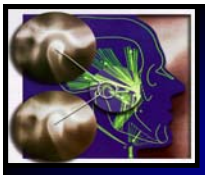


Anatomy of the Head and Neck with Clinical Application

AGD 2015 SAN FRANCISCO
a golden opportunity
Academy of General Dentistry

Henry A. Gremillion, DDS, MAGD
Louisiana State University School of Dentistry

Goals of Comprehensive Dentistry

- Optimum oral health
- Anatomic harmony
- Functional harmony
  - TM joints
  - musculature
  - occlusion
- Orthopedic stability

Chief concern

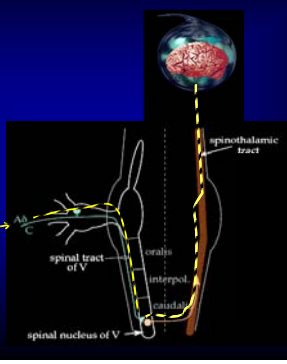
-bitemporal headache *-pain with jaw function*
-sore teeth upon waking *-neck pain*

Key Questions

Should I treat this patient?
What is/are the diagnosis(es)?
How should I treat this patient?
What factors are important in this case?

The Puzzle

Pain Pathways



Differential Diagnosis

The systematic consideration of the patient's signs and symptoms in order to distinguish one disease from another.

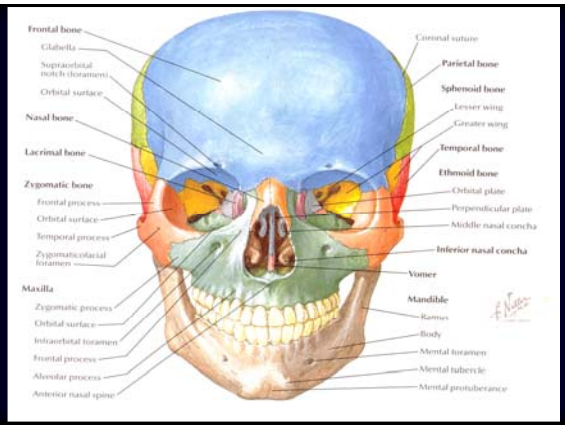
Differential Diagnosis

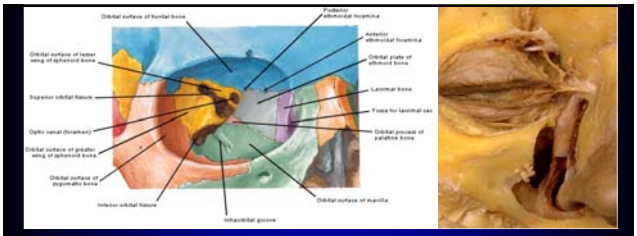
- Teeth
- Paranasal sinuses
- Otologic
- Joint
- Muscle
- Vascular
- Neurogenous

DIAGNOSIS IS THE KEY!

Must Consisider:
- **anatomy**
- **physiology**
- **neurology**
- **psychology**

Osteology
Anatomy of the Skull





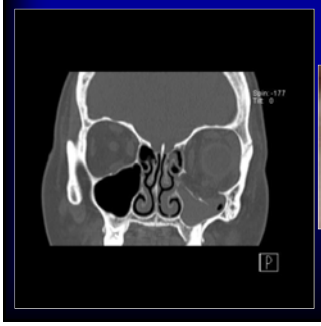
Supraorbital foramen- supraorbital nerve and vessels

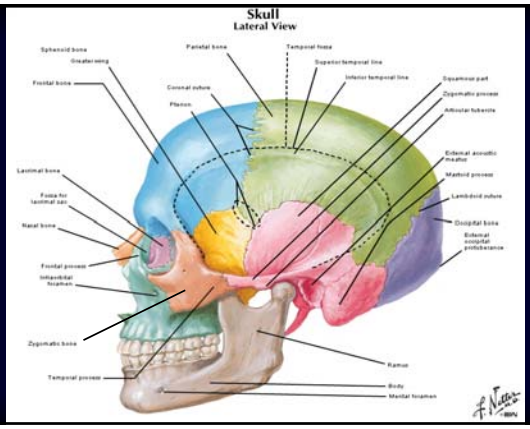
Optic canal- optic nerve, ophthalmic artery

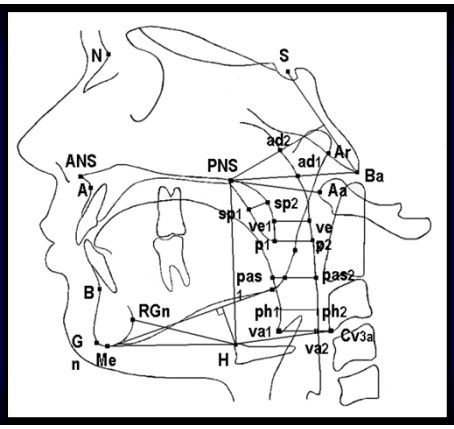
Superior orbital fissure- nasociliary, frontal, and lacrimal branches of V1, occulomotor nerve, trochlear nerve, abducens nerve, superior and inferior ophthalmic veins

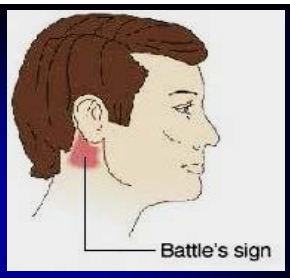
Inferior orbital fissure- V2, zygomatic nerve, infraorbital vessels

Left Blowout Fx



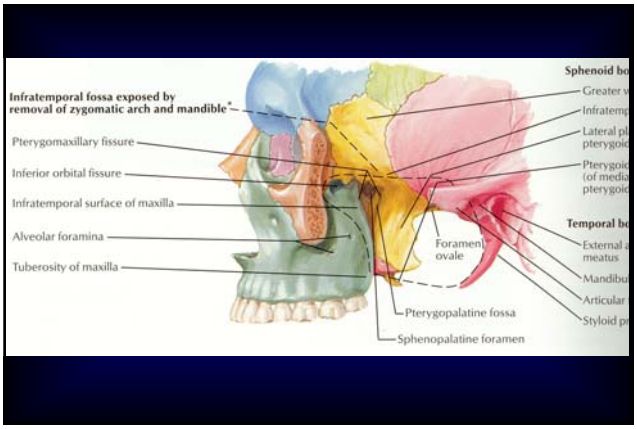


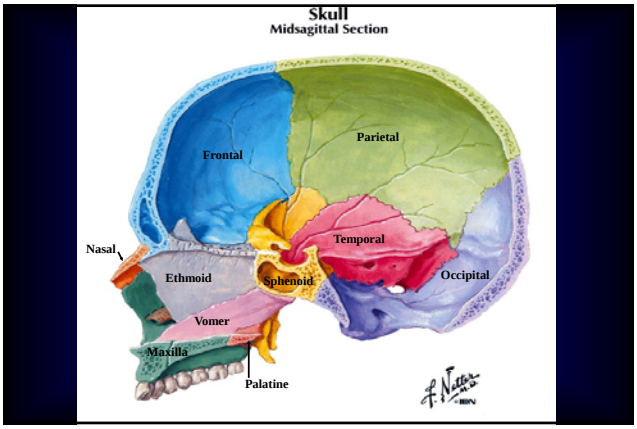


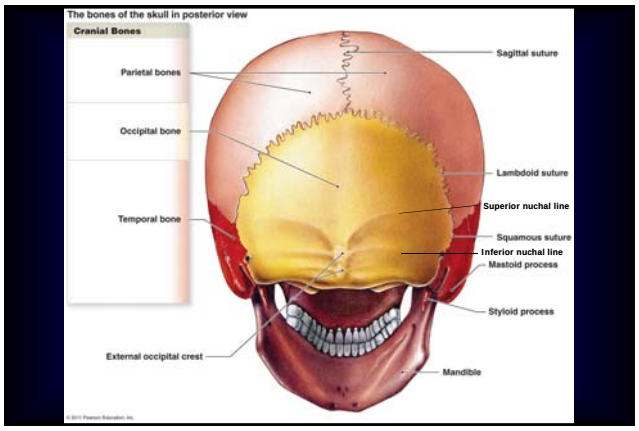


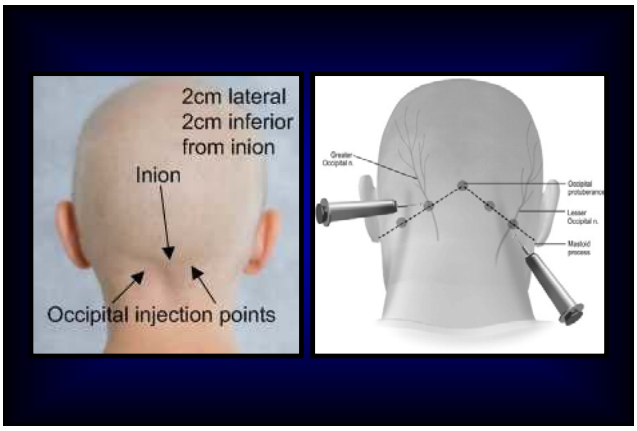
Battle's sign, also called mastoid ecchymosis : consists of bruising over the mastoid process (just behind the auricle), as a result of extravasation of blood along the path of the posterior auricular artery.

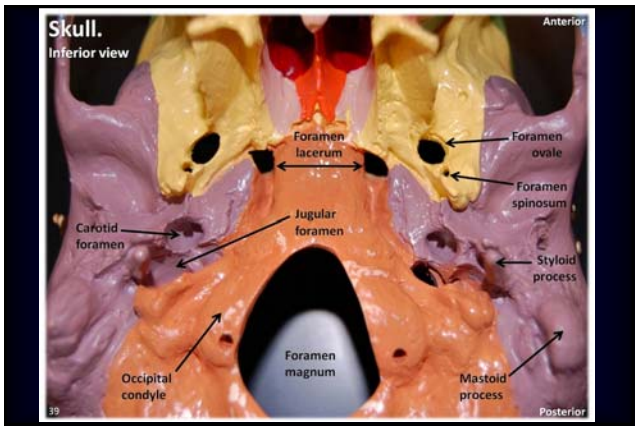
It is an indication of fracture of the base of the posterior portion of the skull, and may suggest underlying brain trauma



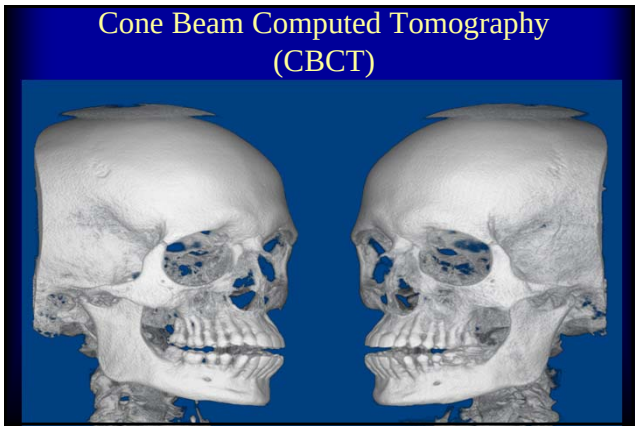


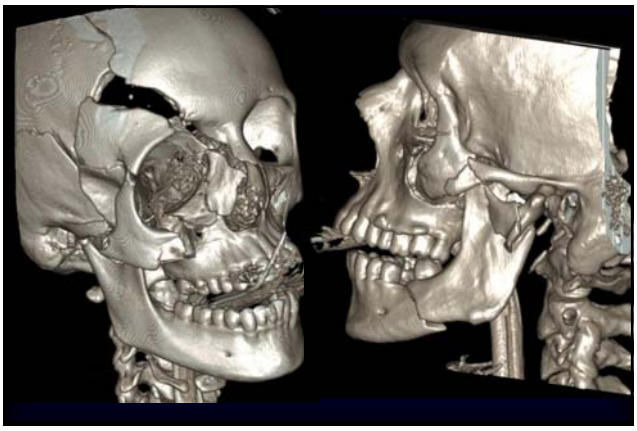

The bones of the skull in posterior view
Cranial Bones
Parietal bones
Occipital bone
Temporal bone
Sagittal suture
Lambdoid suture
Superior nuchal line
Squamous suture
Inferior nuchal line
Mastoid process
Styloid process
External occipital crest
Mandible


2cm lateral
2cm inferior
from inion
Inion
Occipital injection points


Skull.
Inferior view
Anterior
Foramen lacerum
Foramen ovale
Foramen spinosum
Carotid foramen
Jugular foramen
Styloid process
Foramen magnum
Occipital condyle
Mastoid process
Posterior

