

Oral Pathology

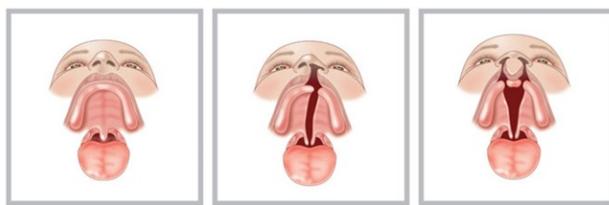
Oral pathology is one of the focuses of the INBDE that requires candidates to draw upon their knowledge of diseases of the teeth, gums, bones, joints, glands, skin, and muscles around the mouth and relate them to appropriate diagnoses and treatments. The following notes cover high-yield information to know for the oral pathology portion of the INBDE, as well as helpful mnemonics and pictures to solidify understanding!



1 Developmental & Hereditary Conditions

Having a good grasp of oral pathologies and understanding of disease etiologies can make a world of a difference in how efficiently a dentist can identify and monitor oral diseases. We start off our discussion with learning about developmental and hereditary conditions — conditions that may not necessarily be a result of choices we make during our lives as is seen in a number of other diseases of the oral cavity.

- **Cleft Lip** - an opening or split between the medial nasal process and maxillary process, embryological structures that should normally fuse together
 - Must know: Can present as unilateral (seen in 80% of cases) or bilateral (seen in 20% of cases)
 - Cleft palate is similar to cleft lip, however this defines a lack of fusion between the palatal shelf embryological structures
 - Prevalence: Very rare, with fewer than 20,000 US cases per year
 - Treatment: Surgery restores normal function, speech therapy may be helpful



4. Normal palate 5. Left unilateral cleft lip and palate 6. Bilateral cleft lip and palate

Figure 1.01 Cleft lip

- **Fordyce Granules** - ectopic sebaceous glands found on the vermillion border of the lips or around the oral cavity
 - Must know: Often most prominent around puberty, these granules appear as yellow-white papules that may be hyper-plastic or nodular
 - Prevalence: Common, occurs in 70-80% of adults
 - Treatment: Completely benign, no treatment necessary



Figure 1.02 Fordyce granules

- **Fissured Tongue** - deep and prominent grooves and fissures across the tongue surface
 - Must know: benign condition
 - **Melkersson-Rosenthal Syndrome (MRS)** is a rare neurological disorder that includes a fissured tongue, granulomatous cheilitis, and facial paralysis as main characteristics
 - Prevalence: Common, affects 2-5% of US population
 - Treatment: None. Brush to remove food debris to prevent irritation



Figure 1.03 Fissured tongue

- **Geographic Tongue** - aka erythema migrans or benign migratory glossitis, atrophy of papillae resulting in red patches surrounded by slightly elevated white border that migrate over time (*like the Pangea continental drift*)
 - Prevalence: Very common with more than 3 million US cases per year
 - Treatment: None if asymptomatic, topical corticosteroid if burning sensation is present



Figure 1.04. Geographic tongue

- **Leukoedema** - wrinkled, diffuse white or white/gray lesion of buccal or labial oral mucosa with intracellular edema
 - Must know: the lesion dissipates when tissue is stretched; useful for diagnosis and to rule out hidden underlying lesions
 - Prevalence: Common, mostly seen among black adults possibly due to contrast against mucosal pigmentation and more prominent in active smokers
 - Treatment: Completely benign, no treatment necessary



Figure 1.05 Leukoedema

- **Lingual Thyroid** - mass of thyroid tissue at midline base of tongue
 - Must know: located along embryonic path of embryonic descent; can be found between foramen cecum of tongue and just past the larynx
 - **Thyroglossal duct cyst:** remnants of thyroid tissue located beyond foramen cecum in midline neck; movable with swallowing
 - Prevalence: Very rare, reported incidence of 1 in 100,000
 - Treatment: Surgical methods include excision with or without autotransplantation to prevent hypothyroidism; non-surgical methods include hormonal therapy or radioactive ablation



Figure 1.06 Lingual thyroid

- **Lip Pits** - pits and fistulas that occur near lip commissures or midline that may produce saliva
 - Must know: Usually presents along with cleft lip/palate as part of **Van der Woude Syndrome**
 - Prevalence: Very rare, with incidence of about 1 in 75,000 to 1 in 100,000
 - Treatment: Usually doesn't require treatment, can be excised for cosmetics



Figure 1.08 Lip pits



Figure 1.07 Thyroglossal duct cyst

Still discussing developmental conditions, we now shift our attention to angiomas, or benign tumors that consist of small blood or lymph vessels. Angiomas can be present on the skin surface or inside the oral cavity. Surface angiomas include cherry angioma, or a small red mole that forms from accumulated capillaries and vessels, and hemangioma, a bright red birthmark that appears at birth that is made up of extra blood vessels in the skin.



Figure 1.09 Hemangioma vs cherry angioma

The oral angioma to know in detail is as follows:

- **Lymphangioma** - congenital abnormal proliferation of lymphatic vessels with head and neck predilection
 - Must know:
 - Referred to as **cystic hygroma** when occurring in the neck (more common than oral lymphangioma)
 - Oral lymphangioma commonly presents as clusters of vesicles on the anterior tongue
 - A syndrome involving lymphangioma is **Sturge-Weber Syndrome**, in which angiomas form on the leptomeninges and skin along the trigeminal nerve
 - Prevalence: Very rare, 1-2/1000 newborns
 - Treatment: Surgical excision, radiation therapy, or steroid administration are common treatments. Sclerotherapy for some subtypes



Figure 1.10 Oral lymphangioma



Figure 1.11 Cystic hygroma

Another category of developmental conditions to know for the INBDE include **exostoses** (or **tori**) which are incidences of excessive cortical bone growth. Exostoses are named primarily based on where they occur, such as buccal exostosis, or torus mandibularis, a bony overgrowth on the lingual aspect of the mandible.



Figure 1.12 Buccal exostosis and torus palatinus

We transition our discussion of developmental conditions to learning about different types of developmental cysts, which are abnormal, usually noncancerous growths filled with liquid, air or other substances. Make sure to know the following conditions!

- **Branchial Cleft Cyst** - aka cervical lymphoepithelial cyst or persistent cervical sinus; lateral neck mass resulting from incomplete involution of branchial clefts and pouches during development
 - Prevalence: Most common congenital cause of neck mass; exact incidence is unknown
 - Treatment: Either surgical removal or drainage of fluid



Figure 1.13 Branchial cyst

- **Dermoid Cyst** - doughy mass consisting of skin-like lining with adnexal structures (e.g. hair, teeth, skin glands) and fluid
 - Must know: formation above mylohyoid presents on the floor of the mouth whereas formation below the mylohyoid presents on the upper neck as "double chin"
 - Prevalence: Common, mostly found in children ages 5 and younger
 - Treatment: Surgical removal



Figure 1.14 Dermoid cyst

- **Globulomaxillary Lesion** - radiographic description (not diagnosis) of a radiolucency between the maxillary lateral incisor and adjacent canine; likely represents an odontogenic cyst (e.g. OKC) that may cause root divergence
 - Must know: appears as inverted **pear-shaped** radiolucency
 - Treatment: Surgical removal



Figure 1.15 Globulomaxillary Lesion

- **Nasopalatine Duct Cyst** - a nonodontogenic developmental cyst arising from remnants of the nasopalatine duct
 - Must know: appears as an inverted **heart-shaped** radiolucency in the nasopalatine canal
 - Prevalence: Most common nonodontogenic cyst
 - Treatment: Surgical enucleation

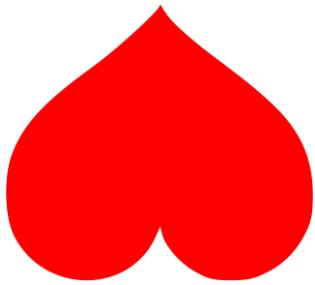


Figure 1.16 Nasopalatine cyst

- **Oral Lymphoepithelial Cyst** - white or yellowish cyst arising from lymphoid tissue of oral mucosa; histologically resembles branchial cleft cyst
 - Must know: commonly seen in Waldeyer's ring (ring of lymphoid tissue in posterior oral cavity consisting of palatine tonsils, lingual tonsils, and pharyngeal adenoids)
 - Prevalence: Rare, usually occurs in adults
 - Treatment: Surgical removal

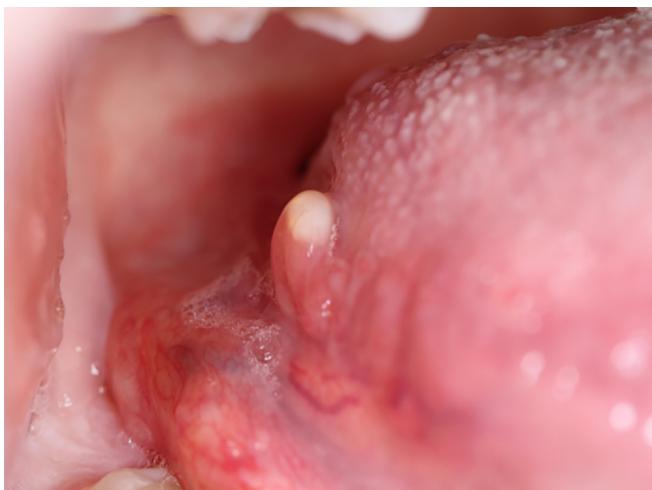


Figure 1.17 Oral lymphoepithelial cyst

Finally, we can wrap up our discussion of developmental conditions with learning about two important bone defects.

- **Stafne Bone Defect** - depression of mandible on the lingual surface beneath the mandibular canal
 - Must know: appears as oval shaped radiolucency in posterior mandible below the mandibular canal
 - Prevalence: Rare, more often found in males over 40 years old
 - Treatment: None required



Figure 1.18 Stafne Bone Defect

- **Traumatic Bone Cyst** - aka simple bone cyst or idiopathic bone cavity; asymptomatic cavity of the jaw without epithelial lining (not true cyst!); possibly due to hematoma secondary to jaw trauma that fails to repair properly
 - Must know: appears as a large radiolucency scalloped around roots
 - Prevalence: Rare, mainly diagnosed in young adults
 - Treatment: Surgical access can stimulate bone regeneration



Figure 1.19 Traumatic Bone Defect

That completes developmental conditions for the INBDE! Let's now move onto hereditary conditions to learn about their inheritance, and some high-yield information about them.

