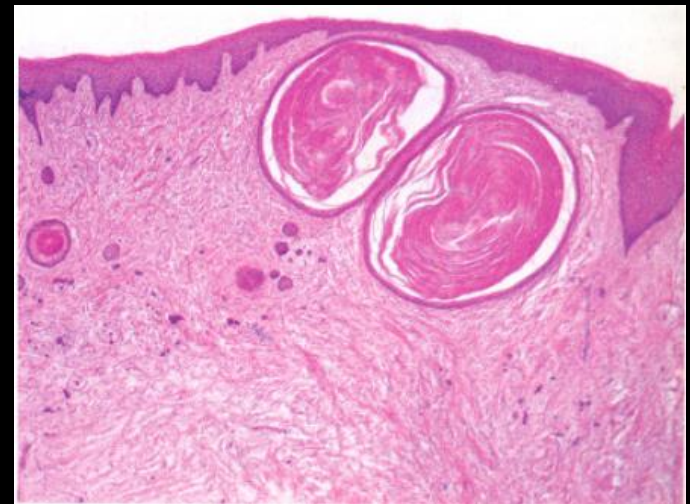
- Arise from epithelial remnants of dental lamina (*cell rests of Serre*)
- These rests have the capacity to proliferate, keratinize and form small cysts

Midpalatal raphe cyst

- Arise from epithelial inclusions along the line of fusion of palatal folds and the nasal process
 - Usually atrophy and get resorbed after birth
 - May persist to form keratin filled cysts

Histopathology

- Round or ovoid
- Smooth or undulating outline
- Thin lining of stratified squamous epithelium with parakeratotic surface
- Cyst cavity filled with keratin (concentric laminations with flat nuclei)
- Flat basal cells
- Epithelium lined clefts between cyst and oral epithelium
- Oral epithelium may be atrophic



Gingival cyst of adults



Clinical features

- Frequency
 - 0.5%
 - May be higher as all cases may not be submitted to histopathological examination

- Age
 - 5th and 6th decade

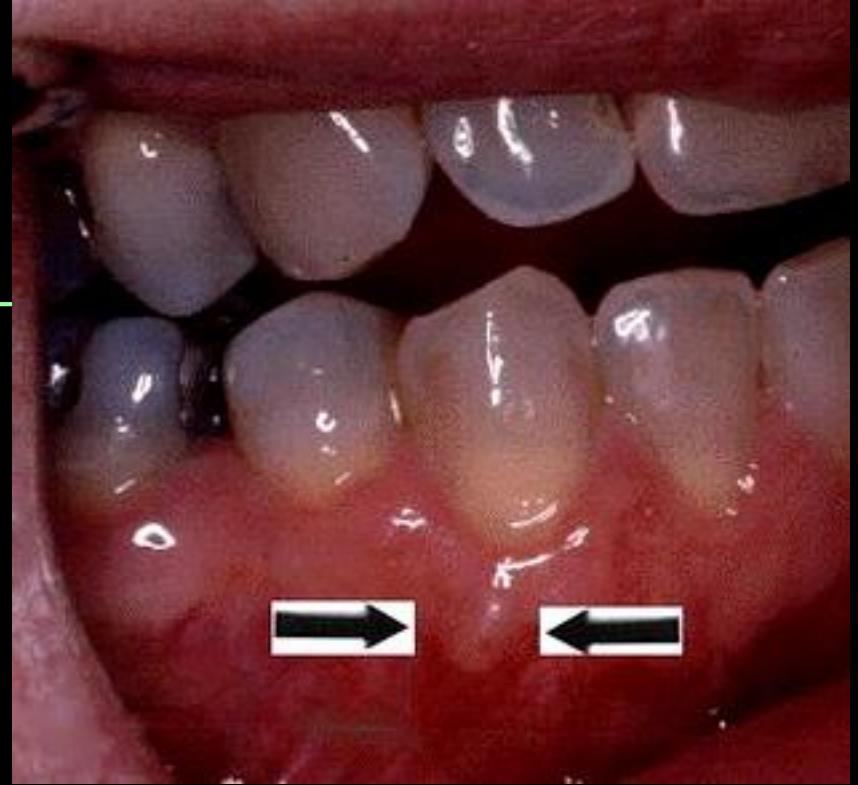
- Sex
 - No predilection

- Site
 - Much more frequent in mandible
 - Premolar-canine region

Clinical presentation

- Soft and fluctuant
- Well circumscribed, slowly enlarging, painless swelling
- Attached gingiva or interdental papilla
- Facial aspect
- Usually less than 1 cm
- Smooth surface
- Colour of overlying mucosa → normal or bluish
- Adjacent teeth usually vital
- Slight erosion of surface of the bone