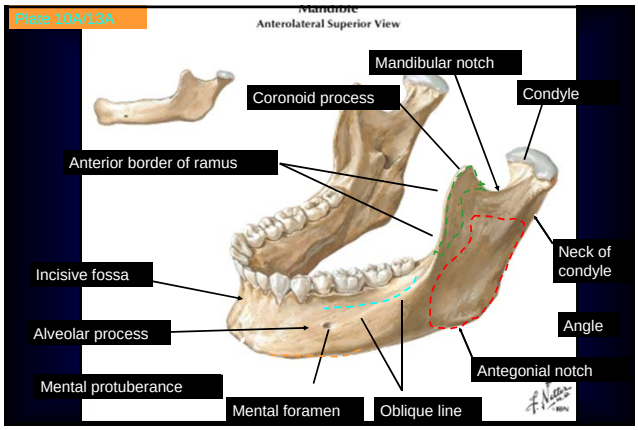

Articular eminence
Articular tubercle
Zygomatic arch posterior root

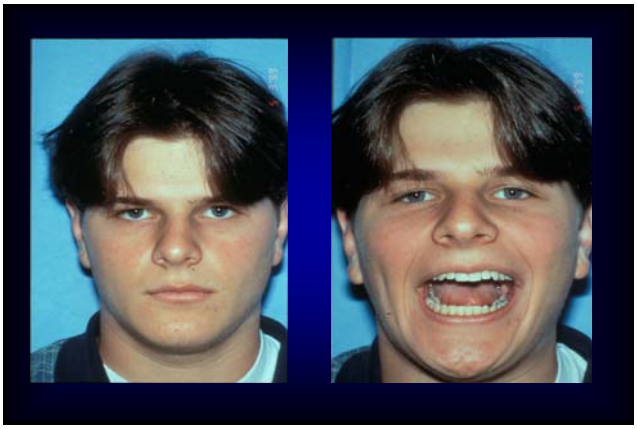

Cone Beam Computed Tomography (CBCT)



LeFort I,II,III Fractures

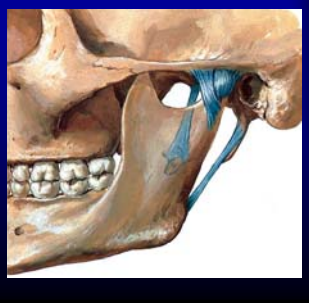
LeFort III Facial Fracture

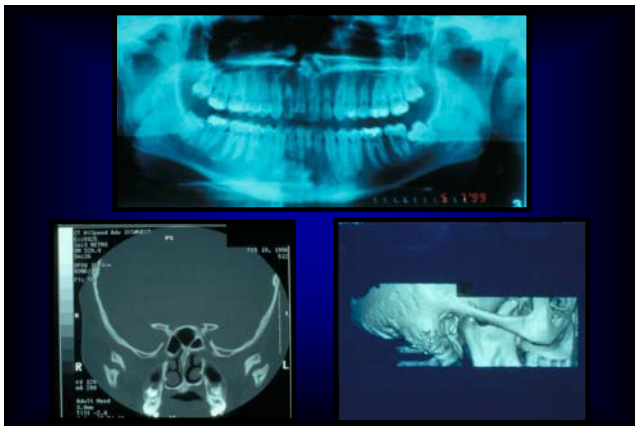


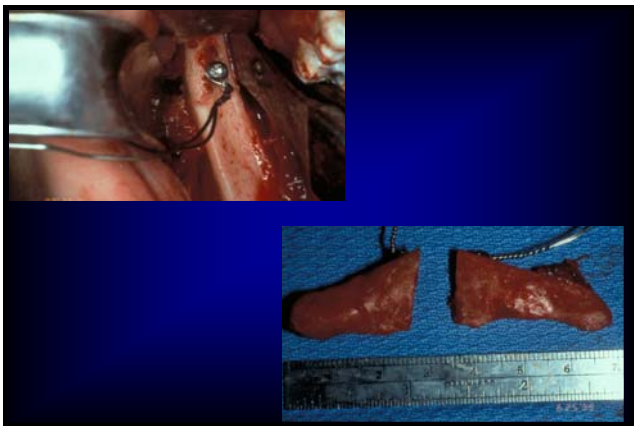


CORONOID HYPERTROPHY

- Limited range of motion (gradually developing)
- May be painless
- Most common in adolescent males





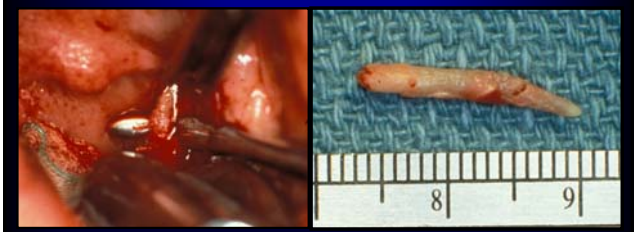


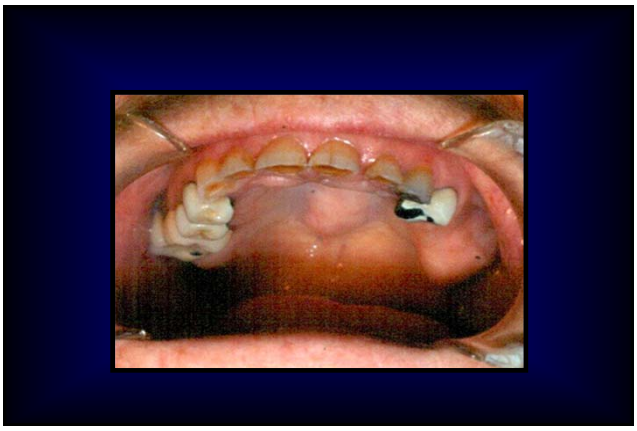
EAGLE'S SYNDROME
ELONGATED STYLOID PROCESS

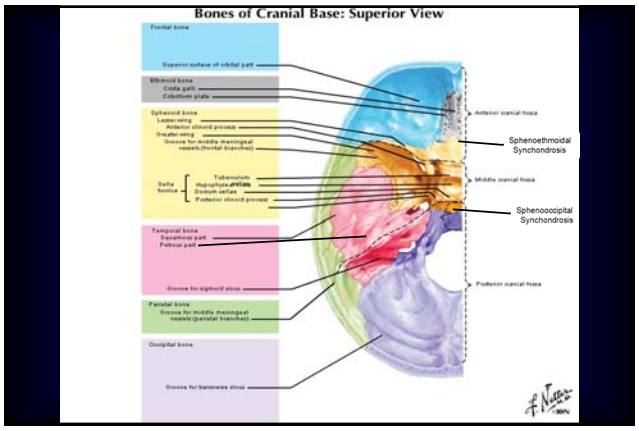
EAGLE'S SYNDROME

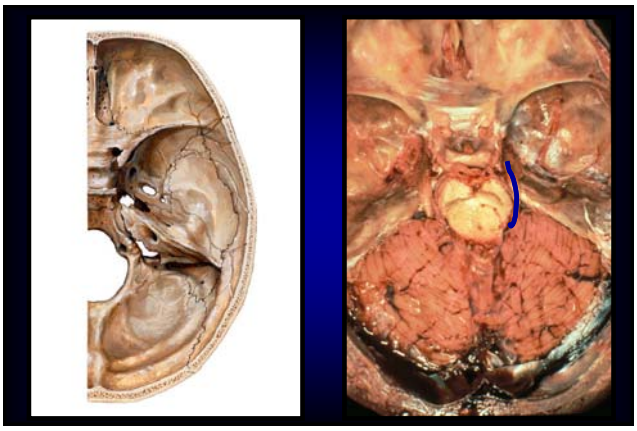
- Pain on swallowing
- Pain upon palpation of lateral pharyngeal wall
- Pain on turning head (associated dizziness?)

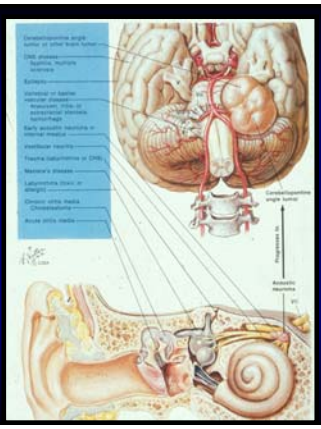
Surgical Removal Of Styloid Process






Bones of Cranial Base: Superior View
Sphenoethmoidal Synchondrosis
Sphenooccipital Synchondrosis

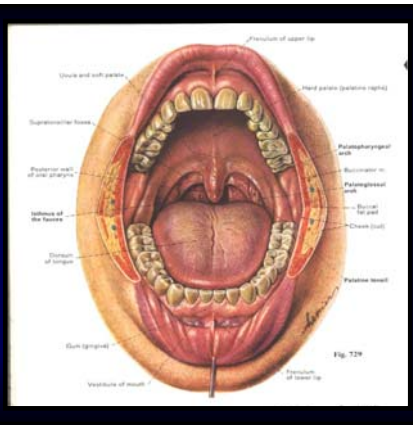


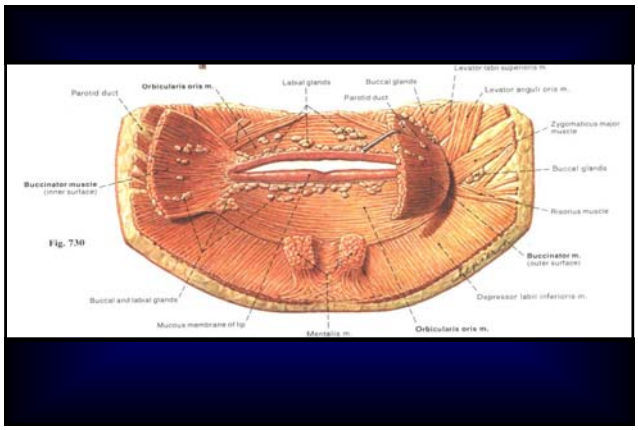


SYMPTOMS & SIGNS OF ORGANIC DISEASE

- Sudden onset of headache
- Meningeal irritation (“stiff neck”)
- Altered consciousness or cognition
- Papilledema or hemorrhage of the ocular fundus
- Pupils equal and/or poorly reactive
- Visual loss

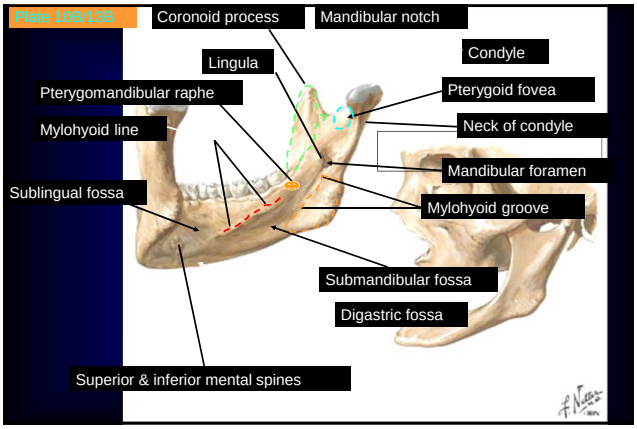
ANATOMY OF THE ORAL CAVITY and FLOOR of MOUTH

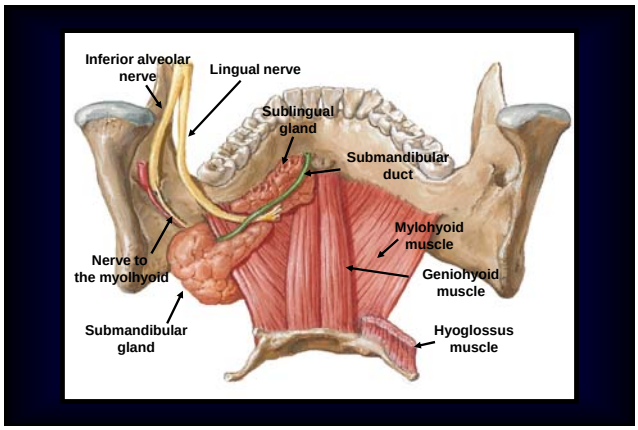


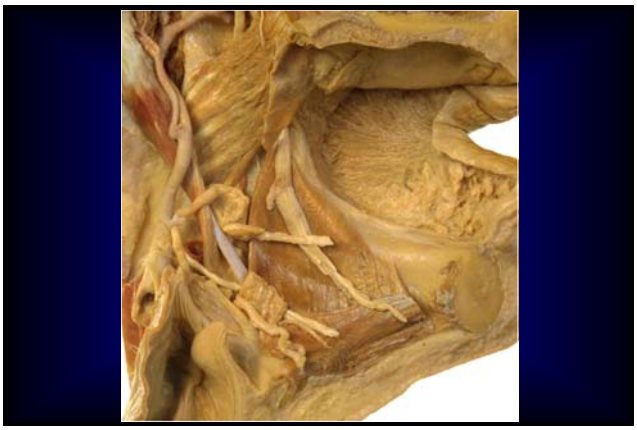


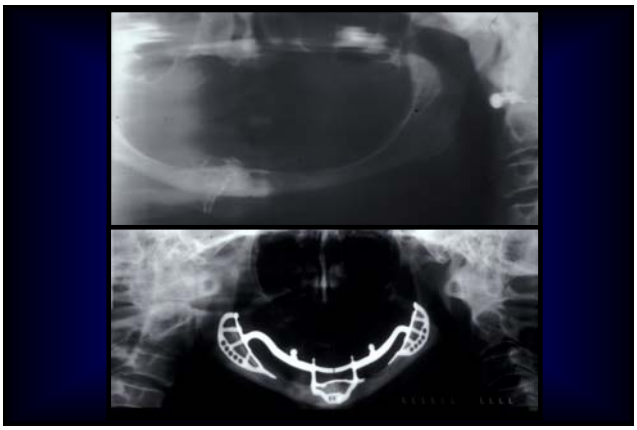
Fordyce Granules: Concentation of Sebaceous Glands