- **Amelogenesis Imperfecta** - disorder of tooth development leading to small, discolored, misshapen teeth
 - Must know: Characterized by abnormal enamel formation (**think: ENAMELogensis imperfecta**), while dentin and pulp are normal
 - Inheritance pattern: Autosomal dominant, recessive, or X-linked
 - Treatment: Full coverage crowns for aesthetics



Figure 1.20 Amelogenesis Imperfecta

- **Cleidocranial Dysplasia** - fragile bones and teeth, collarbones (clavicles) may be absent
 - Must know: Dental abnormalities include delayed loss of primary teeth, delayed appearance of secondary teeth, misshapen teeth, or supernumerary teeth
 - Fun fact, Stranger Things star, Gaten Matarazzo "Dustin Henderson" was born with CCD!
 - Inheritance pattern: Autosomal dominant
 - Treatment: Reconstructive surgery, depending on severity



Figure 1.21 Cleidocranial dysplasia

- **Dentinogenesis Imperfecta** - disorder of tooth development affecting primary and permanent dentition, leading to small, discolored, misshapen teeth
 - Must know: Characterized by abnormal dentin formation, resulting in short roots, bell-shaped and bulbous crowns, and obliterated pulps
 - Patients with DI have blue sclera (whites of the eyes)
 - Can be associated with osteogenesis imperfecta
 - Inheritance pattern: Autosomal dominant
 - Treatment: Full coverage crowns for aesthetics



Figure 1.22 Dentinogenesis Imperfecta

- **Dentin Dysplasia** - disorder of tooth development leading to small, discolored, misshapen teeth
 - Must know: Characterized by abnormal dentin, resulting in chevron pulps and short roots

- Type I has poor root development
- Type II has poor crown development
- Inheritance pattern: Autosomal dominant
- Treatment: Prevention! Not good candidates for restoration, due to both chevron pulps and short roots

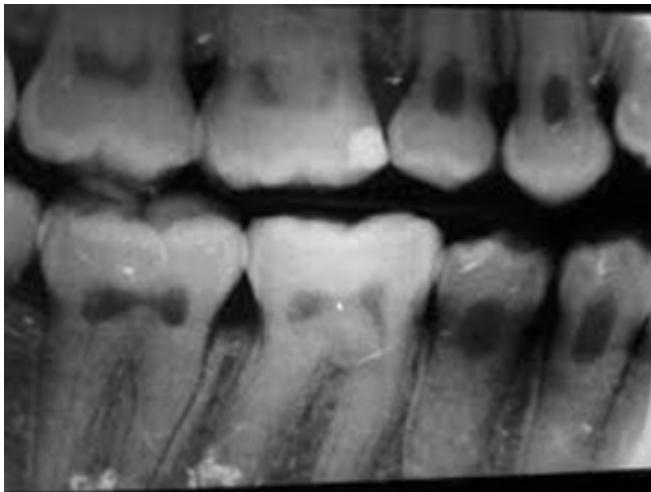


Figure 1.23 Dentin dysplasia

- **Ectodermal Dysplasia** - abnormal development of ectodermal structures such as teeth, mucosal membranes, nails, & hair
 - Must know: dental manifestations include conical crowns, hypodontia, anodontia, and heat intolerance due to decreased sweat glands
 - Inheritance pattern: X-linked recessive
 - Treatment: Dental prosthetics



Figure 1.24 Ectodermal dysplasia

- **Epidermolysis Bullosa** - group of rare diseases that cause blistering skin and mucosa
 - Must know: Mechanical fragility and blistering lead to eventual dental decay due to difficult oral hygiene maintenance
 - Inheritance pattern: Autosomal dominant or recessive
 - Treatment: Topical aids for blisters, dietary and dental hygiene modifications



Figure 1.25 Epidermolysis Bullosa

- **Hereditary Hemorrhagic Telangiectasia** - aka Osler-Weber-Rendu Syndrome; abnormal formation of capillaries on skin, mucosa, and viscera
 - Telangiectasia (spider veins) are dilated or broken blood vessels near skin or mucosa
 - Iron deficiency due to bleeding
 - Epistaxis, or nosebleeds are common symptoms most evident to patient
 - ◆ Think: TIE
 - Inheritance pattern: Autosomal dominant
 - Treatment: Bevacizumab (Avastin)



Figure 1.26 HHT



- Inheritance pattern: Unknown
- Treatment: Extraction of affected teeth



Figure 1.28 Regional Odontodysplasia

- **Osteopetrosis** - aka Albergs-Schonberg disease or marble bone disease; disorder in which bones become overly dense due to lack of bone resorption, causing them to brittle and vulnerable to fracture
 - Inheritance pattern: Autosomal dominant or recessive
 - Treatment: Caries prevention to avoid need for extractions. Surgery for severe functional deformities

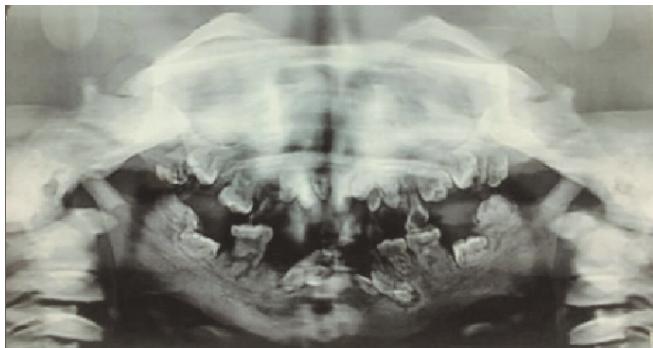


Figure 1.27 Osteopetrosis

- **Regional Odontodysplasia** - development anomaly impacting enamel, dentin, and cementum components of multiple teeth in a quadrant
 - Must know: "ghost teeth" in this condition exhibit short roots, enlarged pulp chambers, and open apical foramen
 - The thin enamel and dentin layers result in a faint, fuzzy image of the teeth when x-rayed, hence the term "ghost teeth"



Figure 1.29 White sponge nevus

We wrap up this first section by distinguishing between tooth fusion and gemination. **Fusion** involves the merging of two buds into one tooth, resulting in the tooth count to be one less tooth than normal. **Gemination**, on the other hand, results when one root buds into two crowns, giving us a normal tooth count.

2 Mucosal Lesions

We now transition to more targeted discussions of conditions of the oral cavity, and will start with mucosal lesions. Mucosal lesions describe chemical and physical injury to the mucosal membranes of the mouth, and can vary widely in their severity. This section will focus on five categories of mucosal lesions: reactive, infectious, immunologic diseases, premalignant, and malignant.

Reactive Mucosal Lesions

Reactive lesions are hyper-plastic tissues that form as a result of a repair response. Let's learn some high-yield information about assorted reactive mucosal lesions!

- **Amalgam Tattoo** - gray/blue/black discoloration on oral mucosal membranes
 - Must know: This common and benign lesion is often mistaken for melanoma, and the radiopaque particles can be viewed on radiographs



Figure 2.01 Amalgam tattoo

- **Chemical Burn** - a whiteish sloughing appearance on mucosal membranes as a result of chemical reactivity
 - Must know: Common compounds that cause chemical burns include hydrogen peroxide, aspirin, silver nitrate, and phenol



Figure 2.02 Chemical burn

- **Dentifrice-Associated Sloughing** -
 - Must know: to treat, suggest non-SLS brands such as Sensodyne, Tom's of Maine, etc



Figure 2.03 Dentifrice-associated sloughing

- **Hairy Tongue** - dorsal tongue appears dark and furry due to buildup of keratin on filiform papillae
 - Must know: associated with poor oral hygiene, certain medications or antibiotics, tobacco use, or radiation treatment of head/neck



Figure 2.04 Hairy tongue

- **Linea Alba** - a fibrous **white line** on the buccal mucosa at level of occlusion; represents hyperkeratosis from chronic friction by the teeth against the mucosa



Figure 2.05 Linea alba

- **Melanotic Macule** - benign hyperpigmentation in the mucosal membrane
 - Must know: this is essentially just a freckle of the mucosa

- **Peutz-Jeghers Syndrome (PJS)** is a genetic condition featuring perioral and oral mucosal melanotic macules with intestinal polyposis. These patients have increased risk of cancers especially colon cancer
- Think: Pigmented lips/mouth and Jejunal polyps



Figure 2.06 Melanotic macule

- **Nicotine Stomatitis** - aka "smoker's palate"; presents as scattered papules with central redness on a whitened palate; redness results from inflamed salivary duct openings due to extreme heat
 - Must know: Nicotine stomatitis may be premalignant if associated with reverse smoking (the lit end of the cigarette is in the mouth)
 - This is reversible with smoking



Figure 2.07 Nicotine stomatitis

- **Smoking-Associated Melanosis** - increased tissue pigmentation due to irritation from tobacco smoke
 - Must know: Tobacco chemicals can stimulate melanocytes resulting in diffuse brown macules that are typically seen in anterior gingiva
 - This condition is reversible if tobacco smoking is ceased



Figure 2.08 Smoking-associated melanosis

- **Submucosal Hemorrhage** - extravascular lesions that do not blanch — or blood that has escaped the vessels into tissues and thus blood pressure cannot be altered
 - Must know: these hemorrhages are characterized based on size:
 - Petechiae: 1 mm
 - Purpura: slightly larger than petechiae
 - Ecchymosis: 1+ cm
 - Hematoma: mass of blood within tissue, often caused by trauma to oral mucosa



Figure 2.09 Submucosal hemorrhage

- **Traumatic Ulcer** - a complete break through the epithelium
 - Must know: This common condition differs from **erosion**, which is an incomplete break of the epithelium

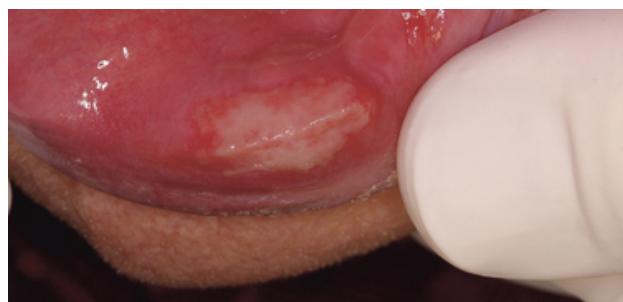


Figure 2.10 Traumatic ulcer

That wraps up reactive mucosal lesions! Let's move onto learning about high-yield infectious lesions!

Infectious Mucosal Lesions

This section will highlight various viral, bacterial, and fungal infections you'll need to know for the INBDE!

Viral Infections

- **Condyloma Acuminatum** - papilloma caused by HPV infection, with strains 6 and 11 having the highest prevalence
 - Must know: This condition may manifest as a genital or oral wart, usually as a result of having oral sex with someone with genital warts



Figure 2.11 Condyloma Acuminatum

- **Coxsackie Virus** - an enterovirus causing hand-foot-and-mouth diseases
 - Must know: This virus can also cause **herpangia**, which results in small blister-like sores in the posterior oral cavity (soft palate, throat, and tonsils)



Figure 2.12 Herpangia

- **Focal Epithelial Hyperplasia (Heck's Disease)** - papilloma caused by HPV 13 and 32 characterized by multiple small dome-shaped warts on oral mucosa
 - Treatment: Excision with excellent prognosis



Figure 2.13 Focal epithelial hyperplasia

- **Herpes Simplex Virus (HSV)** - a viral infection causing contagious genital and/or oral sores
 - Must know: There are two manifestations of HSV = primary and recurrent
 - Primary: **acute herpetic gingivostomatitis** occurs when HSV is contracted by the newborn during vaginal delivery or from contact with infected parent; presents as numerous self-limited oral vesicles. Upon healing, the virus remains latent in the trigeminal ganglion
 - Recurrent: Reactivation of the virus by stress, sunlight, or immunosuppression; has the following different manifestations on keratinized tissue
 - ◆ **Herpes gladiatorum** - sores on lateral neck, sides of face, and forearm
 - ◆ **Herpes labialis (recurrent extraoral herpes)** - cold sores on the vermillion border
 - ◆ **Herpetic whitlow** (an occupational disease of dentists!) - sores on fingers; dentists with this condition should not contact patients until it subsides
 - ◆ **Recurrent intraoral herpes** - sores form exclusively on attached gingiva or hard palate
 - Treatment: Antiviral such as acyclovir during the prodromal period, the period of itching and tingling that starts 12-24 hours before onset of lesions

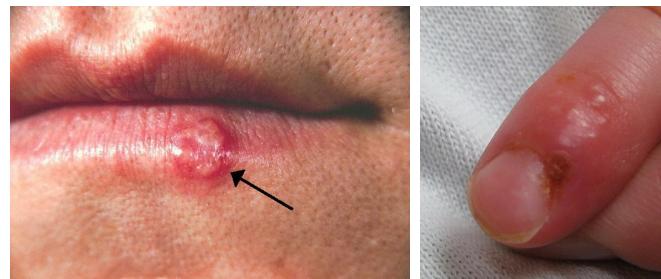


Figure 2.14 HSV (left), herpetic whitlow (right)

- **Measles** - a viral infection with oral manifestations including Koplik's spots, buccal mucosa dot ulcers, that precede the characteristic skin rash
 - Must know: The primary infection of measles is self limiting and occurs during childhood