Radiological features

- No change
- Faint round shadow



Pathogenesis

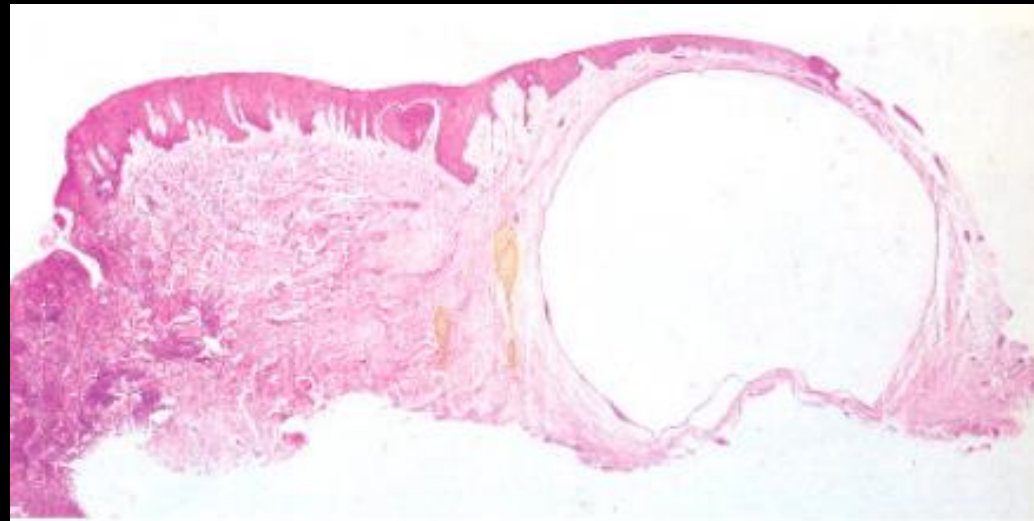
- *Odontogenic epithelial cell rests*
- Traumatic implantation of surface epithelium
- Cystic degeneration of deep projections of surface epithelium
- From glandular elements
- Junctional epithelium
- *May be derived from reduced enamel epithelium*

Histopathology

- Extremely thin epithelium resembling REE
 - 1-3 layers of flat to cuboidal cells
 - Darkly staining nuclei

Or

- Thicker stratified squamous epithelium without rete ridges

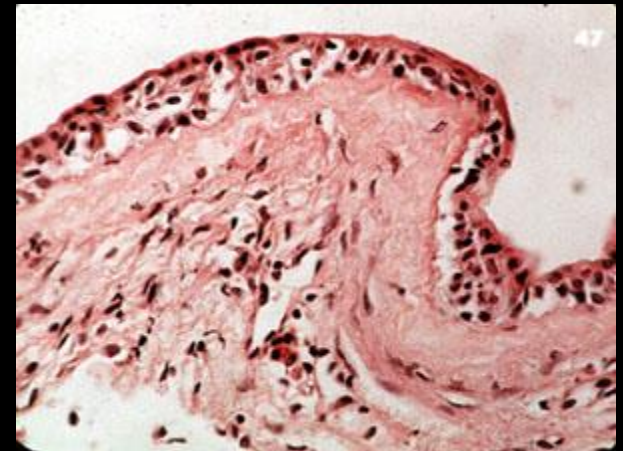


Epithelial cells may show

- Pyknotic nuclei
- Perinuclear cytoplasmic vacuolization
- Atrophic with ghost outlines

Localized epithelial thickenings or plaques

- Some protrude in the cystic lumen
- Some extend into fibrous cyst wall
- Cells
 - Whorled configuration
 - Compact and fusiform
 - Swollen and clear (**water clear cells**)



Low columnar cells on the surface of epithelium → origin from ameloblasts

Attachment of epithelium to connective tissue is
tenuous



Easily peels off



Epithelial discontinuities

□ Fibrous connective tissue wall

- Usually uninflamed
- Except close to junctional epithelium → chronic inflammatory cell infiltrate
- May contain epithelial islands