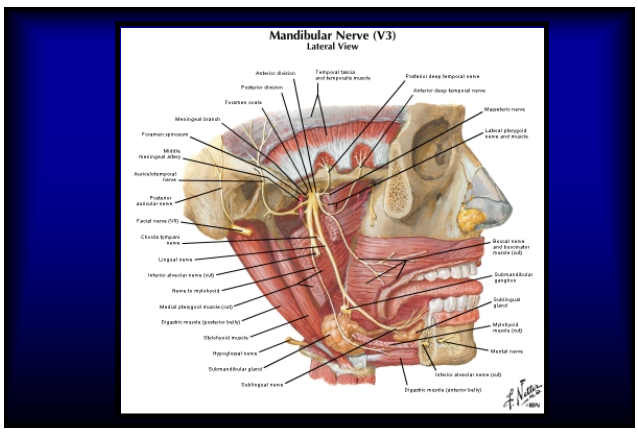
Stenson's Duct

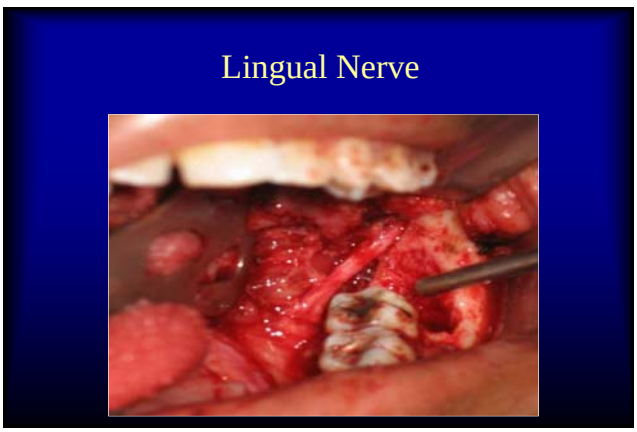


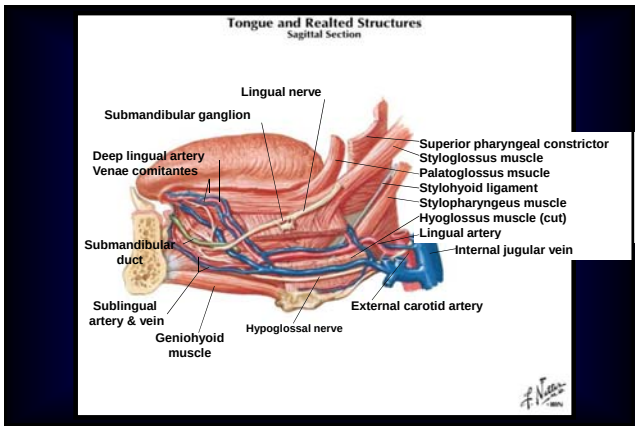

Inferior alveolar nerve
Lingual nerve
Sublingual gland
Submandibular duct
Mylohyoid muscle
Nerve to the myolhyoid
Geniohyoid muscle
Submandibular gland
Hyoglossus muscle

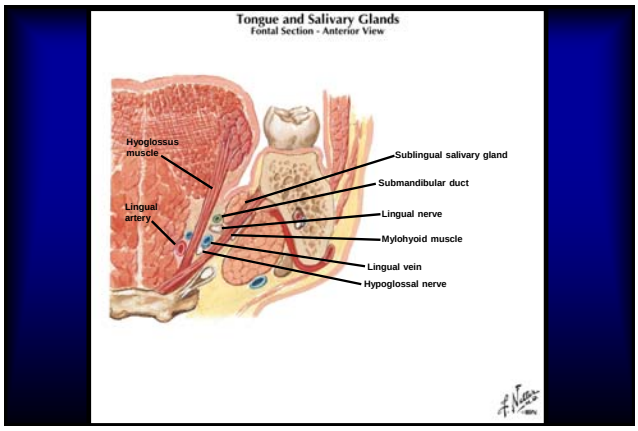





Mandibular Nerve (V3)
Lateral View

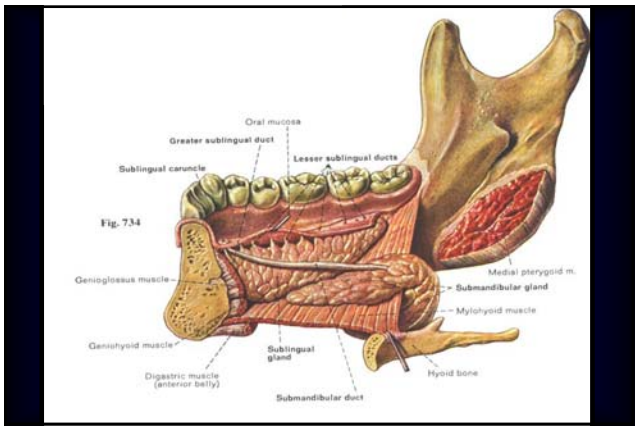

Lingual Nerve



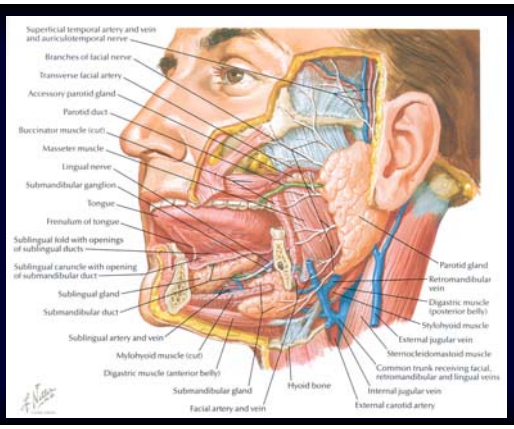


Sublingual Space

- Bounded by oral mucosa superiorly, mylohyoid inferiorly mandible laterally, and intrinsic tongue muscles medially.
- FOM swelling
- Classic symptom dysphagia
- Communicates with submandibular space



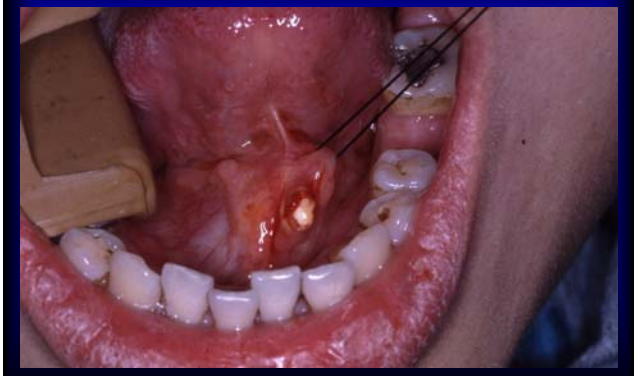
Ranula

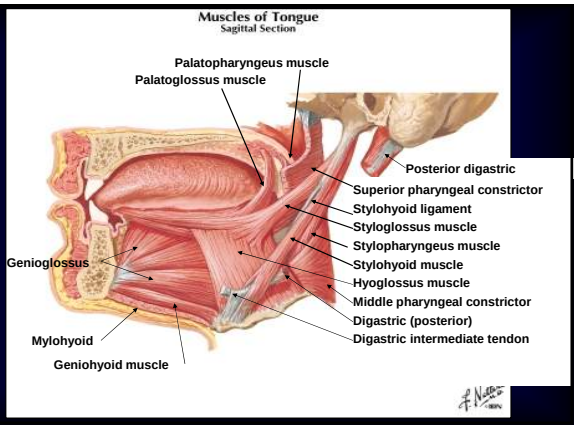


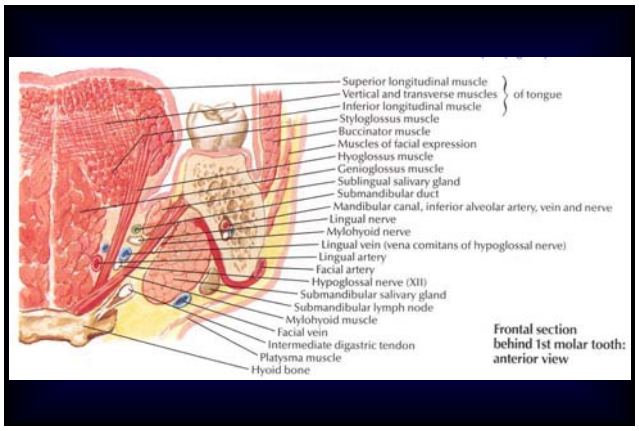
Sublingual Gland and Submandibular Duct

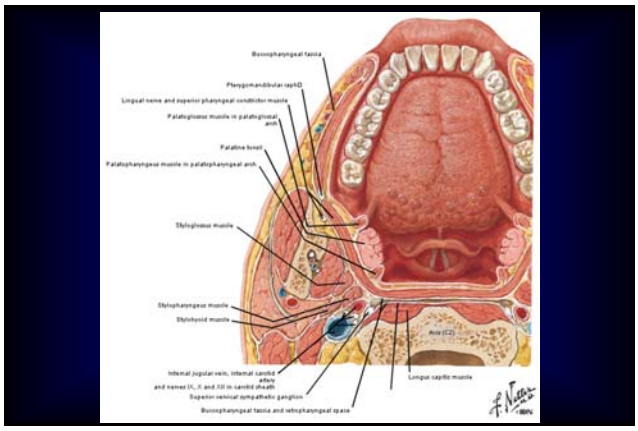
Obstructions

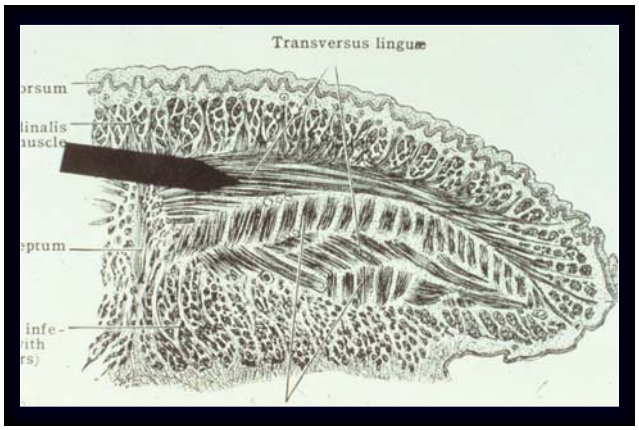
- Mucous plug
- Stones
  - hydroxyapatite
  - trace magnesium carbonate
  - trace ammonia
  - organic matrix (amino acids / carbohydrates)

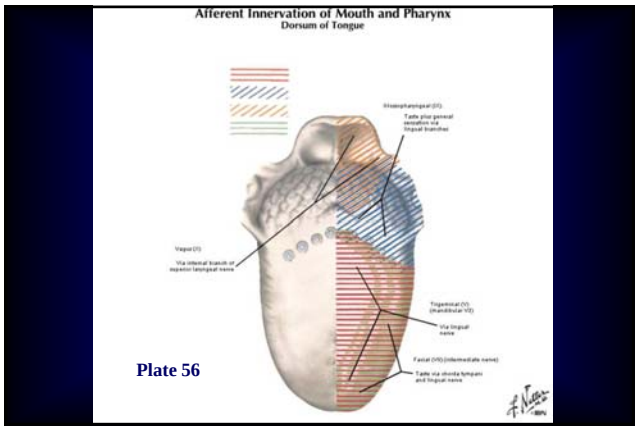


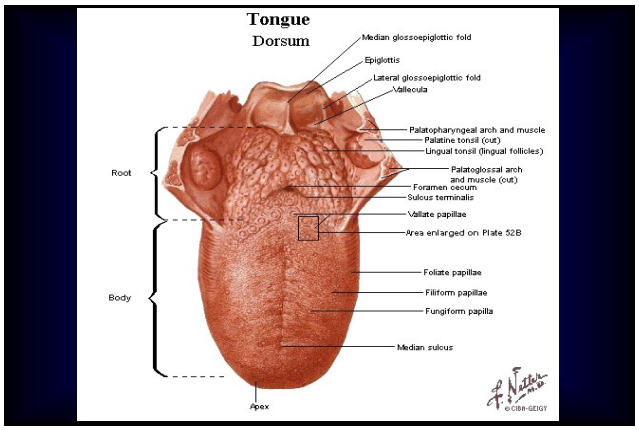


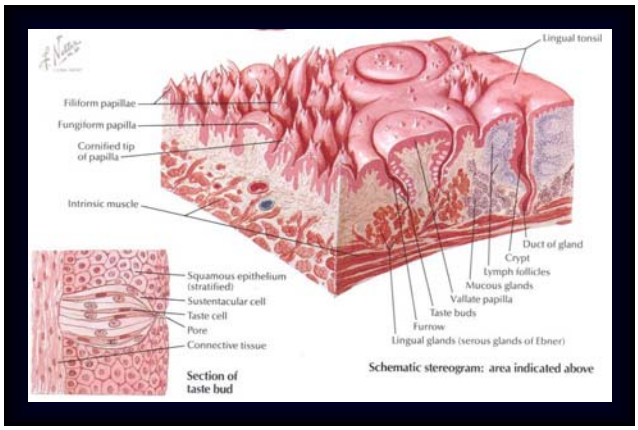

Superior longitudinal muscle
Vertical and transverse muscles
Inferior longitudinal muscle
} of tongue
Styloglossus muscle
Buccinator muscle
Muscles of facial expression
Hyoglossus muscle
Genioglossus muscle
Sublingual salivary gland
Submandibular duct
Mandibular canal, inferior alveolar artery, vein and nerve
Lingual nerve
Mylohyoid nerve
Lingual vein (vena comitans of hypoglossal nerve)
Lingual artery
Facial artery
Hypoglossal nerve (XII)
Submandibular salivary gland
Submandibular lymph node
Mylohyoid muscle
Facial vein
Intermediate digastric tendon
Platysma muscle
Hyoid bone
Frontal section
behind 1st molar tooth:
anterior view