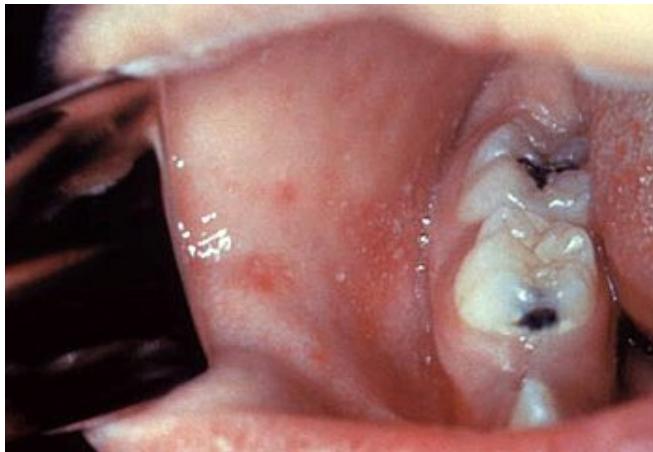


Figure 2.15 Koplik's spots

- **Oral Hairy Leukoplakia** - a condition triggered by Epstein Barr Virus (EBV) causing white hairy-appearing patches on the lateral tongue that do not wipe off
 - Must know: This is an opportunistic infection associated with immunosuppression in HIV and Burkett's lymphoma patients



Figure 2.16 Oral hairy leukoplakia

- **Papilloma** - benign noncancerous exophytic growths caused by several strains of HPV
 - Must know: Can be pedunculate (ballooning) or sessile (mound shaped) proliferations on skin or mucosa



Figure 2.17 Papilloma

- **Varicella Zoster Virus (VZV)** - a herpes virus infection causing itchy, blister-like rashes on the skin
 - Must know: Similar to HSV, VZV has two manifestations = primary and recurrent
 - Primary: Chickenpox occurs when you contract the virus for the first time; is self-limited and occurs during childhood. Upon healing, the virus becomes latent in trigeminal ganglion
 - Recurrent: **Herpes Zoster** aka **Shingles** occurs when the virus is triggered again by stress, sunlight, immunosuppression
 - ◆ **Ramsay Hunt Syndrome:** a herpes zoster reactivation in geniculate ganglion impacting CN VII and VIII leading to facial paralysis, vertigo, and deafness
 - Treatment: Acyclovir



Figure 2.18 Chickenpox lesion in mouth

- **Verruca Vulgaris** - a type of papilloma caused by several strains of HPV
 - Must know: A common skin wart; can auto inoculate



Figure 2.19 Oral verruca vulgaris

Bacterial Infections (uncommon due to preventative effects of saliva!)

- **Actinomycosis** - an infection caused by filamentous bacteria *Actinomyces israelii* — do not confuse this with a fungal infection!
 - Must know: This is an opportunistic, chronic, and granulomatous infection with two main types = periapical and cervicofacial
 - Periapical: jaw infection
 - Cervicofacial: head and neck infection
 - The most common characteristic of actinomycosis is the presence of sulfur granules in the purulent exudate
 - Treatment: Long-term high-dose penicillin



Figure 2.20 Actinomycosis

- **Gonorrhoea** - infection caused by *Neisseria gonorrhoeae* that usually impacts urethra, rectum, or throat
 - Must know: Oral manifestations of gonorrhoea are extremely rare



Figure 2.21 Throat gonorrhoea

- **Syphilis** - a bacterial infection caused by contact with *Treponema pallidum* (spirochete) usually spread by sexual contact and can progress from ulcers to systemic disease
 - Must know: Progresses through 3 stages
 - Primary: painless genital, rectal, or oral chancre (ulcer)
 - Secondary: oral mucous patch, condyloma latum, or maculopapular rash
 - Tertiary: symptom free latency; some patients may then develop gumma (a soft tumor-like growth rarely seen due to modern antibiotic regimens), potentially fatal CNS and cardiovascular involvement
 - **Congenital syphilis:** a mother with syphilis can give birth to a baby with congenital syphilis, and the condition follows Hutchinson's triad pattern of presentation:

- ◆ Teeth abnormalities (notched incisors, mulberry molars), deafness, and ocular keratitis (*think: hear no evil = deafness, see no evil = ocular keratitis, speak no evil = teeth abnormalities*)
- **Scarlet Fever** - a bacterial infection caused by Group A Strep (such as streptococcus pyogenes) that develops when strep throat becomes a systemic infection
 - Must know: Strawberry tongue is a characteristic oral manifestation, and appears as a white-coated tongue with inflamed red *fungiform* papillae — not to be confused with hairy tongue where *filiform* papillae is impacted
 - Treatment: Penicillin



Figure 2.23 Strawberry tongue

- **Tuberculosis** - infection caused by inhalation of *Mycobacterium tuberculosis* that results in chronic, non-healing oral ulcers that follow the lung infection
 - Must know: has different stages of non-linear progression
 - Primary infection: Most are asymptomatic with clearance of infection but some may enter clinical latency. Symptoms that do occur are constitutional with mild respiratory difficulty.
 - Involves formation of the Ghon Complex which is caseating "cheese-like" necrosis of granulomas around bacteria with lymphadenopathy of hilar "root of lung" lymph nodes

- Secondary infection: Reactivation after latency with more widespread infection; pulmonary cavitation is observed
- Miliary infection: Systemic spread of tuberculosis to many organs that may follow secondary tuberculosis or be a direct progression from primary tuberculosis that never entered latency
- Treatment: Multi-drug "RIPE" therapy involving rifampin, isoniazid, pyrazinamide, and ethambutol



Figure 2.24 Oral tuberculosis

Fungal Infections

- **Candidiasis** - a fungal infection caused by *Candida*
 - Different types
 - Angular cheilitis: inflammation of corners of the mouth especially seen with reduced vertical dimension
 - Atrophic candidiasis: a red plaque on oral mucosa that may form due to a poorly fitting or poorly cleaned prosthetic device such as a denture
 - Median rhomboid glossitis: loss of lingual papillae resulting in a "bald spot" on the posterior dorsal tongue
 - Pseudomembranous candidiasis: aka thrush; a white plaque that does wipe off
 - Treatment: An antifungal such as Clotrimazole or Nystatin

- **Systemic fungal infections** - deep fungal infections with geographic predilections; can cause pneumonia and may disseminate with oral symptoms of ulcers or masses
 - Must know: the 4 major regions of the US have higher prevalence (albeit overall low) of the following fungal infections
 - Blastomycosis: Northeast; usually occurs due to inhalation of spores after heavy rain
 - Coccidioidomycosis: Southwest; fungus lives in soil and causes "Valley Fever"
 - Cryptococcosis: West; inhalation of soil contaminated with *Cryptococcus* fungus
 - Histoplasmosis: Midwest; fungus found in soil that contains large amounts of bird or bat droppings



Figure 2.25 Atrophic Candidiasis



Figure 2.26 Median Rhomboid Glossitis



Figure 2.27 Pseudomembranous candidiasis

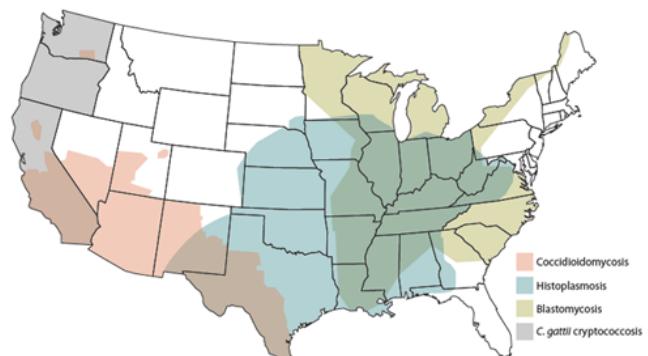


Figure 2.28 Map of US fungal disease

Mucosal Immunologic Diseases

Continuing through our study of mucosal lesions, we now turn our attention to immunologic diseases of the oral cavity. These diseases may be autoimmune, when the immune system attacks itself, or hyperimmune, when the immune response is over-exaggerated.

- **Angioedema** - an allergic reaction in response to contact to food or drugs causing diffuse swelling on face, neck, and/or lips
 - Must know: allergic reactions, in general, are mediated by the mast cell release of IgE and histamines
 - This can also occur due to side effects of angiotensin-converting enzyme (ACE) inhibitors
 - Treatment: antihistamines



Figure 2.29 Angioedema

- **Aphthous Ulcer** - aka canker sore; the most common immunologic mucosal condition
 - Must know: this condition impacts non-keratinized tissues (includes lining mucosa such as alveolar, buccal, labial mucosa; the soft palate; and ventral surface of the tongue)
 - While this condition may superficially look similar to HSV, the two differ in that HSV impacts only keratinized tissues
 - Can have two different types: minor aphthous ulcers which heal without scarring, and major aphthous ulcers (Sutton Disease) which heal with scarring
 - **Behcet's Syndrome** is a multi system vasculitis condition that causes aphthous ulcers in the oral cavity and genitals, as well as inflammation of the eyes
 - Treatment: only necessary for serious cases; corticosteroids are perfect due to their anti-inflammatory properties



Figure 2.30 Aphthous Ulcer

- **Erythema Multiforme** - an acute self-limiting condition causing oral and skin lesions that present as flat, round, bulls-eye, target lesions, as well as hemorrhagic crusting of the lips; associated with HSV infection and certain drugs
 - Must know: major form is distinguished from minor form by the presence of skin lesions and involvement of multiple mucosal site



Figure 2.31 Erythema Multiforme

- **Stevens-Johnson Syndrome and Toxic Epidermal Necrolysis** - spectrum of severe, life-threatening blistering and necrotic skin conditions with febrile prodrome and oral and ocular mucosal involvement; associated with certain medications; toxic epidermal necrolysis is most severe form involving >30% of skin surface
 - Must know: Can be mistaken for erythema multiform but is a distinct disease
- **Lichen Planus** - a skin or oral mucosa inflammatory condition in which T lymphocytes target and destroy basal keratinocytes resulting in a burning or itching rash

- Must know: basal zone vacuolization and sawtooth rete pegs on histology secondary to the destruction of basal keratinocytes
- Two forms of the condition: reticular and erosive
 - ◆ Reticular: characterized by Wickham striae, lacy ribbon-like stripes on affected area
 - ◆ Erosive: has red ulceration with surrounding Wickham striae
- Treatment: No treatment for asymptomatic reticular conditions; corticosteroids for symptomatic erosive conditions



Figure 2.32 Lichen Planus

- Lupus Erythematosus** - an autoimmune disease with widespread inflammation and tissue damage in affected organs
 - Must know: different forms but two common manifestations are as follows
 - Systemic lupus erythematosus: a type III hypersensitivity reaction with involvement of multiple organs; many have butterfly "molar" rash along the bridge of nose; antinuclear antibodies (ANA) detected
 - Chronic cutaneous lupus erythematosus: skin and mucosal involvement only; disc-shaped lesions on face; oral lesions look similar to erosive lichen planus
 - Treatment: corticosteroids



Figure 2.33 Discoid lesions

- Mucous Membrane Pemphigoid** - an autoimmune disease characterized by blistering lesions on mucous membranes
 - Must know: due to autoantibodies against specific basement membrane proteins; causes separation of epithelial layer from basement membrane
 - Treatment: corticosteroids

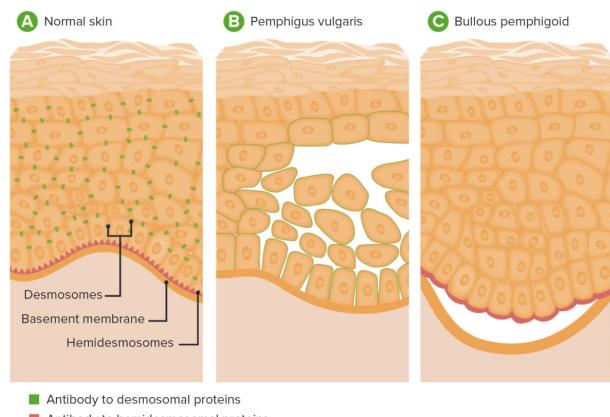


Figure 2.34 MMP vs PV

- Pemphigus Vulgaris** - an autoimmune disorder involving blistering and erosion of skin and mucosal membranes
 - Must know: due to autoantibodies against desmosomes that hold epithelial cells together; leads to separation of epithelial cells aka acantholysis

- The primary lesion of the condition is a soft blister filled with clear fluid "bullae" followed by multiple painful ulcers
- Detected by a positive Nikolsky's sign in which slight rubbing of affected skin or mucosa results in exfoliation of the outermost layer
- Treatment: corticosteroids



Figure 2.35 Pemphigus Vulgaris

- **Scleroderma** - a condition involving the hardening of skin and connective tissue
 - Must know: relating to dentistry, scleroderma can make it more difficult to open the mouth
 - Uniform widening of the PDL space is also observed



Figure 2.36 Scleroderma

- **Granulomatosis with Polyangiitis** - previously Wegener Granulomatosis; likely due to formation of autoantibodies in response to some external antigen, NOT direct mast cell activation as in angioedema
 - Must know: the characteristic oral manifestation of this condition is strawberry gingivitis ("chewing strawberry gum gives you a high GPA")
 - Treatment: corticosteroids (prednisone) and cyclophosphamide chemotherapy



Figure 2.37 GPA

Premalignant Mucosal Lesions

Let us now delve into premalignant, or pre-cancerous, mucosal lesions! High risk areas in mouth for developing cancer include floor of mouth, lateral and ventral tongue, and palate. The risk of premalignant lesions and oral cancers increases with tobacco and alcohol consumption.