Lateral periodontal cyst



Cysts which occur in the lateral periodontal position and in which an inflammatory etiology and a diagnosis of collateral keratocyst have been excluded on clinical and histopathological grounds

Clinical features

- Frequency
 - 0.7%

- Age
 - Prominent peak in the 6th decade

- Sex
 - No sex predilection
 - Some studies show slight male preponderance

- Site
 - Mandibular premolar area
 - Anterior maxilla

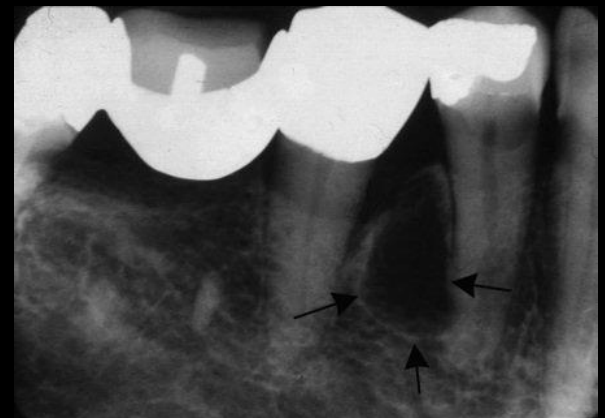
Clinical presentation

- Asymptomatic
- Gingival swelling on facial aspect
- Pain, tenderness on palpation
- Consistency
 - Springy with egg shell crackling
 - Gelatinous feel
- Associated teeth usually vital



Radiographic features

- Round or oval, well circumscribed radiolucency
- Sclerotic margin
- Between the apex and cervical margin of tooth
- Usually less than 1 cm in diameter
- Mean growth → 0.7mm per year
(*Rasmusson, Magnusson, Borrman, 1991*)