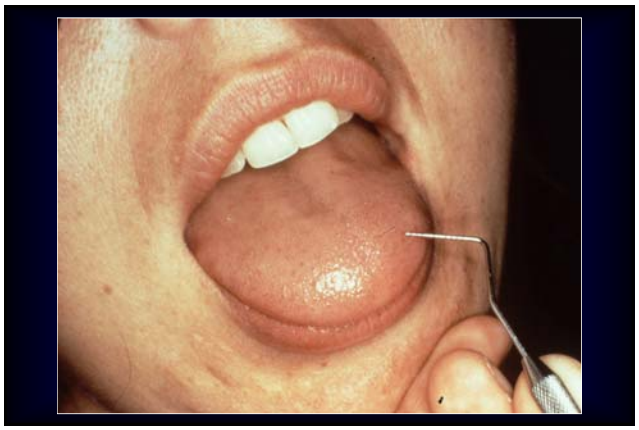



Transversus linguae


Afferent Innervation of Mouth and Pharynx
Dorsum of Tongue
Plate 56

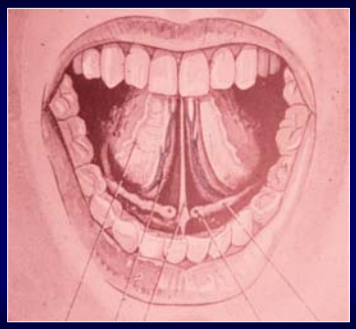

Tongue
Dorsum
Median glossoepiglottic fold
Epiglottis
Lateral glossoepiglottic fold
Vallecula
Palatopharyngeal arch and muscle
Palatine tonsil (cut)
Lingual tonsil (lingual follicles)
Palatoglossal arch and muscle (cut)
Foramen cecum
Sulcus terminalis
Vallate papillae
Area enlarged on Plate 52B
Foliate papillae
Filiform papillae
Fungiform papillae
Median sulcus
Root
Body
Apex


Lingual tonsil
Filiform papillae
Fungiform papilla
Cornified tip of papilla
Intrinsic muscle
Duct of gland
Crypt
Lymph follicles
Mucous glands
Vallate papilla
Taste buds
Furrow
Lingual glands (serous glands of Ebner)
Squamous epithelium (stratified)
Sustentacular cell
Taste cell
Pore
Connective tissue
Section of taste bud
Schematic stereogram: area indicated above

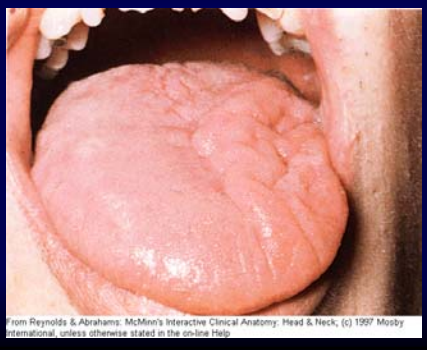


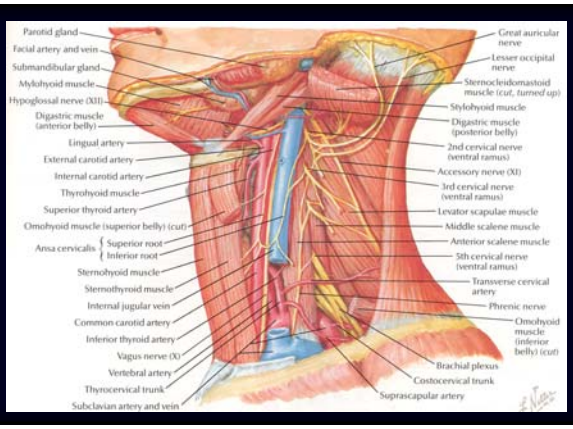
Ectopic Thyroid
Foramen Cecum Relationship

Thyroglossal Duct Cyst

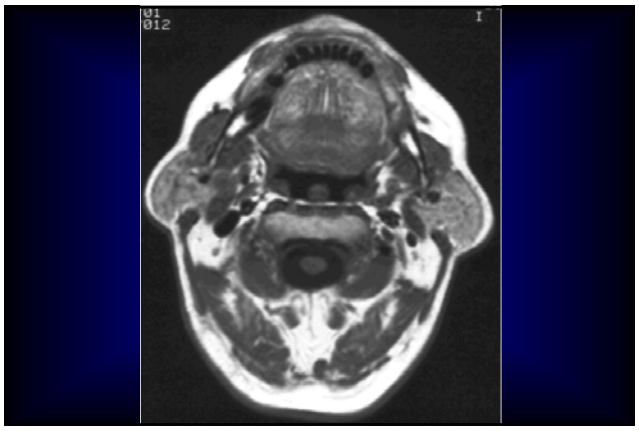


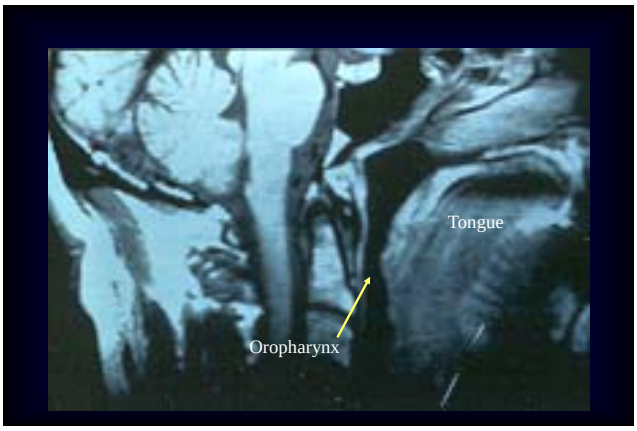
Hypoglossal Nerve Palsy

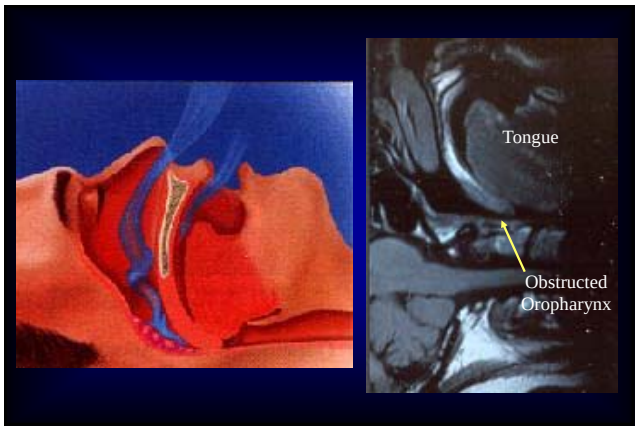


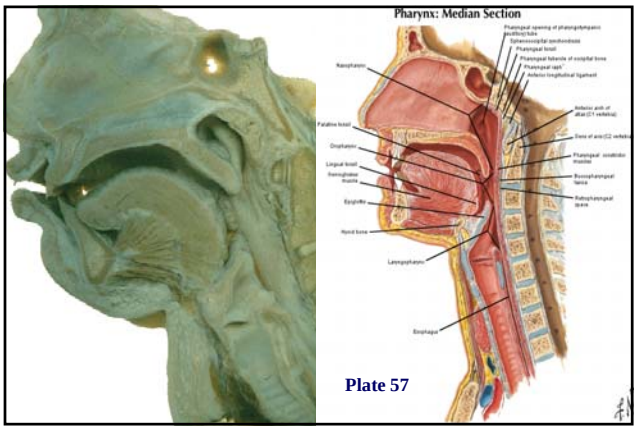


Tongue position and its relationship to sleep-related breathing disorders such as sleep apnea… genioglossus activity









All of the muscles of the pharynx supplied by the pharyngeal plexus except *stylopharyngeus* which is supplied by a muscular branch of the glossopharyngeal nerve.

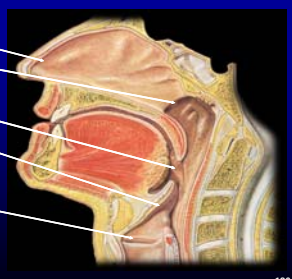
Pharyngeal plexus

Formed by the pharyngeal branches of the glossopharyngeal and vagas nerves

- -glossopharyngeal branch is afferent (sensory) only
- -vagal component is motor to pharynx and palate and sensory to the same areas

Components of the Upper Airway

- Nose
- Nasopharynx
- Oropharynx
- Laryngopharynx
- Larynx



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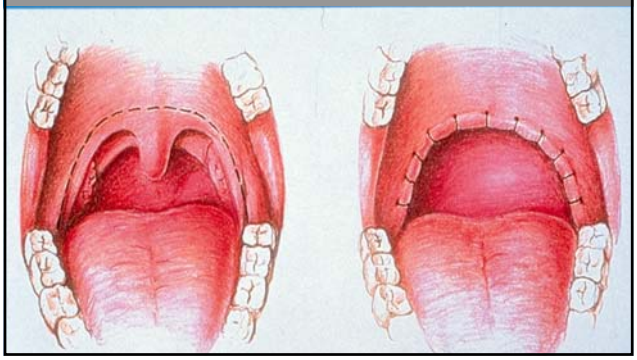
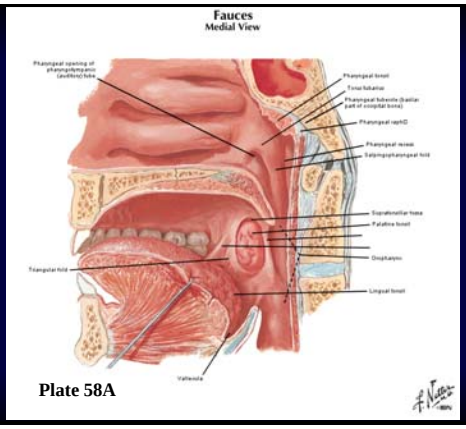
Uvulopalatalpharyngoplasty (UPPP)

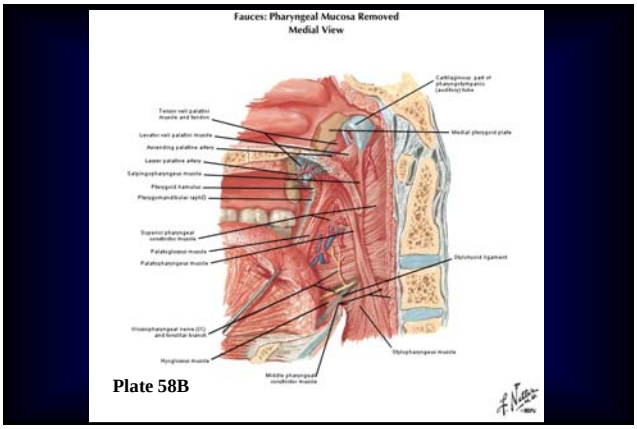


Laser-assisted UPPP

SLEEP-RELATED BREATHING DISTURBANCES

Enlarged & Inflamed Tonsils

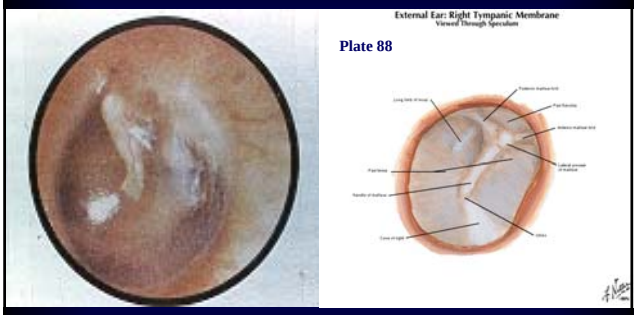




Ear Pain (Otalgia)

- Acute Otitis Externa
- Acute Otits Media
  - Severe ear pain often
  - Fluid/pressure behind the TM
  - Most common in children
  - Treatment
    - Antibiotics
    - Myringotomy (ear tubes)