- **Actinic Cheilitis** - premalignant lesion of lower lip due to prolonged sun exposure; characterized by formation of a scaly patch that may eventually ulcerate
 - Must know: "actinic" = solar, "cheilitis" = reaction to long term sun damage caused primarily by UVB rays
 - Actinic keratosis is a similarly disease that affects the skin
 - Treatment: surgical excision, or laser ablation for severe cases



Figure 2.38 Actinic Cheilitis



Figure 2.40 Leukoplakia

- **Erythroplakia** - red patch on inside surface of mouth
 - Must know: this is a clinical description and not a diagnosis
 - Almost all true erythroplakias are histologically diagnosed as significant epithelial dysplasia or carcinomas
 - Treatment: mandatory biopsy for histology



Figure 2.39 Erythroplakia

- **Leukoplakia** - white patch inside mouth that does not wipe/rub off
 - Must know: clinical description and not a diagnosis. Once diagnosis is determined, we no longer refer to this as leukoplakia
 - Treatment: mandatory biopsy for histology



Figure 2.41 PVL

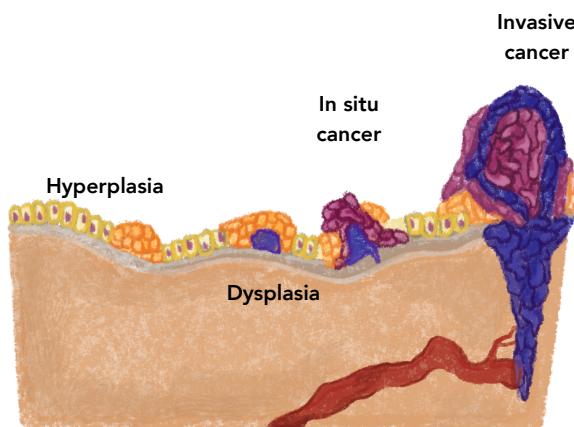
- **Smokeless Tobacco Keratosis** - aka tobacco pouch keratosis; fissured, gray-white lesion that forms a pouch (due to stretching of the mucosa) in the area that smokeless tobacco is held
 - Treatment: no treatment needed since asymptomatic; biopsy for severe lesions; monitor but low malignant potential; resolves with smoking cessation



Figure 2.42 White Mucosal Change

Malignant Mucosal Lesions

We wrap up our discussion of mucosal lesions by learning about malignant conditions. When cells of mucosal lesions do become cancerous, they are now malignant, and follow the progression of cancer development as is seen throughout the body. The following graphic shows four overarching stages of cancer development:



To summarize the graphic, hyperplasia is often an initial stage in the development of cancer, characterized by increased cell reproduction rate. Dysplasia, or the abnormal development of cells, can lead to a variety of conditions and pre-cancerous cells. In situ (original place) cancer refers to cancer cells that have not spread beyond their formation site. As indicated by the image, invasive cancer is when cancer has officially grown past the original tissue and has entered blood or lymph to travel.

The malignant mucosal lesions to know for the INBDE are carcinomas, which are cancers of epithelial tissue, and melanoma, which is a cancer of the melanocytes. While not covered in this section, leukemia is a cancer of blood cells, and sarcoma is cancer of tissues.

- **Oral Basal Cell Carcinoma** - true BCC of the oral cavity is extremely rare
 - Must know: caused by sun damage, BCC has an ulcerated erythroplakia appearance; metastasis is extremely rare
 - Treatment: simple surgery to remove

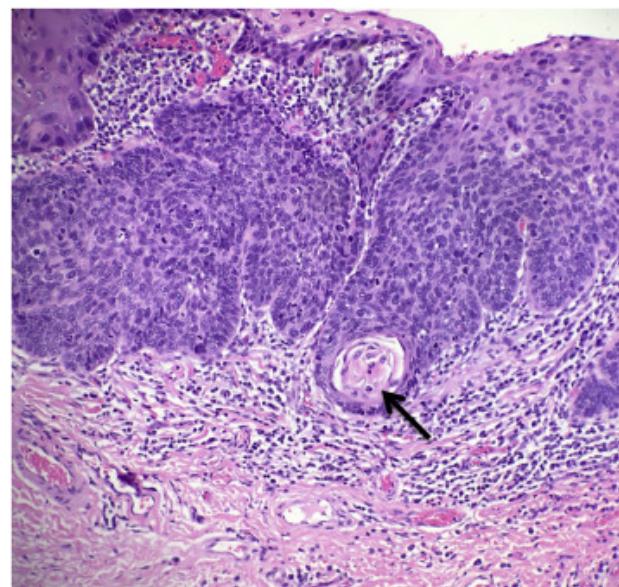


Figure 2.43 OBCC histology

- **Oral Melanoma** - melanoma frequently impacting the hard palate and maxillary alveolar mucosa
 - Must know: a malignancy of melanocytes; the dark purple/black lesions metastasize more rapidly than other malignant mucosal lesions; worse prognosis than cutaneous melanoma
 - Treatment: wide excision, continued follow-ups



Figure 2.44 Oral Melanoma

- **Oral Squamous Cell Carcinoma** - variable presentation; initially a leukoplakia, erythroplakia, or erythroleukoplakia; later may form an exophytic or endophytic growth; most commonly affects the ventral or lateral tongue, or floor of mouth
 - Must know: caused by oncogene or tumor suppressor gene inactivation which is driven by use of tobacco and/or alcohol
 - HPV 16 and 18 have been identified as risk factors for oropharyngeal cancer
 - **Plummer Vinson Syndrome** is a risk factor for OSCC, and presents with mucosal atrophy, dysphasia, and iron deficiency anemia (*think: The Plum(b)er has a MAD IDEAL!*)
 - Treatment: excision or cancer radiation therapy with prognosis depending on stage (based on tumor size, lymphatic spread, and presence of metastases)

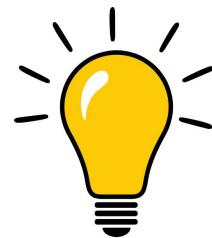


Figure 2.45 OSCC

- **Oral Verrucous Carcinoma (OVC)** - a variant of OSCC; slow growing exophytic mass that appears warty and pebbly; OVC accounts for 2-12% of all oral carcinomas
 - Must know: associated with smokeless tobacco, and HPV strains 16 and 18
 - Treatment: surgical excision with good prognosis



Figure 2.46 OVC

Cancer	5-year Survival Rate
OVC	50%
OSCC	50%
OBCC	100%*
Oral Melanoma	10-25%

*in cases that have not spread to other sites

3 Connective Tissue Conditions

Having completed a detailed discussion of mucosal lesions, we can now travel one layer deeper and discuss different connective tissue conditions. Specifically, this section will consist of information about benign and malignant connective tissue tumors. Connective tissues are particularly interesting because they can be divided into two overarching categories: reactive, or forming as a result of reacting to a trauma, and neoplastic, or new and abnormal growth. Because there are many types of connective tissue, a further distinguishing category characterizes the condition based on the connective tissue type. One last piece of information to note is that because connective tissue is deep to the mucosal membrane, its conditions often appear as lumps and bumps in the mouth.

- **Benign CT tumors:**

- Leiomyoma: neoplasm (new or abnormal growth) of smooth muscle cells
- Lipoma: neoplasm of fat cells; most common on the buccal mucosa
- Rhabdomyoma: neoplasm of skeletal muscle cells

- **Denture-Induced Fibrous Hyperplasia -**

reactive lesions due to a poorly fitting denture

- Must know: there are two main types of this condition
 - Epulis fissuratum: occurs at the base of the vestibule
 - Papillary hyperplasia: occurs on palate; more likely due to poorly cleaned dentures



Figure 3.01 Denture-Induced Fibrous Hyperplasia

- **Fibroma** - aka hyperplastic scar, irritation fibroma, or traumatic fibroma; a benign benign fibroid tumor caused by chronic trauma or irritation; are among the most common benign connective tissue tumors
 - Must know: oral fibroma is specifically known as fibrous hyperplasia of oral mucosa



Figure 3.02 Fibroma

- **Fibromatosis** - benign but aggressive neoplasm of fibroblasts that has high recurrence and is difficult to eliminate



Figure 3.03 Fibromatosis

- **Drug-Related Gingival Hyperplasia** - the enlargement of the gingiva as side effect of certain medications
 - Must know: caused by **DCC: Dilantin** (anticonvulsant), calcium channel blockers, and cyclosporine (an immunosuppressant)
 - This condition is very high yield for the INBDE!
 - Treatment: gingivectomy; discontinued drug use, if possible per physician



Figure 3.04 Gingival Hyperplasia

- **Granular Cell Tumor** - benign neoplasm of Schwann cells, the cells forming the myelin sheath in the peripheral nervous system, that most commonly occurs on anterior dorsal tongue
 - Must know: called a granular cell tumor due to the granular cytoplasm of the tumor cells
 - Pseudoepitheliomatous hyperplasia (PEH) histology has highly proliferative appearance, mimicking squamous cell carcinoma
 - The tumor variant on gingiva of newborn is called congenital epulis of newborn (resembles granular cell tumor but without PEH)



Figure 3.05 Granular Cell Tumor

- **Neurofibroma** - benign neoplasm of Schwann cells and fibroblasts
 - Must know: **neurofibromatosis type 1** (or **Von Recklinghausen's Disease**) is a syndrome characterized by:
 - Multiple neurofibromas (that can transform into neurofibrosarcomas)
 - Multiple skin freckles (cafe au lait spots)
 - Axillary freckles (Crowe's sign)
 - Iris freckles (Lisch spots)
 - ◆ **Think: Von Frecklinghausen's Disease**



Figure 3.06 Neurofibroma



Figure 3.08 Pyrogenic Granuloma

- **Nodular Fasciitis** - benign neoplasm of fibroblasts that rarely recurs after excision
 - ▶ Must know: contrasted to fibromatosis which is hard to eliminate



Figure 3.07 Nodular Fasciitis

- **Schwannoma (neurilemmoma)** - benign neoplasm of Schwann cells; histology reveals a highly cellular Antoni A region whose cells may pallisade to form "lines of scrimmage" aka Verocay bodies, and a less cellular Antoni B region

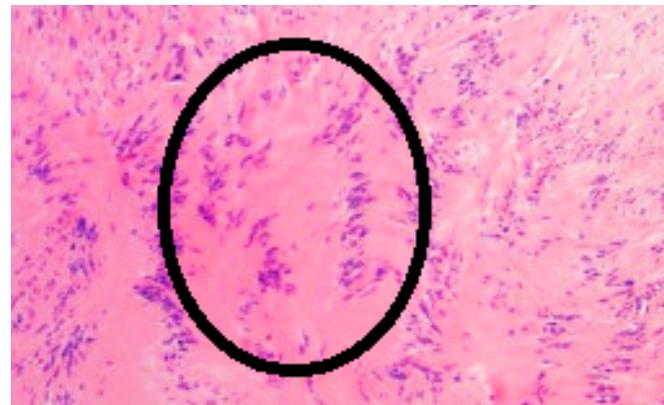


Figure 3.09 Schwannoma

- **Pyogenic Granuloma** - benign hyperplasia of capillaries resulting in a bright red lesion commonly on gingiva; histology resembles granulation tissue
 - ▶ Must know: seen in patients with elevated hormone levels — pregnancy or puberty
- **Peripheral Ossifying Fibroma** - a reactive growth that resembles a fibrous form of pyogenic granuloma
 - ▶ Despite its name, this lesion is not related to central ossifying fibroma (better known as the less ambiguous cemento-ossifying fibroma)