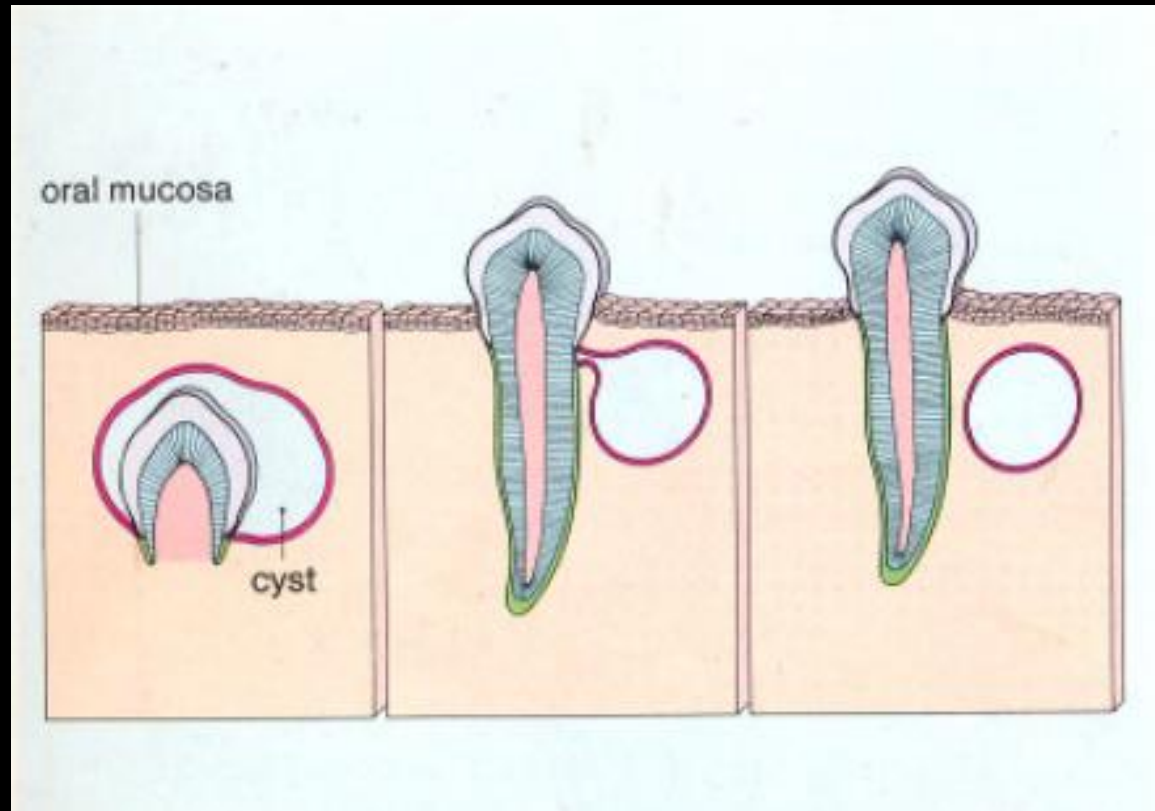


Pathogenesis

- Developmental odontogenic origin
- Three possibilities
 - Reduced enamel epithelium
 - Remnants of dental lamina
 - Cell rests of Malassez

Reduced enamel epithelium

- Arises initially as a dentigerous cyst developing by expansion of the follicle along the lateral surface of crown



□ Support of this hypothesis

- LPC occur in areas where dentigerous cysts are likely to be associated with vertically impacted teeth
- Epithelial plaques similar to those seen in LPC may also be seen sometimes in dentigerous cysts
- Cytokeratin 18 → strongly expressed in LPC & some dentigerous cysts (*Hormia et al, 1987 & Heikinheimo et al, 1989*)

Cell rests of dental lamina (*Wysocki et al, 1980*)

- Cystic change in a single rest → unicystic forms
- Concomitant changes in several adjacent rests → polycystic

Support for this hypothesis

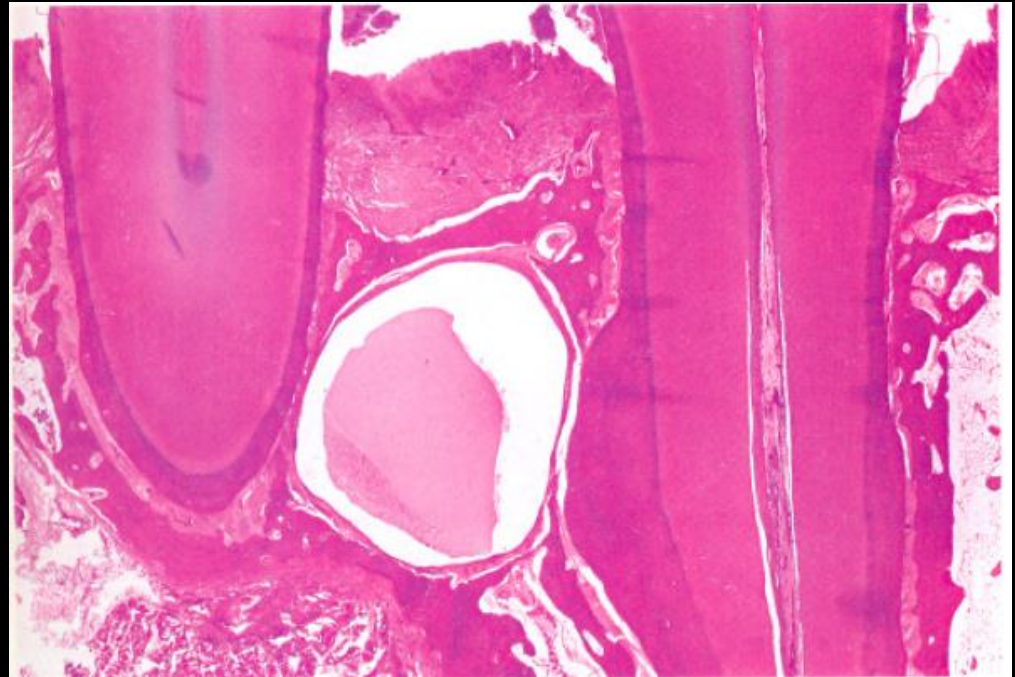
- Limited growth potential of LPC → derivation from post functional cells of dental lamina
- Glycogen containing clear cells seen in rests of dental lamina may also be seen in LPC

□ Cell nests of Malassez

- Occur in the periodontium
- Well positioned for a lateral periodontal cyst
- Has not received much support

