ANATOMY AND PHYSIOLOGY OF SALIVARY GLANDS

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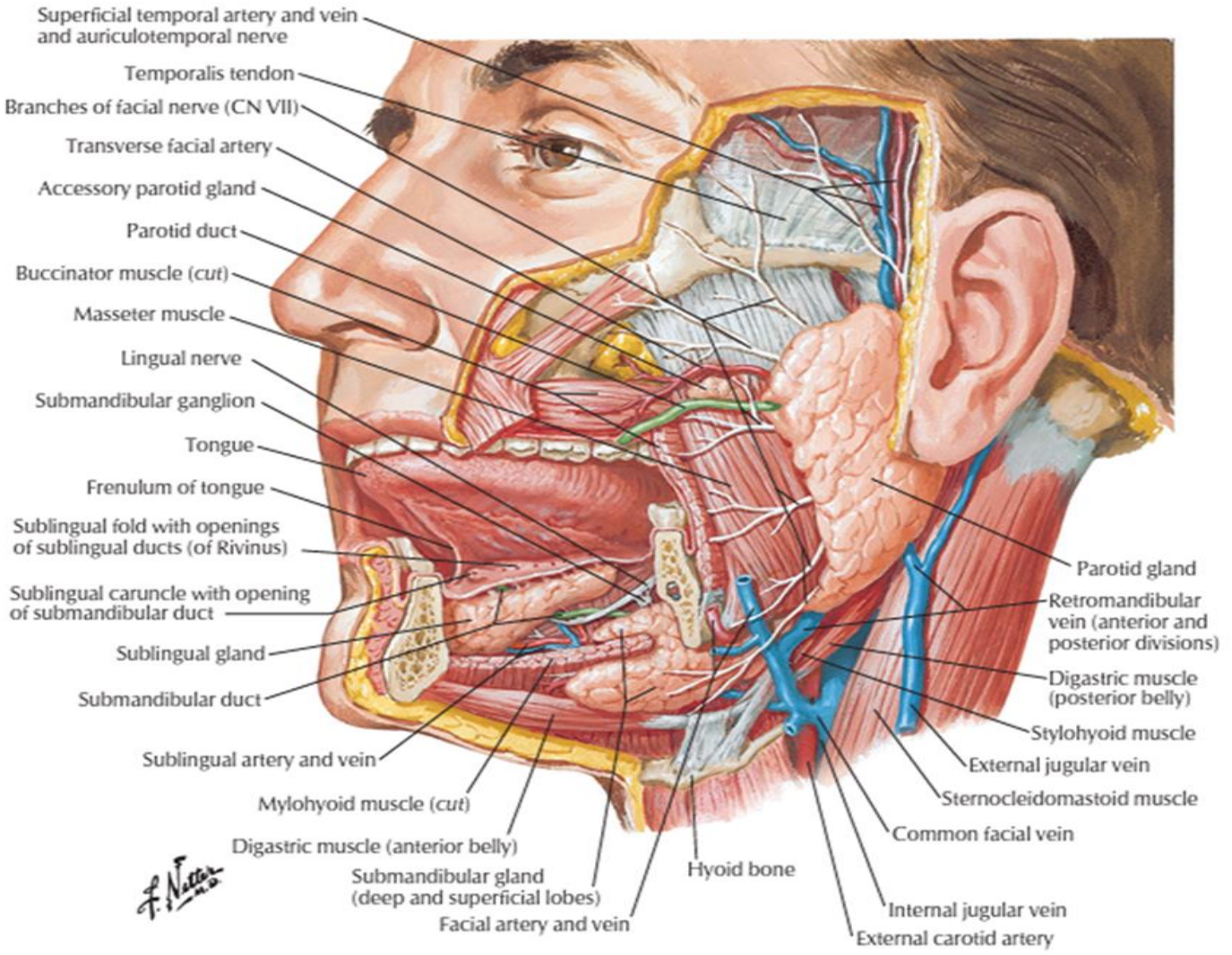
INTRODUCTION