- **Traumatic Neuroma** - a tangle of neural fibers and connective tissue that develops following nerve injury, usually in the mental foramen
- **Multiple Endocrine Neoplasia** - a rare disorder characterized by
 - ▶ Multiple neuromas
 - ▶ Medullary thyroid cancer
 - ▶ Pheochromocytoma of adrenal gland

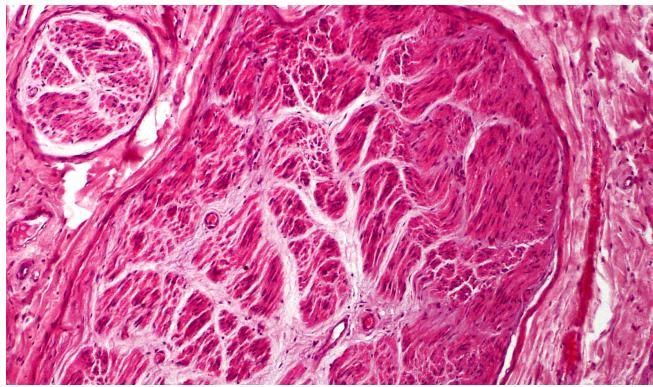


Figure 3.10 Traumatic Neuroma

Malignant CT Tumors

Let's wrap up our discussion of connective tissue lesions with learning about malignant CT tumors! For many of these conditions, they are malignant versions of the benign tumors discussed in the previous CT section, so they will be familiar! Finally, note that because we are now in the connective tissue, the suffix sarcoma will be used, rather than carcinoma, as was seen for mucosal lesions.

- **Neurofibrosarcoma** - aka malignant peripheral nerve sheath tumor; a malignant proliferation of Schwann cells

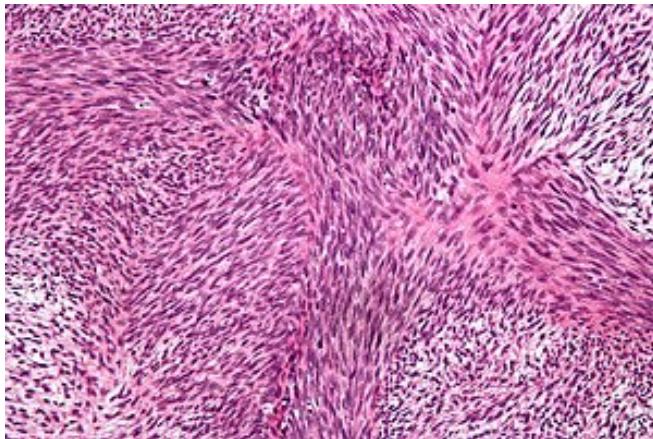


Figure 3.11 Neurofibrosarcoma histology

- **Fibrosarcoma** - a malignant proliferation of fibroblasts
 - ▶ Must know: these tumors are rarely cured by surgical removal, and recurrence and metastasis are common



Figure 3.12 Fibrosarcoma

- **Kaposi's Sarcoma** - a malignant proliferation of endothelial cells caused by HHV 8 and occurring as a complication of AIDS
 - ▶ Unlike the other sarcomas that can vary in their oral appearances, Kaposi's Sarcoma has a very characteristic appearance: a purple lesion



Figure 3.13 Kaposi's Sarcoma

- **Malignant CT Tumors -**

- Leiomyosarcoma: a malignant proliferation of smooth muscle cells
- Liposarcoma: a malignant proliferation of fat cells
- Rhabdomyosarcoma: a malignant proliferation of skeletal muscle cells

4 Salivary Gland Diseases

Still focusing on the sub-mucosa, we now shift our attention to salivary gland diseases, which can also be categorized as reactive, benign, and malignant conditions. Let's start by learning about reactive lesions affecting both the major and minor salivary glands!

Reactive Salivary Gland Diseases

- **Mucous Extravasation Phenomenon -** aka mucocele; a lesion caused by the traumatic rupture of salivary ducts, resulting in the release of mucous into adjacent connective tissue
 - Must know: commonly found on the lower lip. Depending on its size, mucoceles can appear blue due to tissue cyanosis, vascular congestion, and translucency of underlying fluid (*think: CCF*)
 - This lesion is termed "ranula" which means frog's belly when it occurs on the floor of the mouth
 - Treatment: complete excision; must remove entire affected salivary gland, or risk higher chance of recurrence



Figure 4.01 Ranula Lesion

- **Mucous Retention Cyst -** a true cyst

(epithelium lined) that forms due to blockage of a salivary duct by a sialolith, or calcified mass



Figure 4.02 Mucus Retention Cyst

- **Necrotizing Sialometaplasia -** a rapidly

expanding ulcerative lesion usually located towards the back of the hard palate; due to ischemic necrosis of minor salivary glands as a result of trauma or local anesthesia that has a vasoconstrictor (e.g. epinephrine))

- Treatment: self heals in 6-10 weeks



Figure 4.03 Necrotizing Sialometaplasia

- **Sarcoidosis** - a hyperimmune multi-systemic disease leading to formation of granulomas in the lung with rare oral involvement of salivary glands and mucosa; the cause is unknown but speculated to be related to environmental exposure or bacteria such as mycobacteria
 - Must know: Orally, this condition can lead to xerostomia, a salivary gland condition resulting in dry mouth
 - There are two syndromes linked to sarcoidosis:
 - ◆ **Lofgren's Syndrome:** characterized by arthritis, bilateral hilar lymphadenopathy, and erythema nodosum Think: LANA (L= Lofgren Syndrome; A = Arthritis, N = erythema Nodosum; A = bilateral hilar lymphadenopathy)
 - ◆ **Heerfordt's Syndrome** (also known as uveoparotid fever): characterized by anterior uveitis, parotid gland enlargement, facial nerve palsy, and fever Think: HAPPy fever (H = Heerfordt Syndrome; A = anterior uveitis; P = parotid gland enlargement; P = facial nerve Palsy)
 - Treatment: corticosteroids



Figure 4.04 Sarcoidosis

- **Sinus Retention Cyst** - also known as an antral pseudocyst, this cyst is caused by the blockage of glands in the sinus mucosa
 - Must know: this condition can only be observed radiographically, and appears as a bump along the base of the sinus floor
 - Treatment: none needed

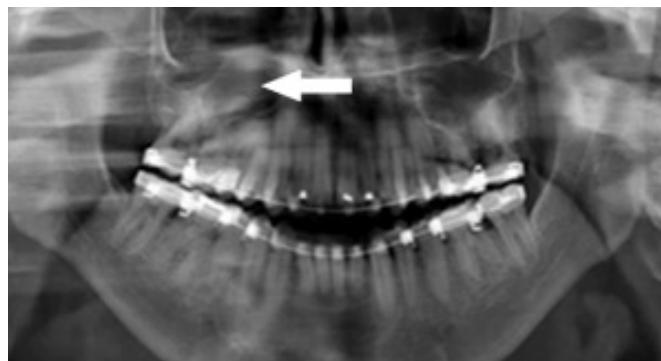


Figure 4.05 Sinus Retention Cyst

- **Sjogren's Syndrome** - an autoimmune destruction of salivary and tear glands; characterized by keratoconjunctivitis sicca (dry eye) and xerostomia (dry mouth)
 - Must know: high-yield; has two forms
 - Primary: symptoms in the absence of another autoimmune disease
 - Secondary: symptoms in the presence of another autoimmune disease (usually rheumatoid arthritis, which typically involves TMJ disorders)
 - Common antibodies include antinuclear antibody (ANA), rheumatoid factor (RF), Sjogren Syndrome A (SSA) and Sjogren Syndrome B (SSB)
 - Think: ABCD (A = ANA, SSA; B = SSB; C = healthy Cells targeted; D = dry eye and mouth)
 - Biopsy of labial salivary gland reveals extensive lymphocytic infiltrate
 - Poses increased risk of MALT lymphoma (mucosal associated lymphoid tissue), a form of extranodal NHL lymphoma
 - Treatment: symptomatic



Figure 4.06 Sjogren's Syndrome

Benign Salivary Gland Diseases

Having discussed reactive lesions, we're ready to discuss benign lesions, which are overall similar to reaction lesions. The main distinguishing quality, therefore, is not clinical differences, but microscopic differences.

- **Monomorphic Adenoma** - an encompassing term to describe multiple benign salivary gland tumors that are composed of a single cell type; includes basal cell adenoma, canalicular adenoma, myoepithelioma, and oncocytic tumor
 - ▶ Contrasted with the multiple cell types involved in pleomorphic adenoma
 - ▶ Oral pathologists prefer to refer to the specific tumor rather than use this term



Figure 4.07 Monomorphic Adenoma

- **Pleomorphic Adenoma** - the most common benign salivary gland tumor developing in the parotid gland (majority of cases) and submandibular gland
 - ▶ Must know: termed 'pleomorphic', this "mixed tumor" adenoma is composed of a mixture of cell types (connective tissue and epithelial cells)
 - Clinically, this tumor can vary widely in size and has firm rubbery swelling



Figure 4.08 Pleomorphic Adenoma

- **Warthin's Tumor** - aka papillary cystadenoma lymphomatosum (this name tells you a lot about the histology!); a benign cystic tumor composed of oncocytes (epithelial cells with excessive number of mitochondria), and lymphoid cells
 - ▶ Must know: this tumor is most commonly found in the parotid gland of older men especially those who smoke



Figure 4.09 Warthin's Tumor

Malignant Salivary Gland Diseases

Let's wrap up our discussion of salivary gland diseases. Just like with benign salivary gland lesions, malignant lesions are characterized by microscopic differences.

- **Mucoepidermoid Carcinoma** - the most common salivary gland malignancy
 - Must know: these low-grade cancers are composed of mucosal and epithelial cells; most commonly affects parotid gland, and minor salivary glands
 - This is the most important condition to know from this section!



Figure 4.10 Mucoepidermoid Carcinoma

- **Polymorphous Adenocarcinoma** - also called polymorphous low-grade adenocarcinoma (PLGA) in some literature but high grade cases have been observed; the second most common salivary gland malignancy in minor glands
 - Must know: the prefix "adeno" refers to gland



Figure 4.11 Polymorphous Adenocarcinoma

- **Adenoid Cystic Carcinoma** - a rare cancer that most commonly forms in salivary glands or other head/neck regions, but can also occur in other regions (breast, skin, cervix)
 - Must know: histologically, a cribriform or Swiss cheese pattern of cells can be observed
 - This cancer has high lethality with a 15-year survival rate of 10%

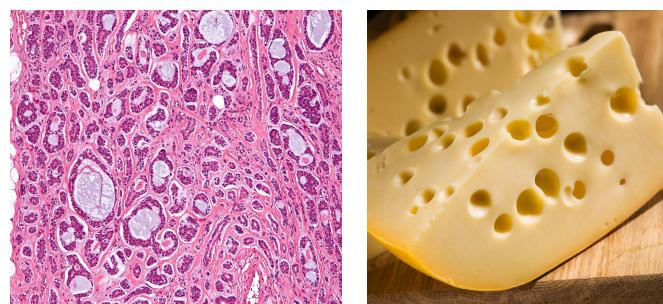


Figure 4.12 Adenoid Cystic Carcinoma

Lymphoid neoplasms are malignant neoplasms of lymphoid cells. These neoplasms include lymphoma, myeloma, and lymphoid leukemia. While lymphomas are neoplastic masses that develop within lymph nodes (though some like MALT lymphoma are extranodal), leukemias start within neoplastic bone marrow and involve the production of malignant white blood cells that circulate.