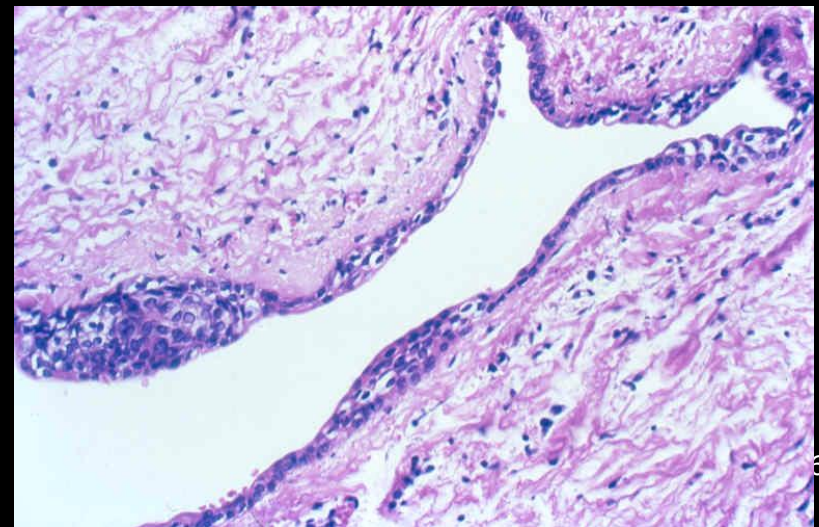
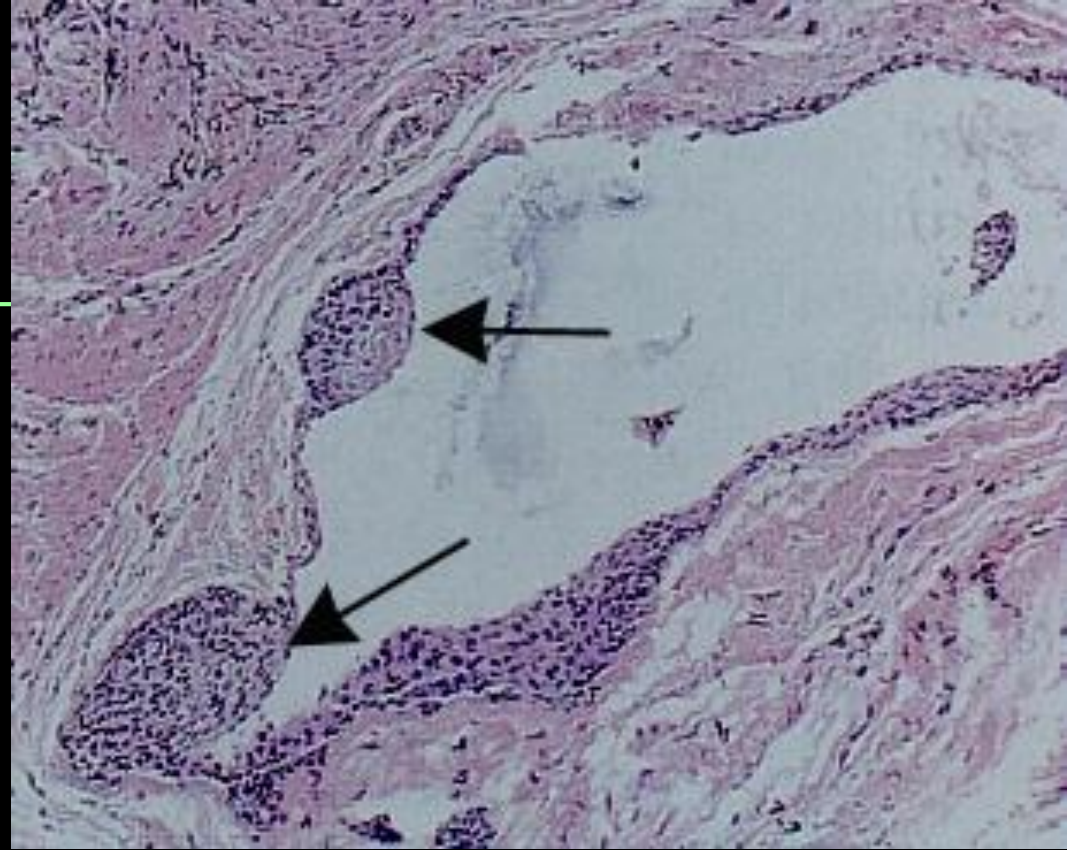
Histopathology