SALIVARY GLANDS –

- **MAJOR –**
  - PAROTID
  - SUBMANDIBULAR
  - SUBLINGUAL
- **MINOR**
  - 600-1000 in number



EMBRYOLOGY

- **MAJOR GLANDS**–

Outpouching of oral ectoderm

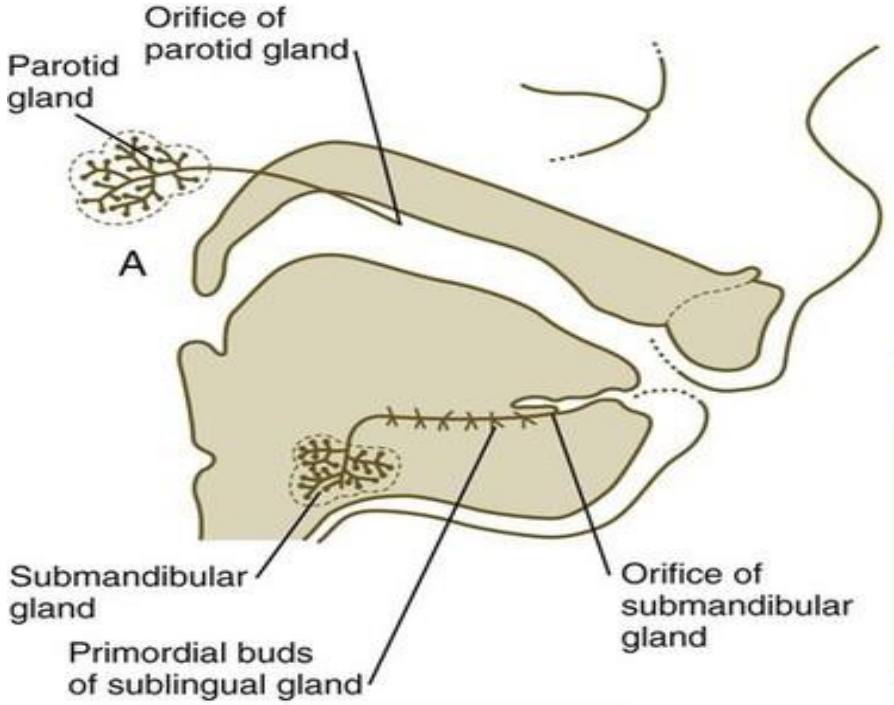
Parotid first develops, last to encapsulate