5 Lymphoid Neoplasms

- **Hodgkin's Lymphoma** - a lymphoma affecting a collection of connected lymph nodes presenting as lymphadenopathy; fever, weight loss, and night sweats may occur; oral involvement is rare
 - Must know: Reed-Sternberg cells (large, malignant B cells with multiple nuclei resembling owl eyes) are pathognomonic
 - Treatment: chemotherapy/radiotherapy

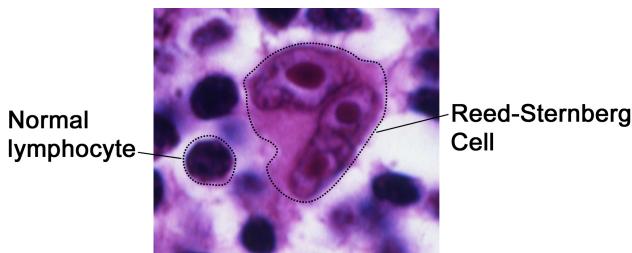


Figure 5.01 Reed-Sternberg cells

- **Non-Hodgkin's Lymphoma (NHL)** - a lymphoma affecting non-connected lymph nodes presenting as lymphadenopathy; fever, weight loss, and night sweats may occur; Reed-Sternberg cells are not present
 - Must know: NHL is a neoplasm of B or T cells, and Burkitt's Lymphoma is a type of B cell NHL characterized by *THe LiP Bone*:
 - Tooth mobility
 - Halted root development
 - Lip paresthesia
 - Pain and swelling
 - Bone marrow involvement

- Treatment: chemotherapy/radiotherapy



Figure 5.02 Burkitt Lymphoma

- **Leukemia** - a cancer of early blood-forming cells in the bone marrow: granulocytes, lymphocytes, megakaryocytes, and NK cells
 - Must know: leukemia is classified by cell lineage (myeloid or lymphoid) and whether the disease is acute or chronic
 - The different forms can be ranked by the age they are most likely to impact (from youngest to oldest): acute lymphocytic leukemia (ALL) in children → chronic myelogenous leukemia (CML) in adults → acute myelogenous leukemia (AML) → chronic lymphocytic leukemia (CLL)
 - ◆ **Think: ALL CaMeLs Are ChiLL**
 - The clinical signs of leukemia are based on a deficiency of normal blood cells and include bleeding (platelets), fatigue (RBCs), and infection (WBCs)

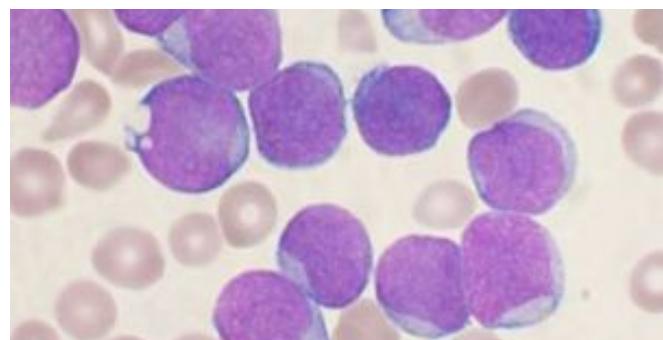


Figure 5.03 Leukemia

- **Multiple Myeloma** - aka plasma cell myeloma; a cancer affecting the antibody producing plasma cells
 - ▶ Must know: this can be observed radiographically as punched out radiolucencies usually in the skull (**think: Mixed Martial (MM) artists Punch the skull**)
 - Another characteristic sign of multiple myeloma is amyloidosis, the accumulation of amyloid proteins, that develop from antibody light chains
 - ▶ Treatment: chemotherapy with poor prognosis



Figure 5.03 MM Radiolucencies

- **Calcifying Odontogenic Cyst** - aka Gorlin cyst; a benign cyst occurring in **gnathic** bones appearing as a unilocular, mixed radiolucency with scattered radiopacties due to irregular calcifications
 - ▶ Must know: this rare and unpredictable cyst involves **ghost** cells, epithelial cells where keratin replaces the nucleus and which may undergo calcification.
 - ▶ Remember by "C-O-C triple G"



Figure 6.01 Gorlin cyst

- **Dentigerous Cyst** - aka follicular cyst; the second most common type of odontogenic cyst that most commonly affects impacted canines and third molars; appears as radiolucency attached to the cement-enamel junction due to accumulation of fluid between the crown and reduced enamel epithelium
 - ▶ Must know: called an eruption cyst if it affects erupting teeth
 - ▶ Treatment: excision, but this could give rise to a future odontogenic tumor

6 Odontogenic Cysts and Tumors

We are now ready to discuss conditions directly impacting tooth formation! Residual odontogenic epithelium can form cystic lesions at any time, so there is an interesting variety of conditions discussed in this section.

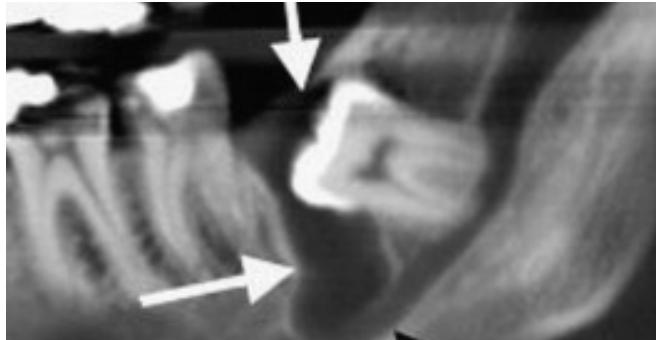


Figure 6.02 Dentigerous Cyst



Figure 6.04 Newborn Gingival Cyst

- **Gingival Cyst (adults)** - a gingival cyst formed near the mandibular canine and premolar regions
 - ▶ Must know: this cyst is the soft tissue counterpart of lateral periodontal cysts, and has no radiolucency
 - ▶ Treatment: excision



Figure 6.03 Adult Gingival Cyst

- **Gingival Cyst (newborn)** - raised nodules that appear as small, isolated, or multiple cysts
 - ▶ Must know: the rests of dental lamina epithelialize these lesions, making them true cysts, which have different names depending on where in the mouth they form
 - Bohn's nodules: lateral palate
 - Epstein's pearls: midline palate
 - ▶ Treatment: none needed as the cysts involute during aging



Figure 6.05 Lateral Periodontal Cyst

- **Odontogenic Keratocyst (OKC)** - a rare, aggressive, and recurrent cyst that commonly forms in the posterior ascending mandibular ramus
 - ▶ Must know: histology reveals a thin corrugated parakeratinized epithelium; OKCs seen in the fatal **Gorlin Syndrome** (aka nevoid basal cell carcinoma syndrome) which presents as:
 - Multiple OKCs
 - Multiple Basal Cell Carcinomas
 - Calcified falx cerebri
 - ▶ Treatment: aggressive enucleation



Figure 6.06 OKC

- **Primordial Cyst** - a cyst that forms where a tooth should have formed (**early on, in primordial matter**) but is missing
 - ▶ Must know: this cyst is most common in the mandibular third molar region
 - ▶ Treatment: complete removal

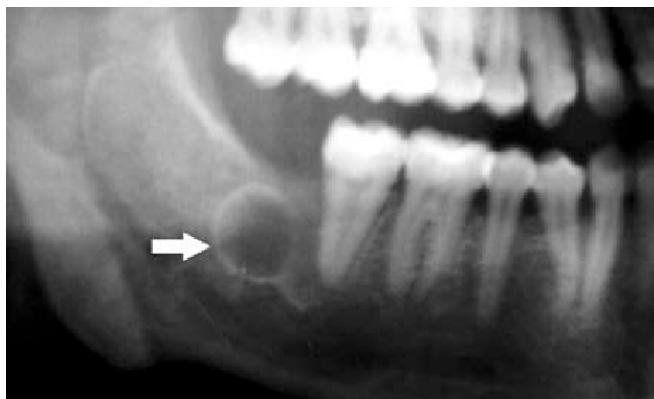


Figure 6.07 Primordial Cyst

- **Radicular Cyst** - aka periapical cyst; the most common odontogenic cyst; a periapical cyst resulting from inflammatory stimulation of epithelial remnants of the periodontal ligament that appears as a periapical radiolucency
 - ▶ Must know: violation of the pulp by bacteria leads to inflammation then pulpal necrosis forming a non-vital tooth
 - Acute inflammation leads to an abscess, while chronic inflammation leads to granuloma formation
 - Epithelial Rests of Malassez (ERM), or residual cells from tooth development, from Hertwig's Epithelial Root Sheath (HERS) encapsulate the lesion within the pocket of inflammation, allowing it to be a true cyst (**HERS → ERM → cyst**)
 - ▶ Treatment: root canal, apicoectomy, or tooth extraction with curettage

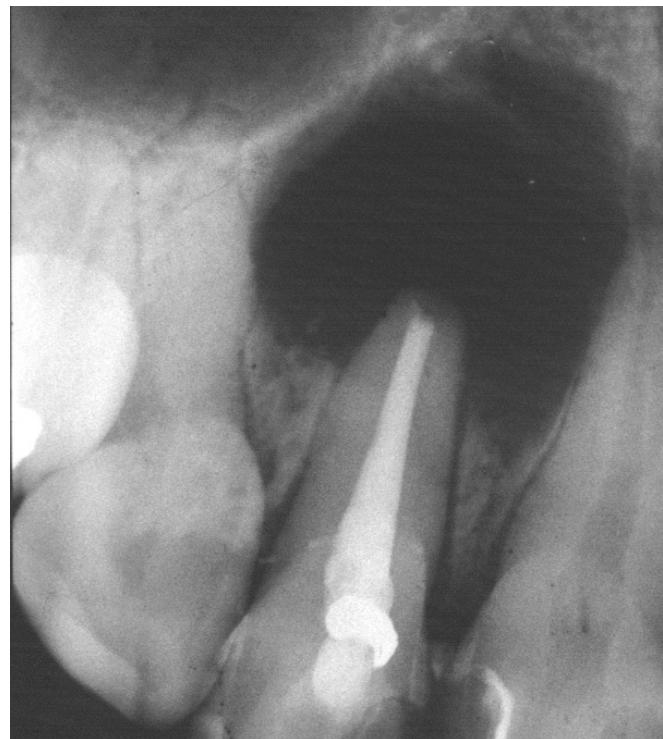


Figure 6.08 Radicular Cyst

Odontogenic Tumors

Odontogenic tumors are derived from the bone, and are unique to the jaw because they are derived from epithelial and mesenchymal cells involved in the formation of teeth. Note that these tumors do appear radiographically similar to odontogenic cysts, so use the images as more of a reference rather than exact representations of the tumors.