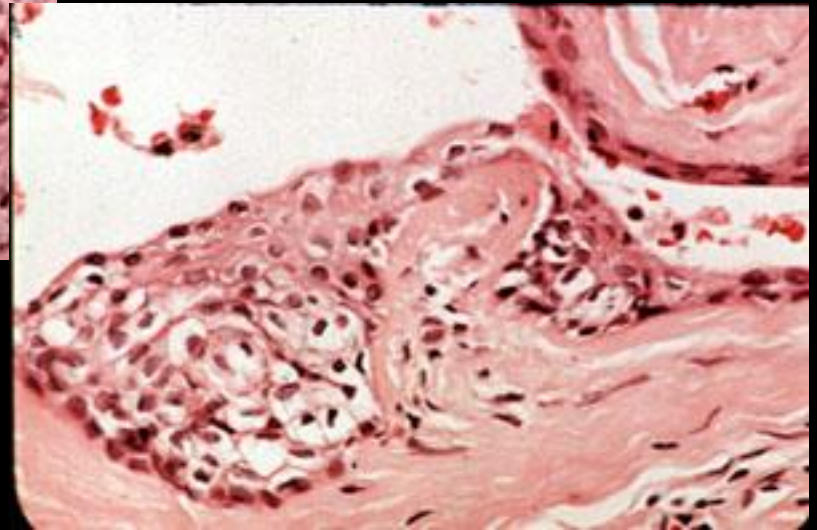
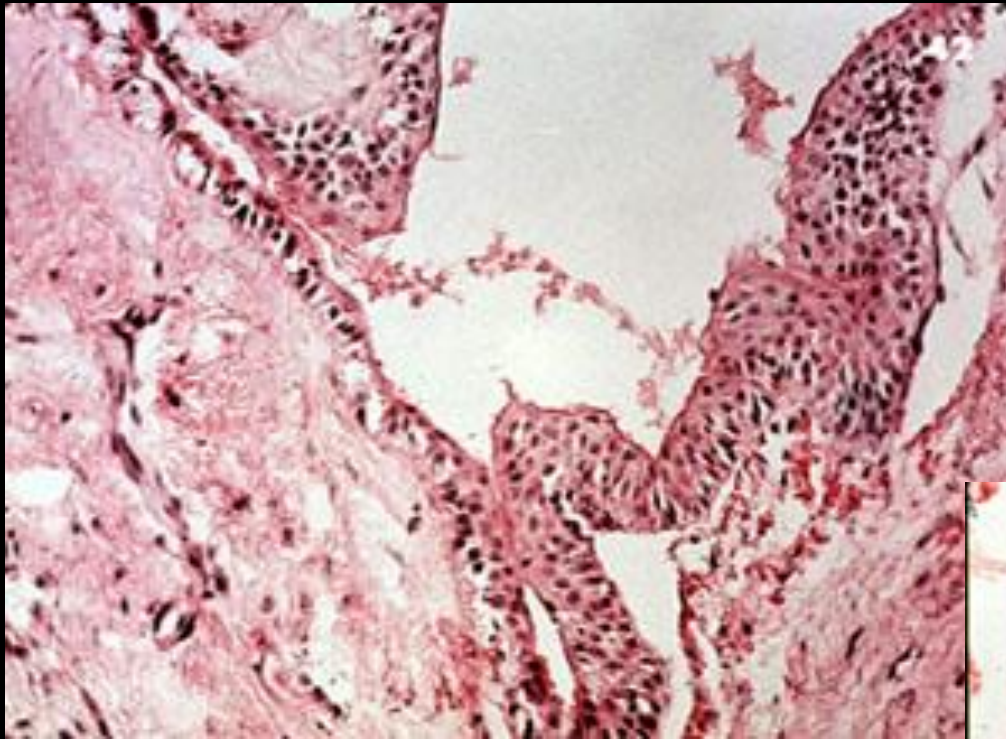
- Thin, non-keratinized squamous or cuboidal epithelial lining
- 1-5 cell layers
- Resembles reduced enamel epithelium
- Sometimes stratified squamous



Localized plaques or thickenings of the epithelial lining

- Extend into the surrounding cyst wall
- Mural bulges
- Cells are some times fusiform with long axis parallel to basement membrane
- Cells of the plaque may differentiate to take a spinous shape