Normal Tympanic Membrane



Otitis Media

Otitis Media

Tympanic Membrane Perforation

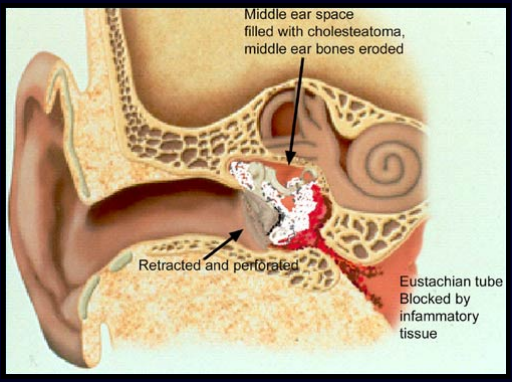
Placement of PE Tubes

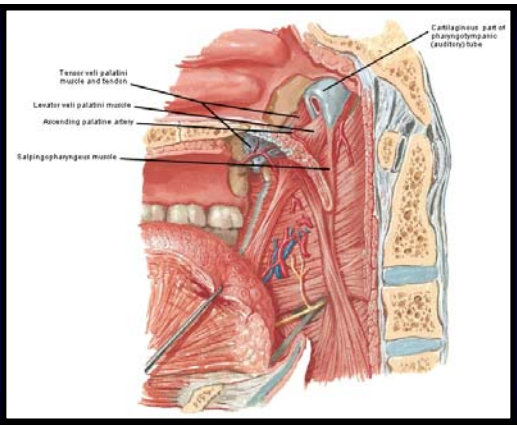
Eustachian tube dysfunction

- Normal function
  - Dilatation
  - Primarily involves the tensor veli palatini
  - Swallowing causes momentary eustachian tube dilitation which equalizes pressure
  - Secondarily involves
    - Levator veli palatini
    - Salpingopharyngeus
    - Superior constrictor

Eustachian tube dysfunction

- Acute obstruction may cause ear pain or sense of stuffiness in ear
- URI, Post nasal drainge,Inflammation-ET blocked
- Vacuum in middle ear-retraction of TM
- More common in children-Et shorter/more horizontal



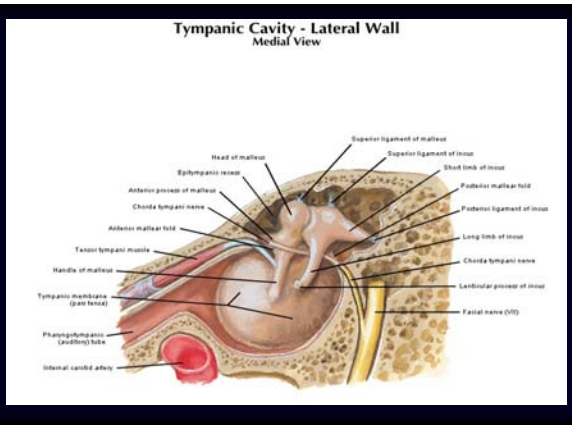


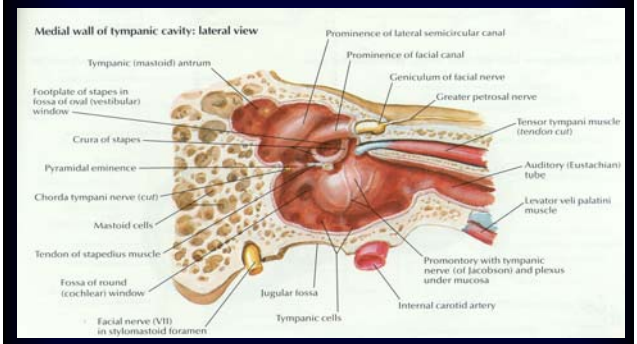
Tinnitus: Differential Diagnosis

- **Noise-induced**
- **Metabolic disease**
- **Endocrine disease**
- **Autoimmune disorders**
- **Structural abnormalities**
- **Medication-induced**
- **Occluso-muscle**

Ear Symptoms and TMJ

- Ear pain (Otalgia)
- Hearing changes- stuffiness most likely related to ET dysfunction.
- Tinnitus (ringing in ear)
- Dizziness





Tonic Tensor Tympani Phenomenon

- Hypertonia of medial pterygoid produces a concomitant reflex hypertonia of the tensor tympani muscle
- Tonic tensor tympani cannot initiate the reflex that increases the tonus of the tnsor veli palatini muscle
- Failure of the eustachian tube to open during deglutition

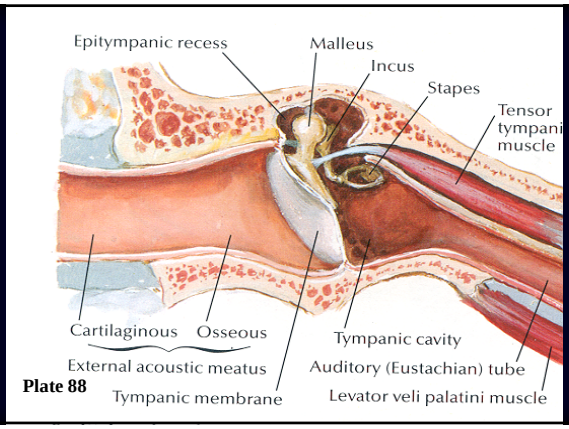


Plate 88

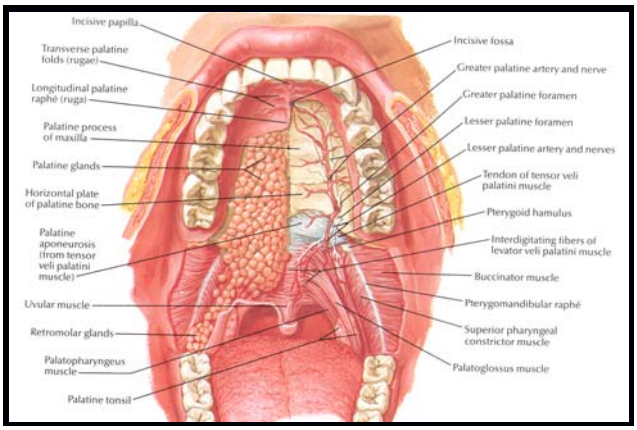
Otomandibular Syndrome

1 or more of the following without pathology

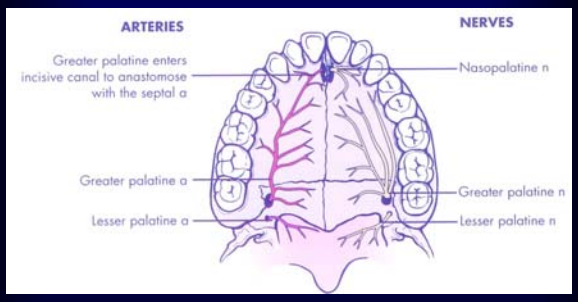
in ENT exam plus 1 or more muscles symptomatic

- Pain / fullness in and around ear
- Hearing loss
- Tinnitus
- Loss of equilibrium

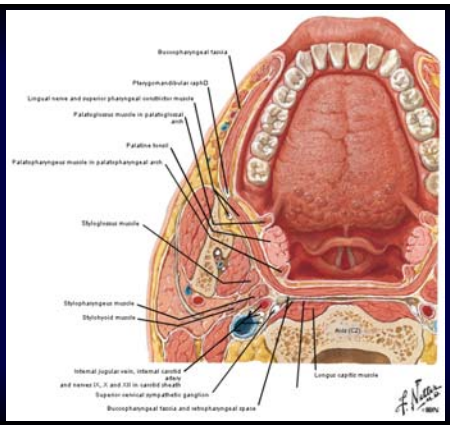
PALATE



Blood and Nerve Supply to Palate



Pharyngeal Region

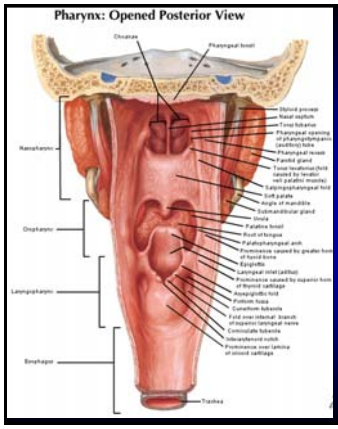


Tonsils

- small masses of lymphatic tissue (specialized lymph nodes)
- prevent infection in the body at areas where bacteria is abundant

There are five tonsils:
-a pair on either side of the inner wall of the throat (palatine tonsils)
-one near the rear opening of the nasal cavity (pharyngeal tonsil)
-a pair near the base of the tongue (lingual tonsils)

This "ring" around the throat helps trap and remove any bacteria or other foreign pathogens entering the throat through breathing, eating, or drinking.



Pharyngeal tonsil
Lymphoid tissue (adenoids) distributed within the back wall of the nasopharynx

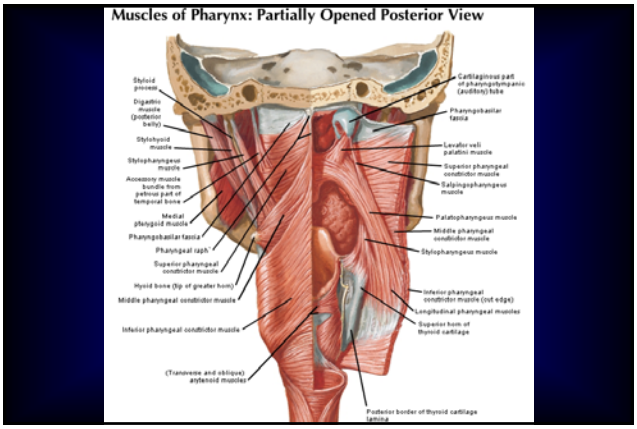
Choanae
Openings of nasal cavity into pharynx

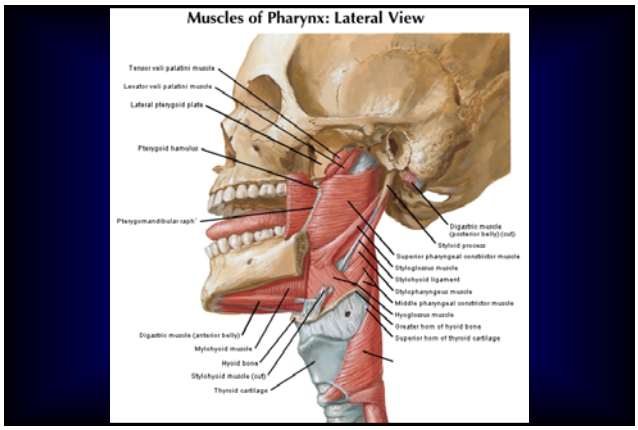
Pharyngeal opening of auditory tube

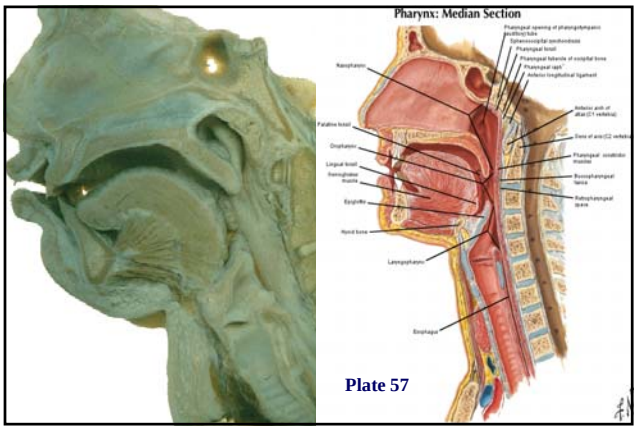
Nasal Septum

Palatine tonsils
Lymphoid tissue , helps protect against infection

Piriform fossae
Channels in laryngopharynx lead food into the esophagus







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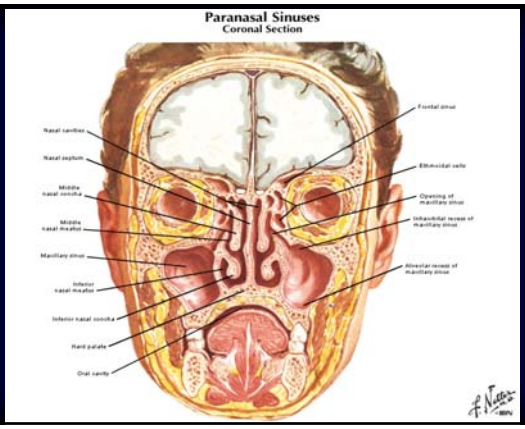
Formed by the pharyngeal branches of the glossopharyngeal and vagas nerves

- -glossopharyngeal branch is afferent (sensory) only
- -vagal component is motor to pharynx and palate and sensory to the same areas