- **Conventional Ameloblastoma** - aka multicystic ameloblastoma; a benign but very aggressive form of ameloblastoma that erodes through tooth roots and the cortical plate; arises from odontogenic epithelium
 - ▶ Contrast with unicystic ameloblastoma and peripheral ameloblastoma which have much lower recurrence rates
 - ▶ Must know: very HIGH YIELD; must be included in the differential diagnosis for a multilocular radiolucency (bubbly appearance, dark shadows) in the posterior mandible
 - ▶ The differential includes MOCHA: Odontogenic Myxoma, Odontogenic keratocyst (OKC), Central giant cell granuloma (CGCG), Hemangioma (vascular lesions), Ameloblastoma
 - ▶ Treatment: wide excision as too conservative can lead to high recurrence



Figure 6.09 Ameloblastoma

- **Adenomatoid Odontogenic Tumor (AOT)** -

a rare, benign, painless, noninvasive, and slow growing lesion often misdiagnosed as an dentigerous cyst; histology reveals epithelial duct-like spaces (hence adeno-) as well as enameloid material; appears as a radiolucency but may have a fluffy radiopacity

- ▶ Must know: commonly found in anterior maxilla affecting impacted canines
- ▶ Treatment: excision with good prognosis

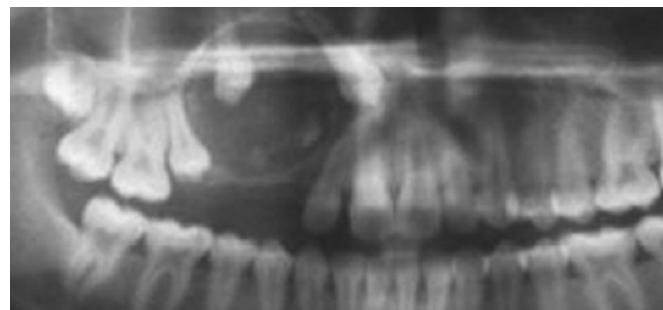


Figure 6.10 AOT

- **Calcifying Epithelial Odontogenic Tumor (CEOT)** - aka Pindborg tumor; characterized by scattered-dense areas of calcification that appear as a "driven snow" radiolucency

▶ Must know: histology reveals amorphous pink amyloid proteins surrounded by concentric calcifications called Leisegang rings, are observed

- ▶ Treatment: surgical excision with good prognosis



Figure 6.11 CEOT Histology

- **Ameloblastic Fibroma** - a rare benign mixed epithelial and mesenchymal tumor that often occurs in children and teens (*adolescent ameloblastic fibroma*)
 - ▶ Must know: this tumor is most common in the posterior mandible, in myxomatous connective tissue
 - ▶ Treatment: surgical excision



Figure 6.12 Ameloblastic Fibroma

- **Gardner Syndrome** involves multiple odontomas and intestinal polyps; patients diagnosed with this syndrome have a higher risk of early colorectal cancer (*think odonTOMATO → the opaque lesion is buried in tissues like a tomato in a GARDEN*)



Figure 6.16 Odontoma

- **Ameloblastic Fibro-Odontoma** - a benign mixed epithelial and mesenchymal tumor that has features of ameloblastoma fibroma and odontoma
- **Odontoma** - a benign mixed epithelial and mesenchymal hamartoma (abnormal growth of multiple cells in contrast to the single cell lineage of neoplasms); this radiopaque lesion is composed of masses of enamel and dentin that can block eruption and cause impaction
 - ▶ Must know: commonly tested; has two forms, compound and complex
 - Compound: mostly in anterior region, and is just a bunch of miniature teeth
 - Complex: mostly in posterior region, and appears more like a messy conglomerate mass of tissue



Figure 6.13 Cementoblastoma

- **Central Odontogenic Fibroma (COF) -**
appears as an asymptomatic expansion of the cortical plate of the mandible or maxilla, this tumor has dense collagen with strains of epithelium
 - ▶ Must know: has two forms, central or peripheral
 - Central: occurs in bone and has a well-defined multilocular radiolucency (similar to ameloblastoma)
 - Peripheral: occurs in gum tissue, so no radiolucency is observed as no bone has eroded



Figure 6.14 COF

- **Odontogenic Myxoma** - aka myxofibroma; this tumor has myxomatous connective tissue that has a pulp-like material with very little collagen (**slimy** stroma)
 - ▶ Must know: radiographically, this has a **messy** radiolucency with a honeycomb pattern and **unclear** borders
 - ▶ Treatment: surgical excision with moderate recurrence



Figure 6.15 Odontogenic Myxoma

Let's review the differential for multilocular radiolucencies. Recall the MOCHA mnemonic stands for Odontogenic **M**yxoma, **O**dontogenic keratocyst (OKC), **C**entral giant cell granuloma (CGCG), **H**emangioma (vascular lesions such as aneurysmal bone cyst), **A**meloblastoma. Remember, this is only based on the most common presentations.

- ▶ Ameloblastoma and central giant cell granulomas (discussed in the next section) are expansile and displace teeth
- ▶ Ameloblastoma classically affects the posterior mandible while central giant cell granuloma affects the anterior mandible.
- ▶ Odontogenic keratocysts tend to grow along the mandibular arch without displacing teeth. They aren't expansile unless infected such as during a biopsy.
- ▶ Central giant cell granulomas have a ghost-like wispy septations in contrast to the straight, angular septations seen in odontogenic myxoma.
- ▶ Odontogenic myxoma has poorly defined margins in contrast to the other lesions.
- ▶ Aneurysmal bones cysts (discussed in the next section) are classically seen in children as mass that develops over a couple weeks. They may be associated with the mandibular canal.

7 Bone Lesions

We've officially reached our final topic in INBDE oral pathology! We'll be discussing fibro-osseous, giant cell, inflammatory, and malignant bone lesions as part of this final section. Starting with the benign fibro-osseous lesions, benign lesions in which fibrous tissue (radiolucent) replaces bone but then develop bony islands (radiopaque).

- **Cemento-Ossifying Fibroma (COF)** - aka central ossifying fibroma (but this name isn't preferred since it is unrelated to peripheral ossifying fibroma); an odontogenic tumor of mesenchymal origin often grouped with the fibro-osseous bone lesions; this lesion is composed of fibroblastic stroma (radiolucent) in which foci of mineralized products are formed (central radiopacity)
 - Must know: expansile; occurs between the premolar and molar regions of the mandible
 - Similar to the distinct entity of juvenile ossifying fibroma variant which presents in younger patients with aggressive and rapid growth (COF is seen in middle aged patients)
 - Treatment: surgical excision



Figure 7.01 Central Ossifying Fibroma

- **Fibrous Dysplasia** - a fibro-osseus lesion in which scar-like fibrous tissue grows in place of normal bone, and usually does not stop growing until after puberty

- Must know: very slowly expansile; radiographically, has a ground-glass appearance with soft radiopaque areas throughout the lesion

- **McCune-Albright Syndrome (MAS)** is characterized by polyostotic fibrous dysplasia (affecting multiple bones), as well as cutaneous café au lait spots, and endocrine abnormalities (such as precocious puberty)

◆ *Use mnemonic MASEBS to remember MAS affects Bone, Endocrine system, and Skin*

- Treatment: surgical re-contouring, preferably after puberty when the lesion stops growing

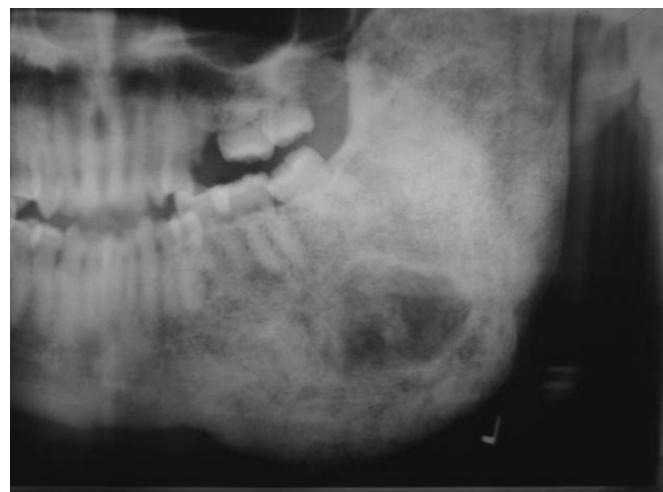


Figure 7.02 Fibrous Dysplasia

- **Periapical Cemento-Osseous Dysplasia (PCOD)** - this is a fibro-osseous lesion of unknown origin characterized by fibrous tissue replacing normal bone tissue, commonly at the apices of vital mandibular anterior teeth
 - ▶ Must know: while the pulps may radiographically look necrotic, the affected teeth are vital (contrast with condensing osteitis which is associated with non-vital teeth)
 - This is more prevalent in middle-aged black females
 - This condition starts out looking radiolucent, but transitions to being radiopaque with a radiolucent border
 - ▶ Treatment: none



Figure 7.04 PCOD

- **Osteoblastoma** - a circumscribed radiopaque mass of osteoblasts and bone
 - ▶ Treatment: surgical excision

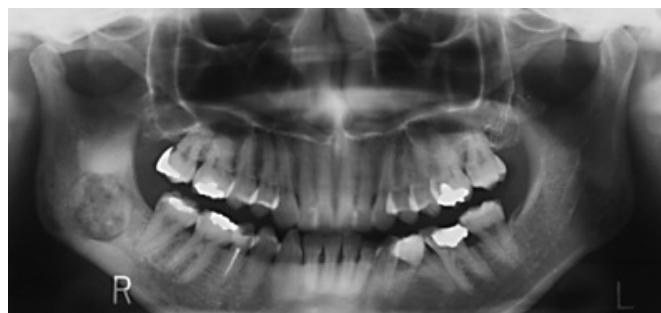


Figure 7.03 Osteoblastoma

Giant Cell Lesions

Giant cell bone lesions are termed as such because biopsy reveals multinucleate giant cells, large cells resulting from the fusion of smaller constituent cells. Osteoclasts are an example of physiologic multinucleate giant cells. Multinucleated giant cells may also form as part of an immune response to contain foreign bodies or other pathogens that can't be readily eliminated (leading to granulomas seen in various conditions), in the setting of autoimmune disease, or in malignancy (Reed-Steinberg cells in Hodgkin Lymphoma).

- **Aneurysmal Bone Cyst** - a benign blood-filled pseudocyst that classically presents in younger patients as a rapidly enlargement (over weeks) of posterior mandible
 - ▶ Must know: this lesion has a multilocular radiolucency, and is commonly found in the posterior mandible
 - An aspiration biopsy is the first step for diagnosing a condition like this to determine, if this is, in fact, a vascular bone cavity filled with blood
 - ▶ Treatment: surgical excision

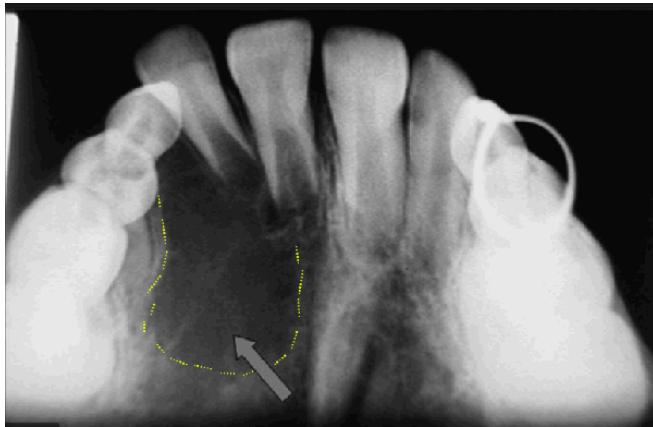


Figure 7.05 Aneurysmal Bone Cyst

- **Central Giant Cell Granuloma** - an expansile osteolytic neoplasm composed of fibroblasts and multinucleated giant cells; appears as a radiolucency with **thin wispy** septations
 - ▶ Must know: commonly found in the anterior mandible
 - ▶ Peripheral giant cell granuloma has the same histological appearance but presents on the gingiva as a **red/purple** mass
 - ▶ Treatment: surgical excision

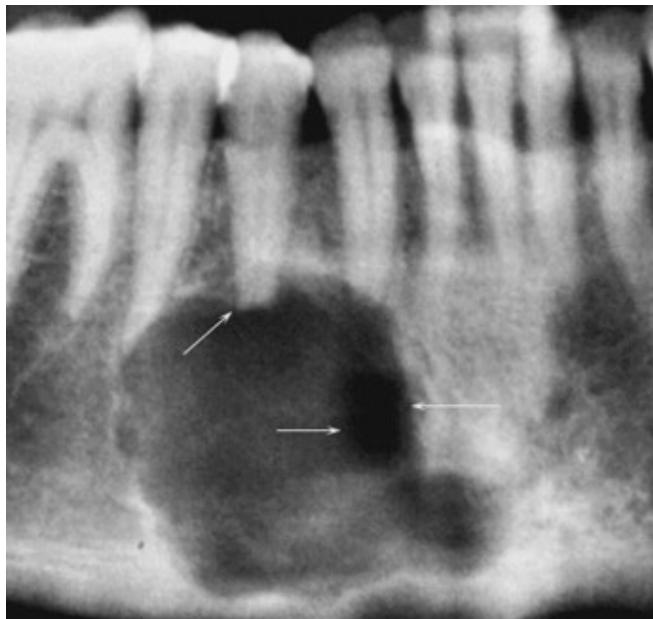


Figure 7.06 Central Giant Cell Granuloma

- **Cherubism** - an autosomal dominant disorder characterized by enlargement and prominence of the mandible and maxilla as bone is replaced by a fibrous granuloma containing multinucleated giant cells
 - ▶ Must know: this condition has **symmetrical** **bilateral** swelling (**Bilateral cherubism**), and expansile bilateral multilocular radiolucencies that stop growing after puberty (unlike fibrous dysplasia that has unilateral swelling)
 - Can think of cherubism as being multiple central giant cell granulomas