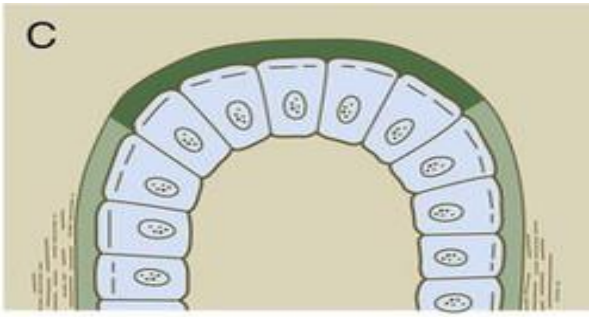
Submandibular – 6th week

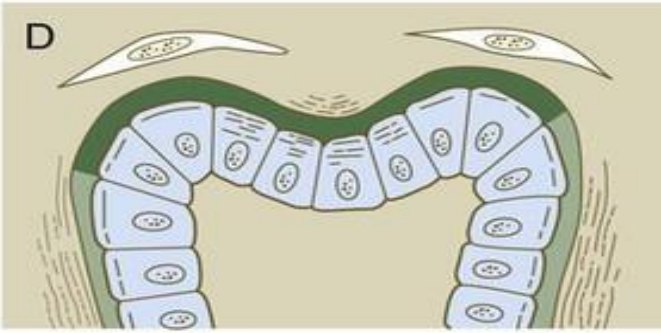
Sublingual – 8th week

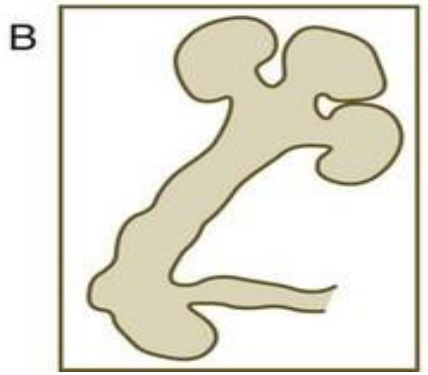
- **MINOR GLANDS**-

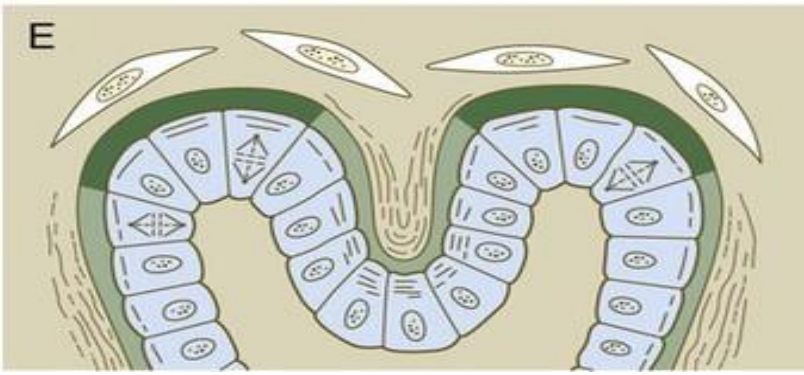
Oral ectoderm and Nasopharyngeal Endoderm







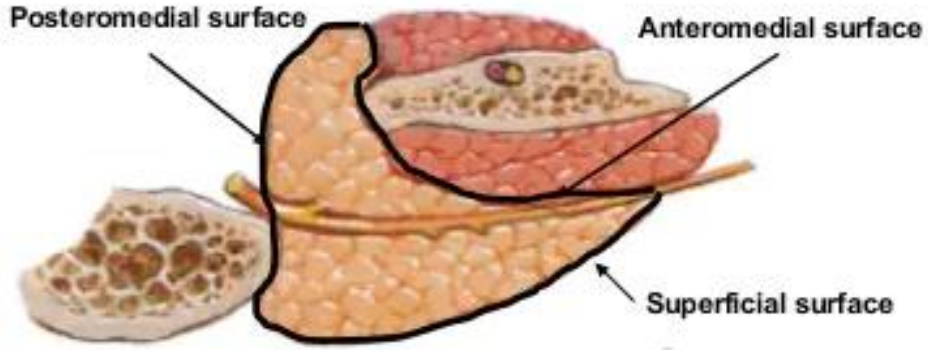


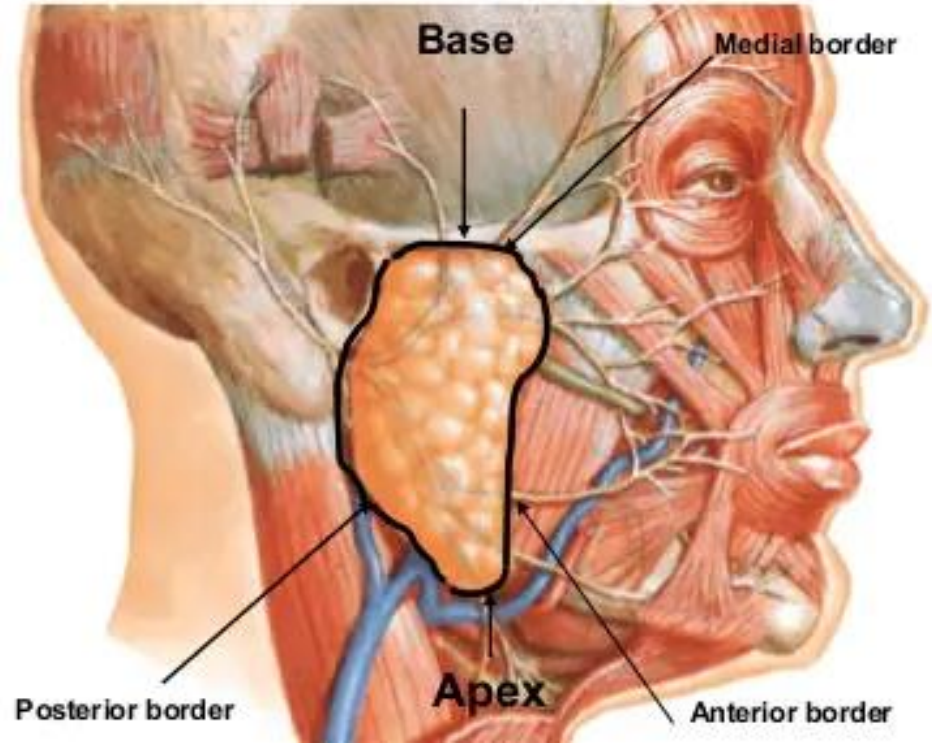


PAROTID GLANDS

CLINICAL ANATOMY –

- Largest gland
- Mainly Serous
- Weight – 25gm
- Apex and base
- Three Borders - Anterior
  -Posterior
  -Medial
- Four Surfaces - Anteromedial
  -Posteromedial
  -Superficial
  -Superior