Nasal Cavity & Paranasal Sinuses



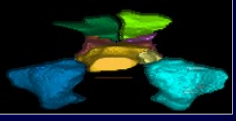
Paranasal Sinuses

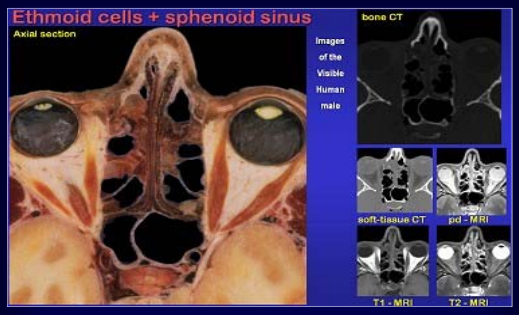
- Recesses of nasal mucosa growing into bones
- starts in late fetal period – after birth
- considerable variations:

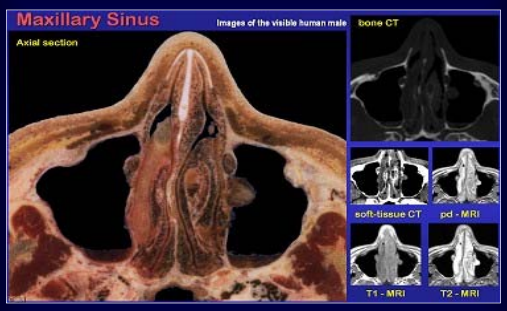
(interindividual & intraindividual)

- onset and continuation of growth
- size
- shape
- tiny cristae
- small recesses

3D-reconstruction





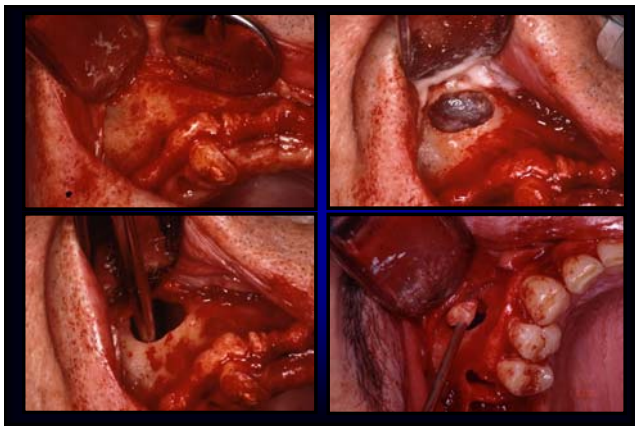


Mucous Retention Cyst

DISPLACED ROOT / TOOTH

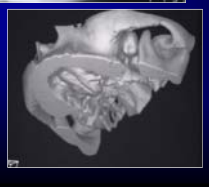
1. Under flap
2. Sinus
3. Infratemporal Fossa

Root Tip in Maxillary Sinus



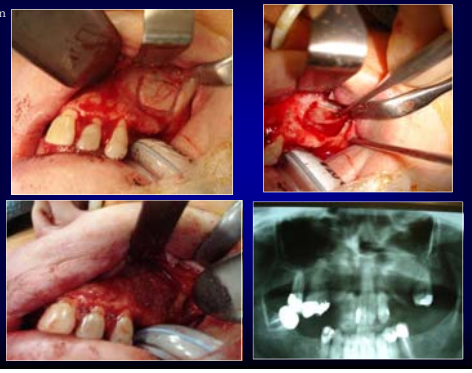
Third Molar Displaced into Maxillary Sinus

Third Molar Displaced into Infratemporaral Foss



Fractured Tuberosity with Maxillary Sinus Exposure

Sinus Lift with Iliac Bone Graft



PARANASAL ORIGINS OF PAIN

Paranasal Sinuses

Headache and facial pain are commonly related to infection, inflammation, and/or obstruction of the outflow of the tracts of the paranasal sinuses.

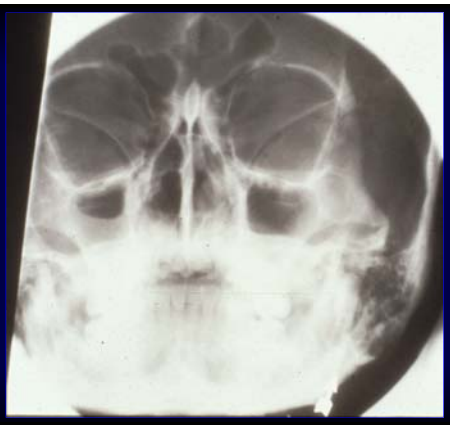
Acute / Chronic Sinusitis:
PAINFUL COMPLICATIONS

- Mucosal inflammation and thickening in cases of acute sinusitis
- Partial or complete obstruction of sinus ostia
- Pressure sensation
- Maxillary mucoceles
- Osteomyelitis

Acute / Chronic Sinusitis:

Sinus involved	***Site(s) of referral***
• Sphenoid sinus	• Vertex, other parts of the cranium
• Frontal sinus	• Frontal region
• Ethmoid sinus	• Between the eyes
• Maxillary sinus	• Maxilla, dental structures
• Pansinusitis	• Pain may be coalescent, less localized, associated with frontal headaches, constant pressure

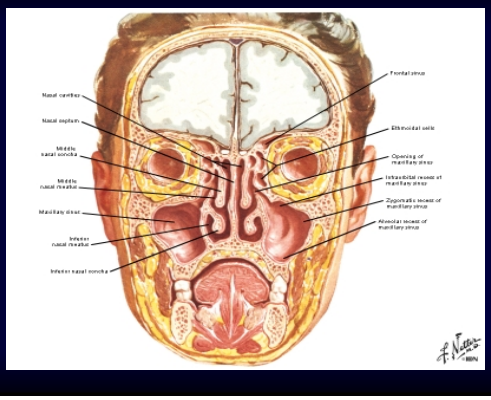
Pansinusitis

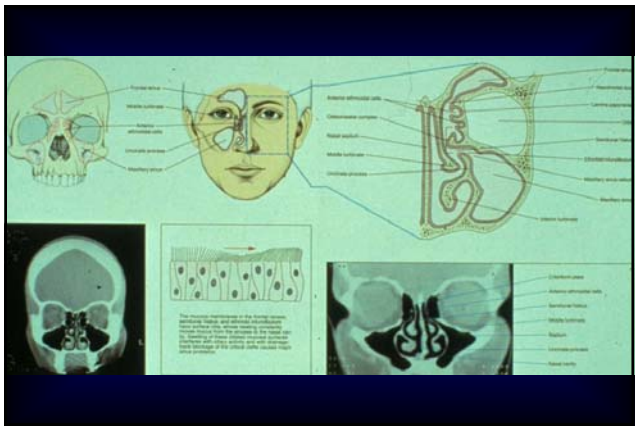


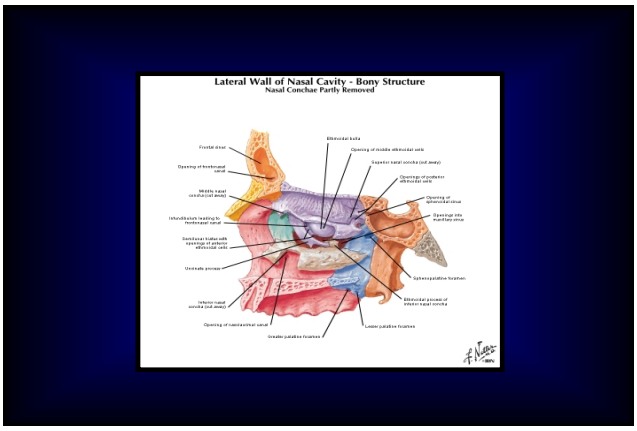
MUCOSAL CONTACT HEADACHE

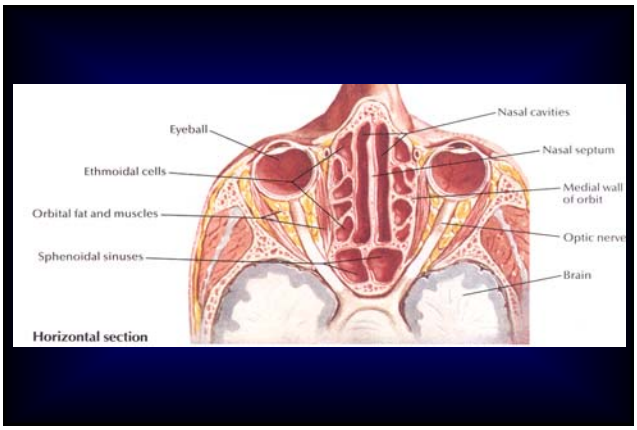
Mucosal Contact Headache

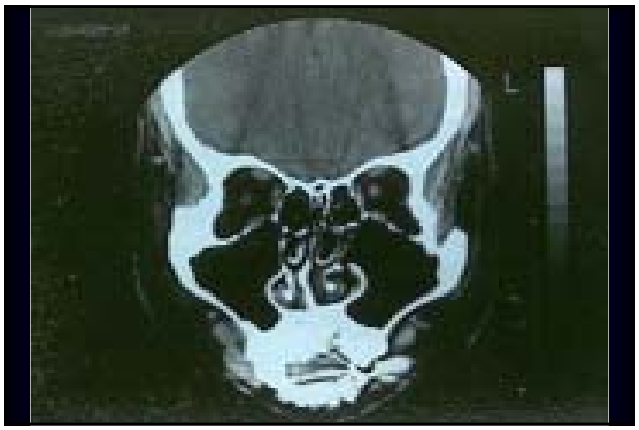
- Dull and aching
- Diffuse peri-/retro-ocular, supraorbital pain
- History of chronic maxillary sinusitis
- Allergy prone
- Associated with upper respiratory tract infection
- Impedance of normal mucosal activity



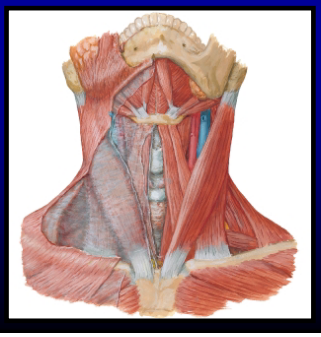






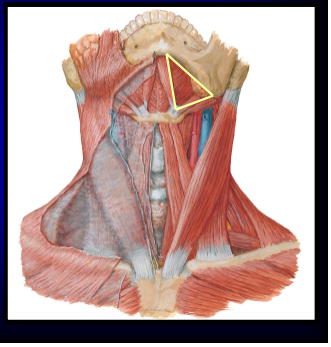


Cervical Triangles

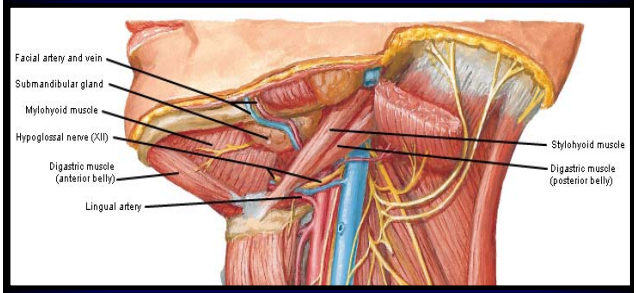


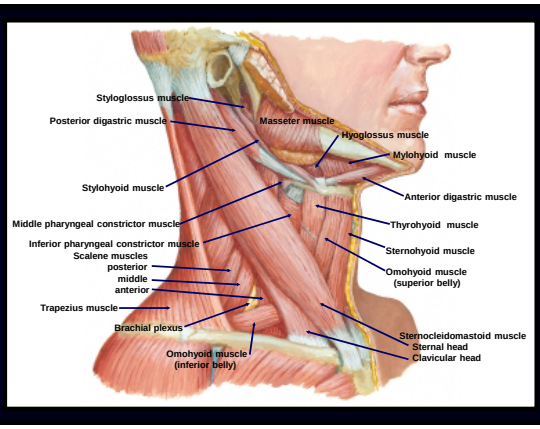
Submandibular (Digastric) Triangle

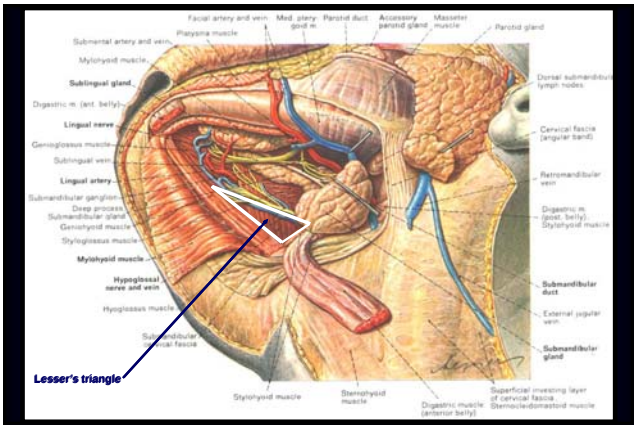
- Superior
  - Inferior border of mandible
- Anterior
  - Superior border of anterior belly of digastric
- Posterior
  - Superior border of posterior belly of digastric



Digastric Triangle





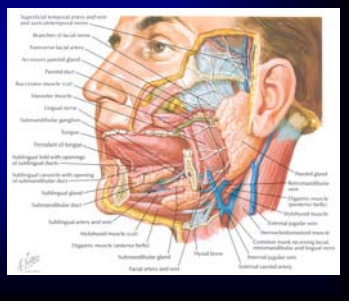


Major Salivary Glands

Parotid gland
-pure serous

Submandibular gland
-primarily serous

Sublingual gland
-primarily mucous

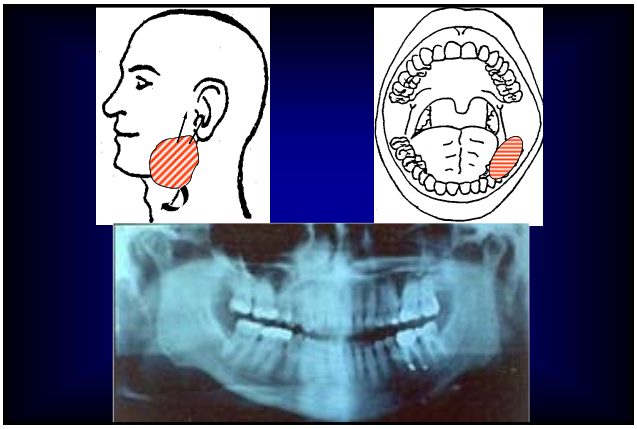


Patient: Betty

- 51 year old Caucasian female
- Medical history significant for:
  - left temporomandibular surgery X2
  - hypothyroidism

Patient: Betty

- Chief pain concern:
  - "I have pain in my jaw and throat when I eat. The pain radiates to my ear. It feels like a toothache."