- Glycogen rich clear cells in the epithelial lining

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- ❑ What produces this localized proliferations??????
 - ❑ Spontaneous process occurring in odontogenic epithelium
 - ❑ *Odontogenic epithelium recapitulating ontogeny under pathological conditions*
 - ❑ Similar to early stages of tooth development

-
- ❑ Small epithelial nests of follicles in the fibrous cyst wall
 - ❑ Epithelial lining may separate from the cyst wall
 - ❑ Areas of juxta-epithelial hyalinization of collagen
 - ❑ Usually free of inflammation

□ Histochemical findings

■ Positive reactions for

- NADH₂ and NADPH₂ diaphorase
- Glutamate dehydrogenase
- Lactate dehydrogenase

■ Unreactive for

- Acid and alkaline phosphatase

□ Other findings

- Melanin containing cells in the epithelial lining
(Grand and Marwah, 1964)
- Extensive granular cell change in the epithelial lining → granular-cell odontogenic cyst *(Gold and Christ, 1970)*

Botryoid odontogenic cyst



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- First reported by *Weathers and Waldron, 1973*, who also proposed the name → resemblance to cluster of grapes
 - Variant of LPC
 - Microscopically similar to LPC with some differences

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- ❑ Multilocular with thin fibrous connective tissue septa
 - ❑ Smaller cyst cavities are oriented towards the larger ones
 - ❑ Usually lined by thin non-keratinized epithelium, 1-2 layer thick
 - ❑ In some areas thicker stratified squamous epithelium

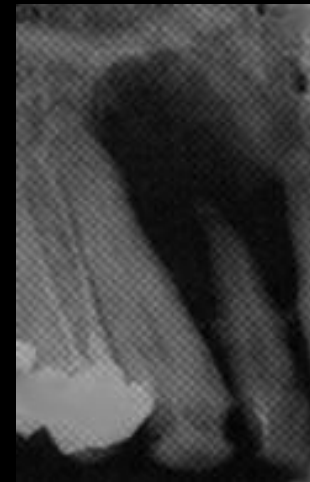
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- Foci of plaque like thickenings
 - Flat fusiform cells
 - Clear cells are unusual
 - Plaques show convoluted zone on electron microscopic examination → similar to AOT (*Greer & Johnson, 1988*)
 - May arise from stratum intermedium
 - Strong expression of cytokeratin 18

Glandular odontogenic cyst

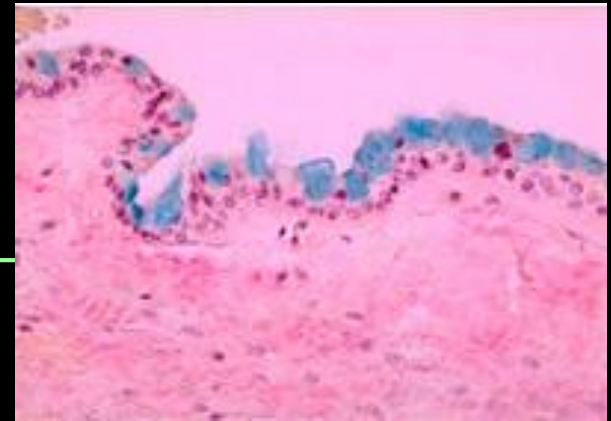


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- Sialo-odontogenic cyst
 - Glandular odontogenic cyst (*Gardner, 1988*)
 - Mucoepidermoid odontogenic cyst (*Sadeghi, 1991*)

- Wide age range
- Can occur in either jaws
- Propensity to grow to a large size and to recur
- Radiologically
 - Unilocular or multilocular
 - Smooth or scalloped margin



Histologically



- ❑ Non-keratinized stratified squamous epithelium
- ❑ Chronic inflammatory infiltration of connective tissue wall
- ❑ Superficial layer of epithelial lining
 - Columnar or cuboidal cells, occasionally with cilia
 - Glandular or pseudoglandular structure
 - Intraepithelial crypts or microcysts ↓

may open onto the surface of epithelium ↓

Papillary or corrugated surface

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- Numerous goblet cells may be present
 - Occasionally epithelium resembles REE
 - Epithelial thickenings or plaques may be present
 - Protrude into the cyst cavity
 - Extend into the connective tissue wall
 - Islands of odontogenic epithelium
 - Microcysts
 - Irregular calcifications

To be contd.





thank you