Relations:

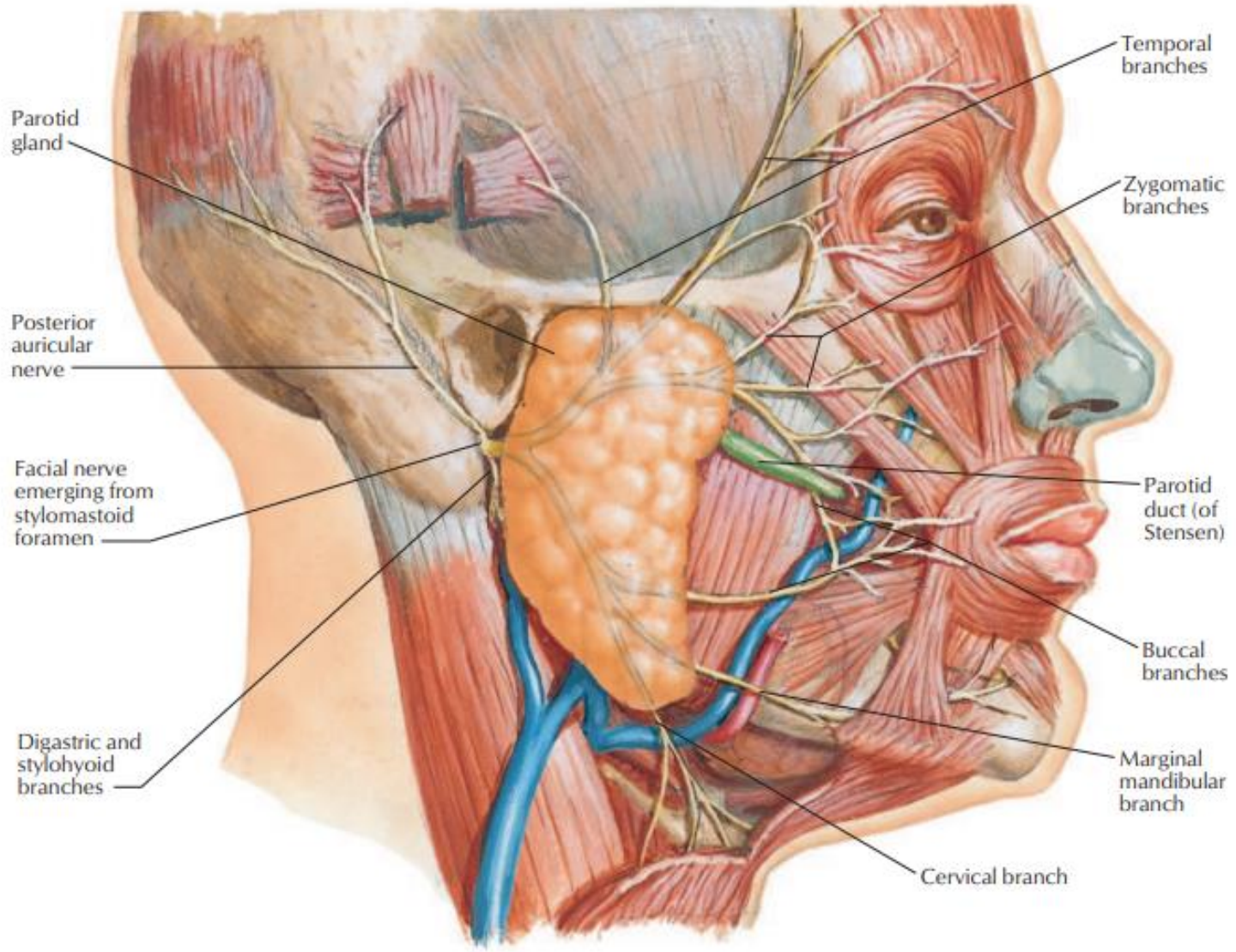
- Laterally – Superiorly – Zygomatic Arch
  Inferiorly – Upper part of Neck