Patient: Betty

- Aggravating factors:
  - chewing and drinking
  - certain aromas
- Alleviating/relieving factors:
  - none identified

Sialolithiasis

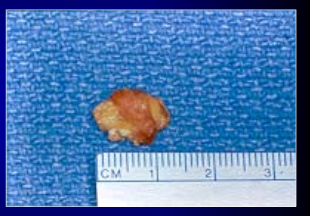
Diagnosis

- History
  - pain with salivation
- Inspection
- Palpation

Sialolithiasis

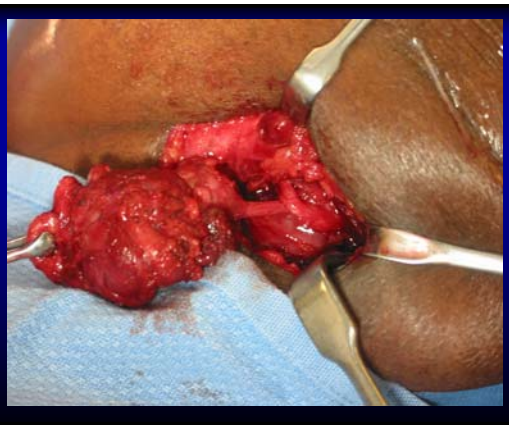
Diagnosis

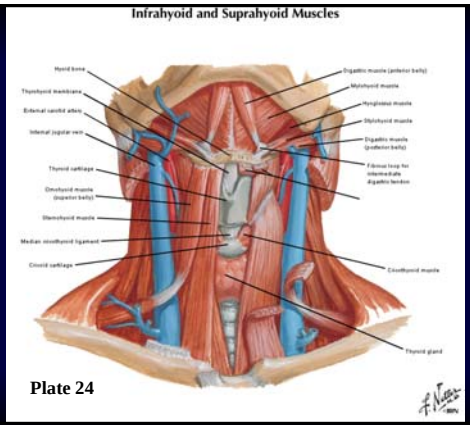
- Imaging
  - occlusal
  - lateral jaw
  - panoramic
  - sialogram

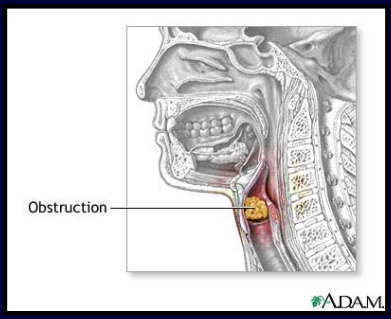


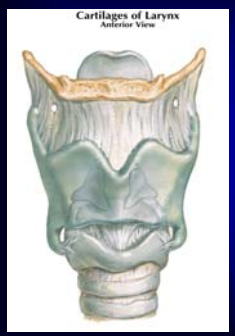
Submandibular Gland Stone

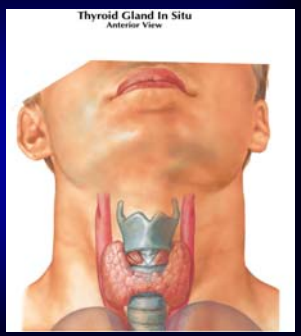
Sialogram



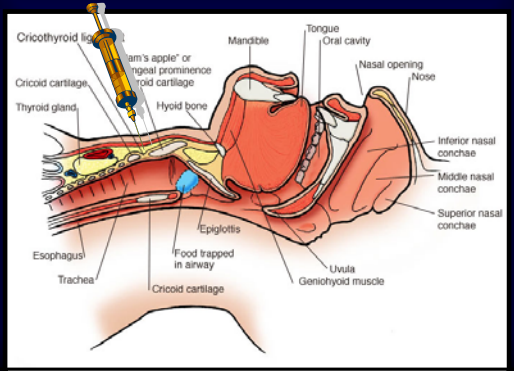




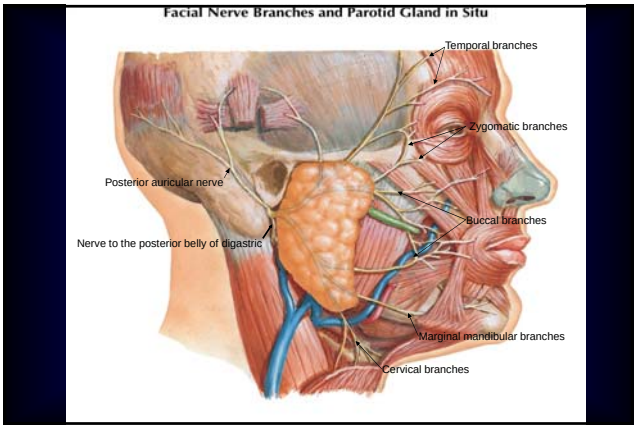


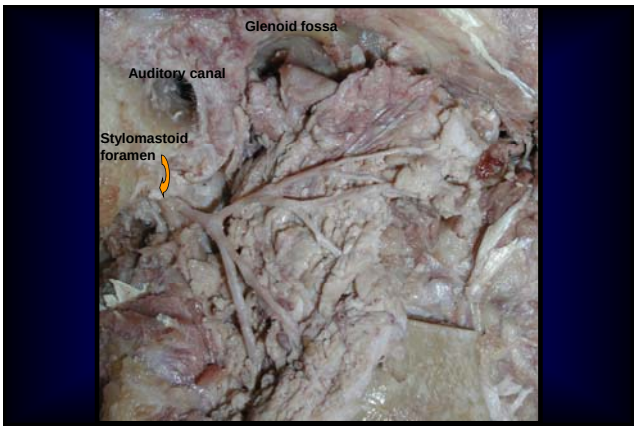


Cricothyrotomy: Emergency airway



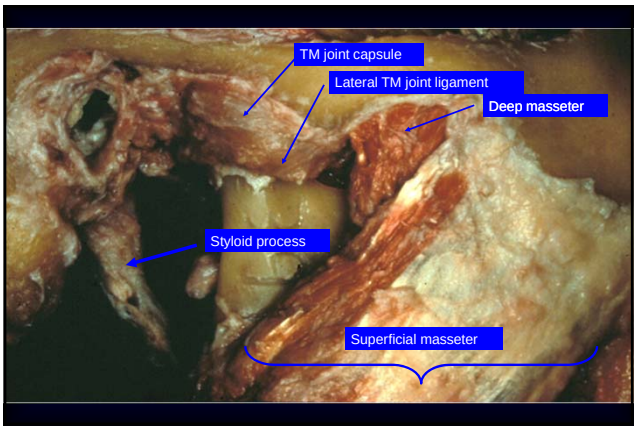
Superficial Face

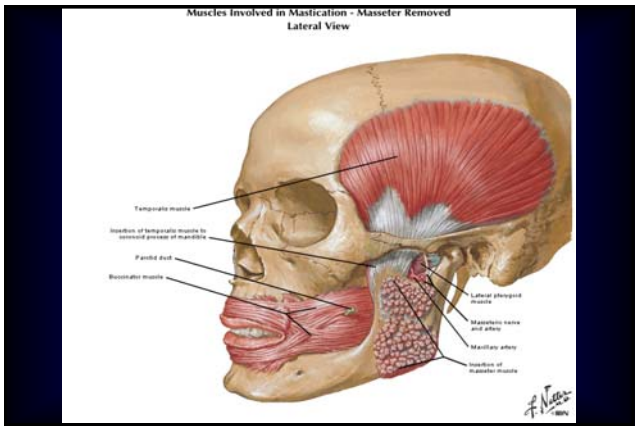




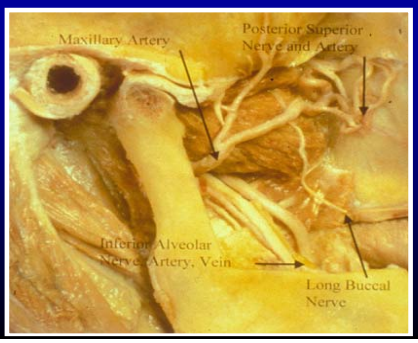
BELL'S PALSY

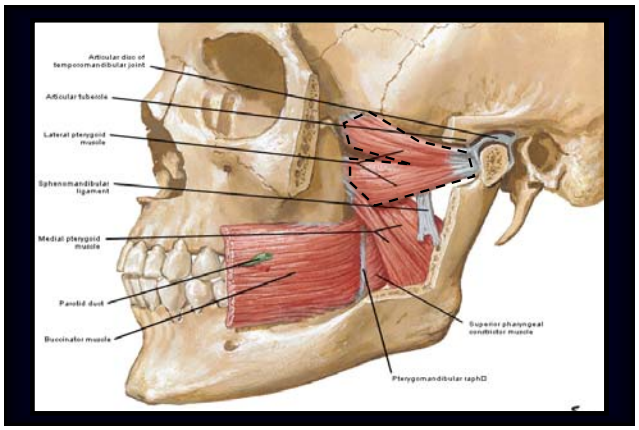
- Cranial nerve VII paralysis
- May occur post-dental procedure
- Usually unilateral
- Gradual or sudden onset
- Viral relationship???

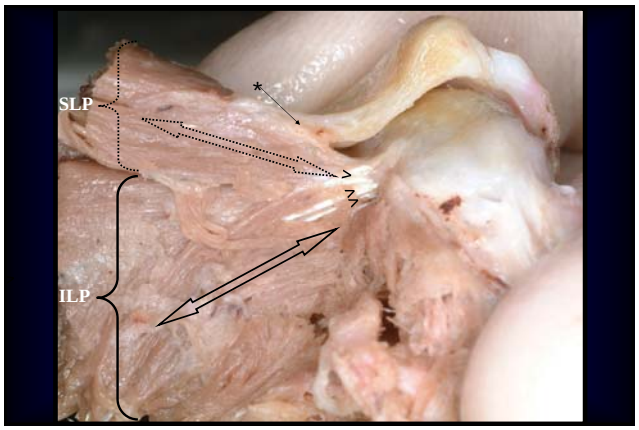




Lateral Pterygoid





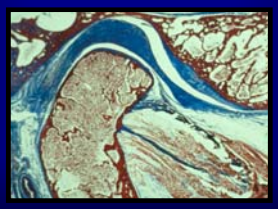


IMPORTANT ASSOCIATED STRUCTURES

Muscles involved in joint function

1. Muscles active on jaw opening-lateral pterygoid (inferior belly), suprahyoid and digastric muscles
2. Muscles active on jaw closure-temporalis, masseter, medial pterygoid muscles, lateral pterygoid (superior belly)
3. Excursive movements-lateral pterygoid

Functional Anatomy/Biomechanics of the Masticatory System



Temporomandibular Joint

Masticatory System: Unique Features

- Right and left function as one unit
- Articulating surfaces are fibrocartilaginous
- Articular disc separates the joint into two compartments
- Ginglymoarthrodial joint (hinge-gliding)

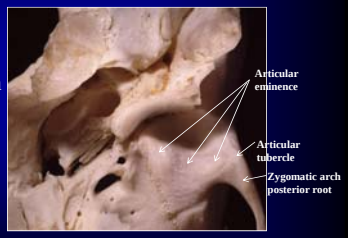
Masticatory System: Unique Features

- Right and left function as one unit
- Articulating surfaces are fibrocartilaginous
- Articular disc separates the joint into two compartments
- Ginglymoarthrodial joint (hinge-gliding)
- Articulation has a rigid end point on closure of the teeth

OSSEOUS STRUCTURES

Glenoid fossa and articular eminence

1. Part of temporal bone
2. Glenoid fossa is concave structure covered with thin layer of fibrocartilage
3. Articular eminence is convex, posterior slope has an average angle of 60°



OSSEOUS STRUCTURES

Condyle

1. Adult condyle is elliptical
2. Mediolateral dimension is about 20 mm and is twice the size of its antero-posterior width
3. Articular surface is covered by a layer of fibrocartilage