Figure 7.07 Cherubism

- **Hyperparathyroidism** - excessive levels of parathyroid hormone results in multiple bone lesions that look similar to CGCs
 - ▶ Must know: **Brown tumor** is the name of the lesion, which forms due to excess osteoclast activity
 - As a result of excess osteoclast activity, elevated alkaline phosphatase levels are observed. Abnormal calcium and phosphate levels are also seen in contrast to Paget's disease.
 - This condition can lead to **Von Recklinghausen's disease of bone** NOT to be confused with Von Recklinghausen's Disease/neurofibromatosis

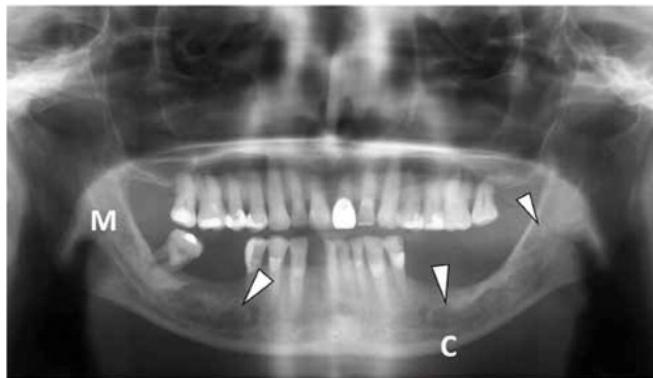


Figure 7.08 Hyperparathyroidism

- **Langerhans Cell Histiocytosis** - aka idiopathic histiocytosis; a rare cancer with abnormal deposition of Langerhans cells (a histiocyte derivative; immune cells normally found in the skin) in skin and bone
 - ▶ Must know: this condition presents as a skin rash with punched/scooped out radiolucencies that cause a floating teeth appearance (think: Levitating Langerhans)
 - ▶ Treatment: surgical excision, radiation, and chemotherapy

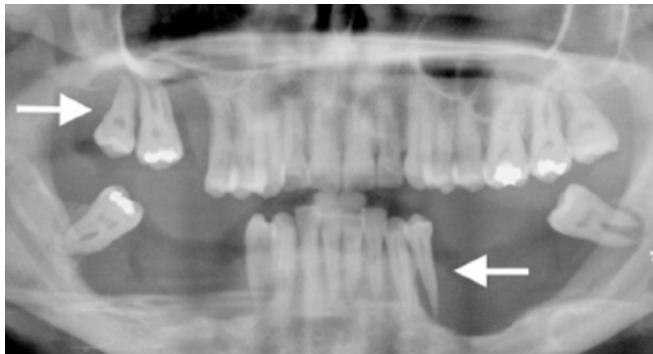


Figure 7.09 Langerhans Cell Disease

- **Paget's Disease** - aka osteitis deformans; a disorder of bone remodeling (skull, jaw, spine, femur) involving excess bone resorption followed by excess deposition; presents as symmetrical enlargement of bones with a cotton wool appearance of radiograph

- ▶ Must know: distinguished from hyperparathyroidism because all labs are normal other than elevated alkaline phosphatase levels (due to increased breakdown of bone)
 - Because of enlargement, dentures, or even hats, become too tight (think pinching Paget's)
- ▶ Treatment: bisphosphonates, calcitonin

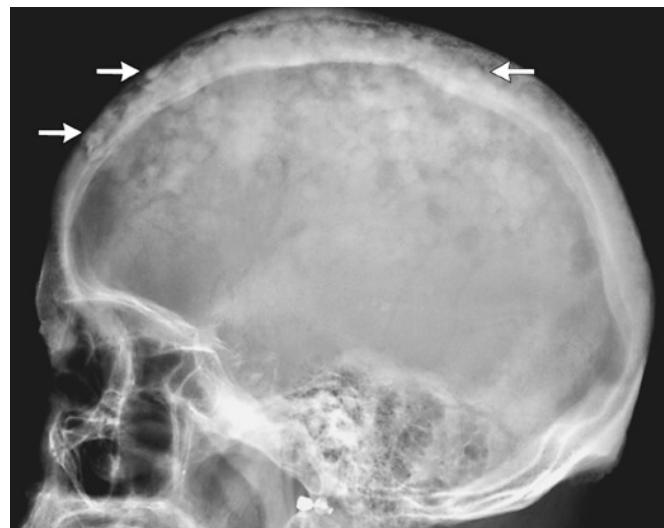


Figure 7.10 "Cotton Wool" Skull

Bone Inflammatory Lesions

Inflammation of jaw bones is common, and most lesions are of periodontal or endodontic origin. Other lesions form in response to trauma.

- **Acute Osteomyelitis** - a clinical term for a new infection in bone most commonly due to odontogenic infection and trauma
 - ▶ Must know: infection and inflammation first start in the medullary space, involving cancellous, or spongy, bone. To observe any radiolucency, the infection needs to have spread to cortical bone, periosteum, and soft tissues, otherwise we won't see much radiographically
 - Noteworthy symptoms include deep

- pain, high or intermittent fever, and paresthesia or anesthesia of IAN. Note that teeth do NOT become loose — this is caused by periodontitis
- Treatment: antibiotics and drainage



Figure 7.11 Acute Osteomyelitis

- **Bisphosphonate-Related Osteonecrosis of the Jaws (BRONJ)** - current or previous treatment of bisphosphonates is associated with the formation of exposed bone that does not heal quickly after trauma such as from extractions or implants
- Must know: this condition has a higher risk of development with IV administered bisphosphonates (drugs that end in -dronate) which is the common route for the treatment of metastatic bone cancer and multiple myeloma
 - Oral bisphosphonates are more commonly used for osteoporosis
- Treatment: chlorhexidine (CHX) rinse, antibiotics, conservative surgery



Figure 7.12 BRONJ

- **Chronic Osteomyelitis** - a bone infection persisting despite treatment, resulting in recurring drainage and intense pain
 - Must know: has diffuse mottled radiolucency, since it has now been able to impact cortical bone
 - Garre's osteomyelitis is a condition that involves chronic osteomyelitis and proliferative periostitis as the body tries to heal (**think: GO COPP!**)
 - Proliferative periostitis is bone formation resembling onion skin
 - Treatment: antibiotics and debridement

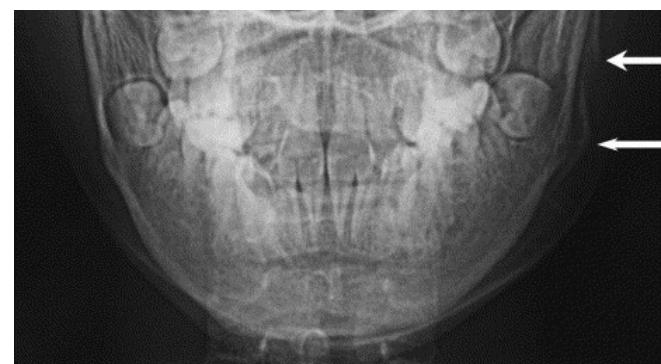


Figure 7.13 Proliferative Periostitis

- **Focal Sclerosing Osteomyelitis** - aka condensing osteitis; a periapical lesion resulting from low-grade inflammation such as chronic pulpitis
 - Must know: a wall of diffuse dense bone forms to "wall off" the infection

- Treatment: none, other than addressing the cause of infection, such as performing a root canal



Figure 7.14 Condensing Osteitis

Diffuse Sclerosing Osteomyelitis - similar to the previous condition, but on a wider scale

- Must know: this condition may lead to jaw fracture and osteomyelitis
- Treatment: none, other than addressing the cause of infection

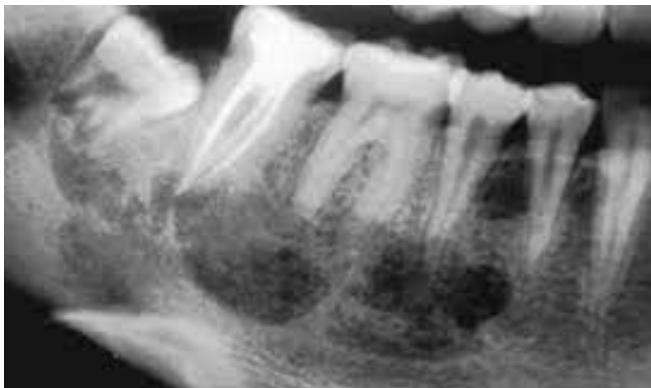


Figure 7.15 Diffuse Sclerosing Osteomyelitis

Bone Malignant Lesions

We've reached the final section in our oral pathology notes! Malignancies occurring in bone encompass a lot of what we have already discussed, such as sarcomas, lymphomas, and leukemias. While we'll get into specific symptoms as we discuss the conditions, know

that paresthesia is the most common symptom (due to impingement of the inferior alveolar nerve) and is also most frequently tested as related to bone malignancies on the INBDE.

- **Chondrosarcoma** - sarcoma of jaws when tumor cells produce new cartilage
 - Must know: commonly involves the condyle due to its cartilaginous origin and has a **sunburst pattern**

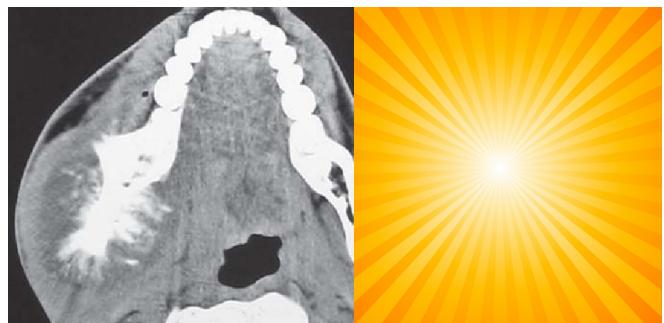


Figure 7.16 Chondrosarcoma

- **Ewing's Sarcoma** - sarcoma of long bones involving undifferentiated mesenchymal cells called round cells
 - Must know: rarely affects the jaws; most commonly affects children with intense swelling as the primary symptom

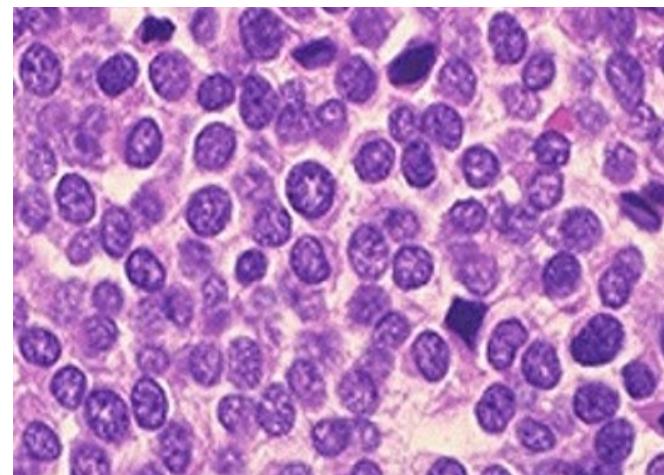


Figure 7.17 Ewing's Sarcoma

- **Metastatic Carcinoma** - orally, this condition involves pain, swelling, and most importantly, paresthesia (lip numbness)
 - ▶ Must know: diffuse and ill-defined changes such as eroding bone are observed radiographically
 - Results from the metastatic spread of some primary malignancy in another part of the body. Ranked from most to least likely, the location of the primary tumor: breast > lung > kidney > colon > prostate



Figure 7.18 Metastatic Carcinoma



Figure 7.19 Osteosarcoma

- **Osteosarcoma** - sarcoma of jaws when tumor cells produce new bone
 - ▶ Must know: the rapid deposition of new bone creates a sunburst pattern radiopacity
 - ▶ Treatment: resection and chemotherapy

That wraps up oral pathology for the INBDE!
Onto the next chapter!