SOFT TISSUES

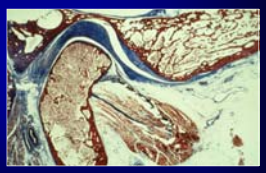
Articular Disk (Meniscus)

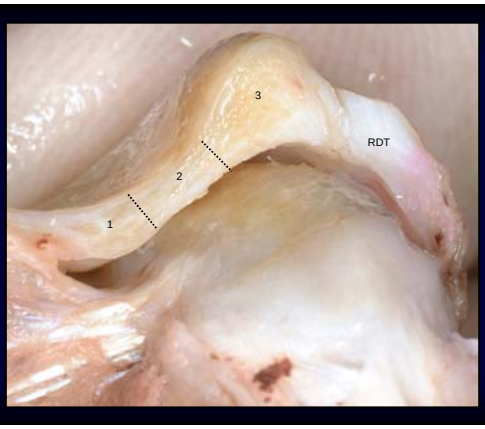
1. Bioconcave structure, divided the joint space into superior and inferior spaces
2. Attachments
   a. Anterior-capsule and superior belly lateral pterygoid
   b. Posterior-bilaminar zone (retrodiskal tissues)
   c. Medial/lateral condyle

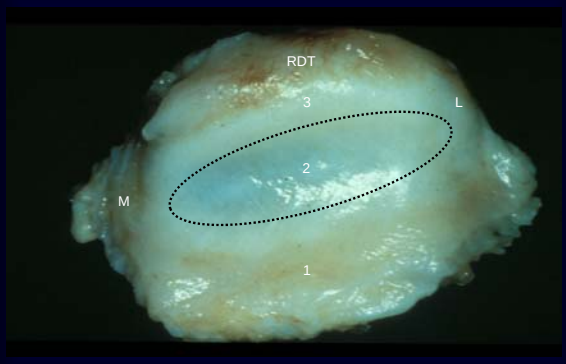
SOFT TISSUES

Articular Disk (Meniscus)

3. Made up of three zones
   a. Posterior band – 3 mm thick
   b. Intermediate zone – 1 mm thick
   c. Anterior band – 2 mm thick
4. Consists of avascular connective tissue with some cartilaginous elements



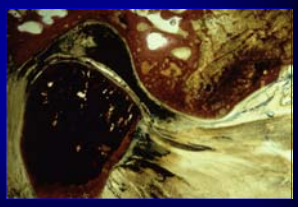




JOINT SPACES

Disk divides joint space into two compartments

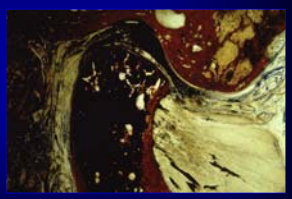
1. Superior joint space (UJS)
   a. Larger than inferior
   b. Translation occurs between condyle-disk unit and articular eminence in the UJS

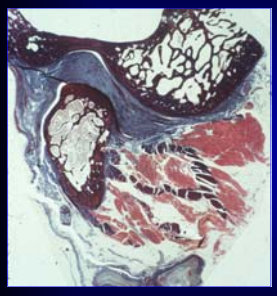


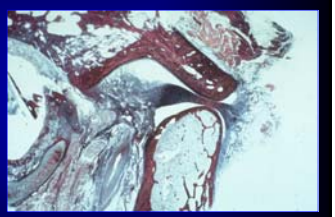
JOINT SPACES

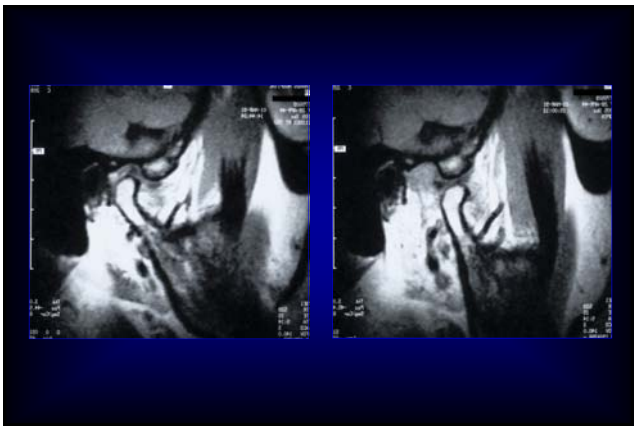
Disk divides joint space into two compartments

2. Inferior joint space (LJS)
   a. Smaller than superior
   b. Rotation occurs between condyle and disk in LJS





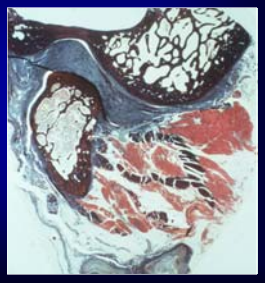




SOFT TISSUES

Articular Disk (Meniscus)

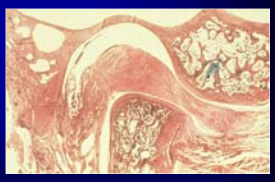
5. Functions
   a. Load adapter
   b. Fluid distribution
   c. Divides joint space into two compartments allowing complex movements consisting of rotation and translation



JOINT SPACES

Synovial Membrane

1. Lines all non-loaded surfaces
2. Made up of intimal layer of cells 1-4 deep
   a. Type A – phagocytic
   b. Type B - secretory
3. Functions of synovial fluids
   a. Lubrication
   b. Nutrition
   c. Maintains and protects articular cartilage



TM Joint Surfaces

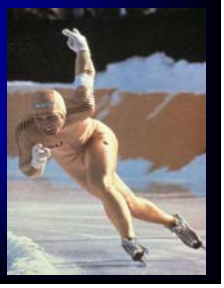
Without lubrication

- relatively smooth
- have high surface energy
- may shear and rupture

TM Joint Biomechanics

The role of lubricant

- Reduces area of contact
- Reduces surface energy
- Reduces shearing



TM Joint Biomechanics

Lubrication

- Boundary
- Surface (weeping)

Synovial Organ

Functions

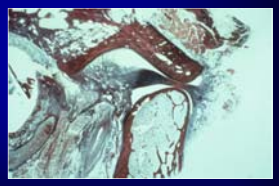
- Semi-permeable membrane which allows for adjustment of pressures within the TM joint.

Bauer W, et al. Physiological Rev 1940; 20:272-312

JOINT SPACES

Intra-articular Joint Pressures

1. Resting (-4 mm Hg)
2. Opening (-54 mm Hg)
3. Closing (+64 mm Hg)



Synovial Fluid

As the intra articular pressure increases, the viscosity of the synovial fluid decreases.

This may impair the lubricating ability of the fluid… thus increasing the frictional resistance.

TM Joint Mechanical Stress

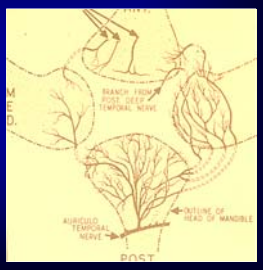
Increased sustained TM joint pressures result in:

- impaired diffusion
- local ischemic changes
  - may lead to cell death
  - free radical formation
- decreased lubrication
  - increased frictional resistance

IMPORTANT ASSOCIATED STRUCTURES

Sensory Innervation of the TMJ

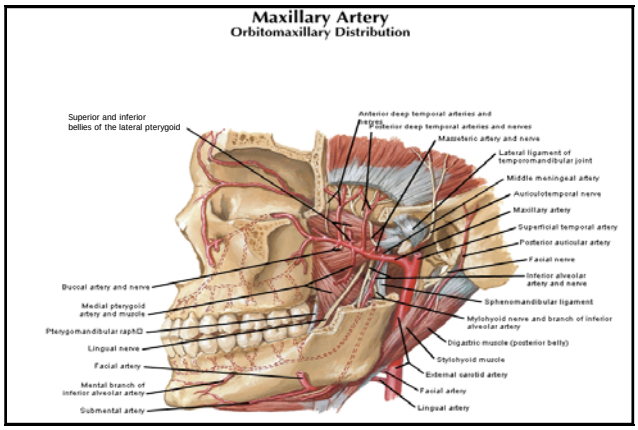
1. Branches of the 3rd division of the trigeminal nerve
   a. Auriculotemporal
   b. Masseteric
   c. Deep temporal
2. Fibers for pain and proprioception are mainly located in the bilaminar zone and capsule

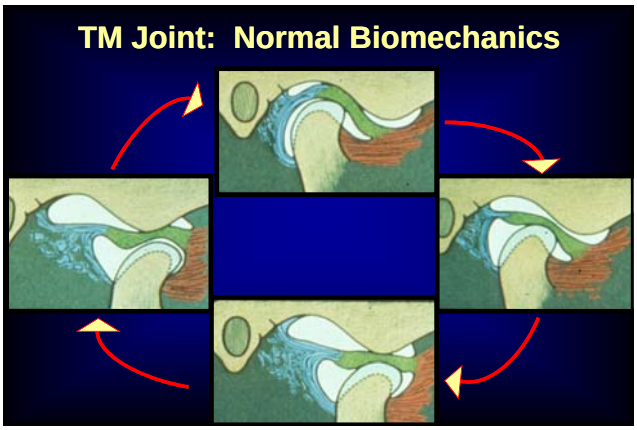


IMPORTANT ASSOCIATED STRUCTURES

Blood Supply

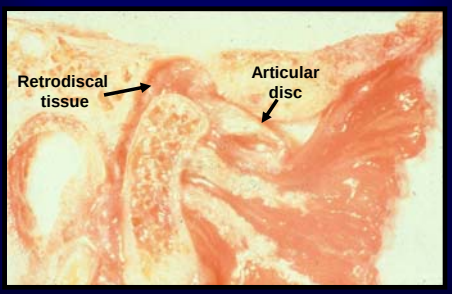
1. Branches from superficial temporal and maxillary artery
2. Extensive venous plexus in the bilaminar zone

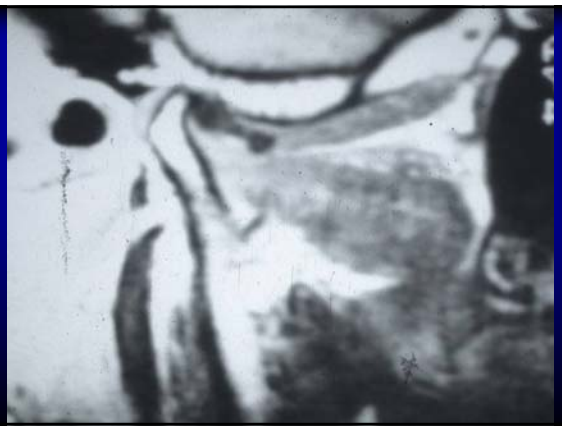




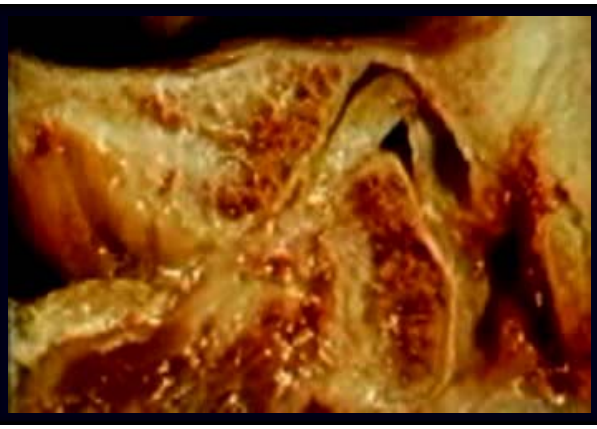
Condyle-Disc-Lateral Pterygoid Complex

Articular Disc Displacement



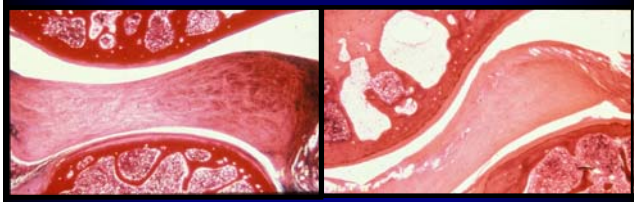


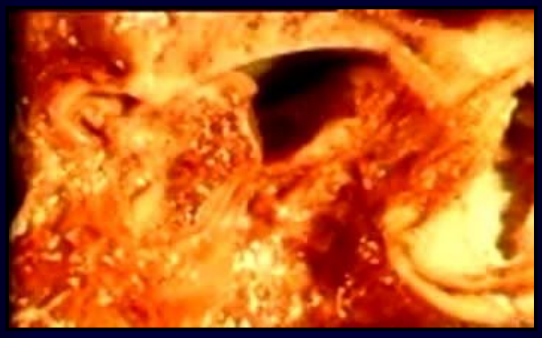
Articular Disc Displacement With Reduction



Degenerative temporomandibular joint disease is the result of maladaptation to increased joint loading.

Westesson, Rohlin 1984
Axelson, et al. 1992, 1993
Stegenga, et al. 1992
deBont, Stegenga 1993





Thank you!

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