- Anteriorly – Overlies Masseter

- Posteriorly – Below External auditory canal
  Overlies Mastoid process
  Lateral Process of C1

- Medially – Fills gap

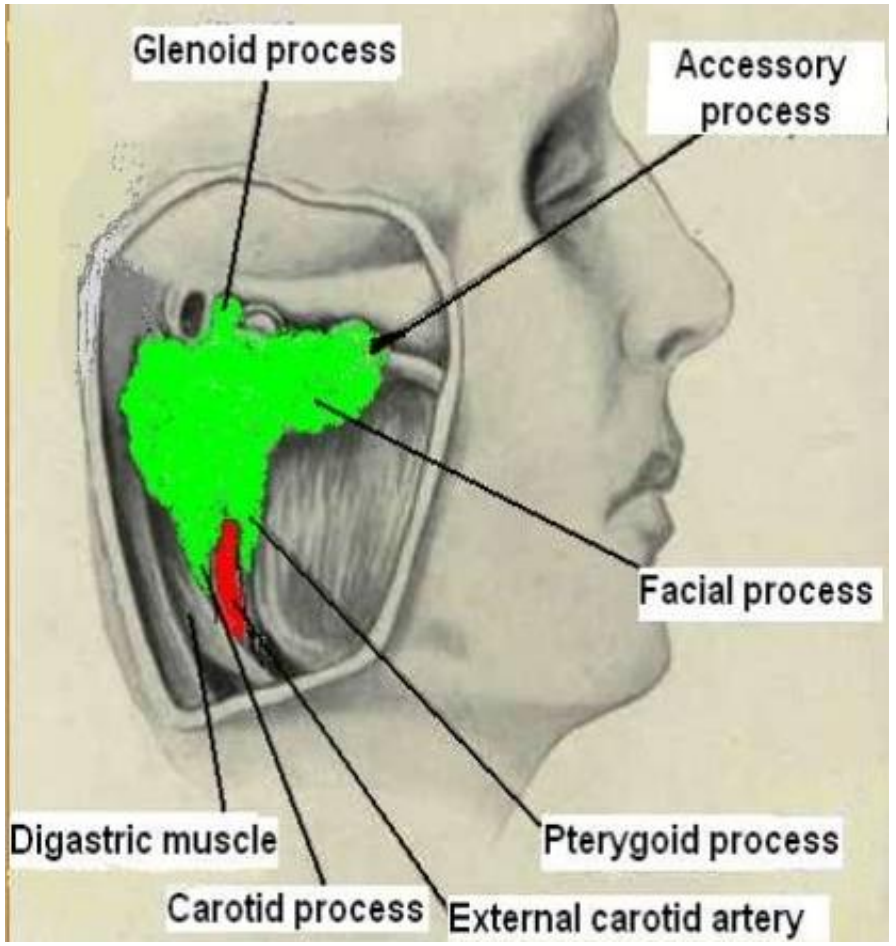
Accessory Parotid Gland



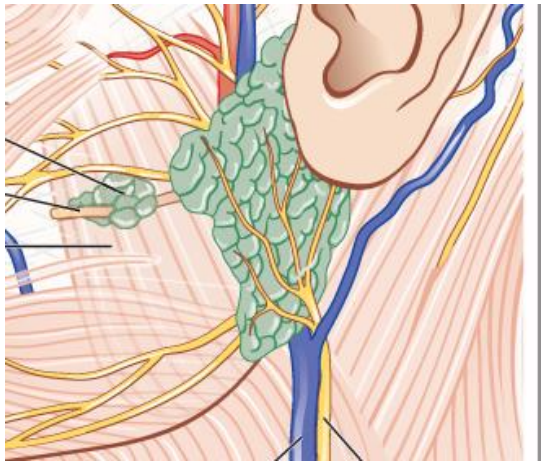
- Parotid has five processes:

1. Glenoid process- ward behind the temporomandibular joint in front of external auditory meatus
2. Accessory process
3. Facial Process- extends anteriorly onto the masseter muscle.
4. Pterygoid Process- extends forward from the deeper part lies between the medial pterygoid muscle & the ramus of mandible
5. Carotid Process- lies posterior to the external carotid artery

Tissue here are left behind during total parotidectomy which leads to recurrence of disease.

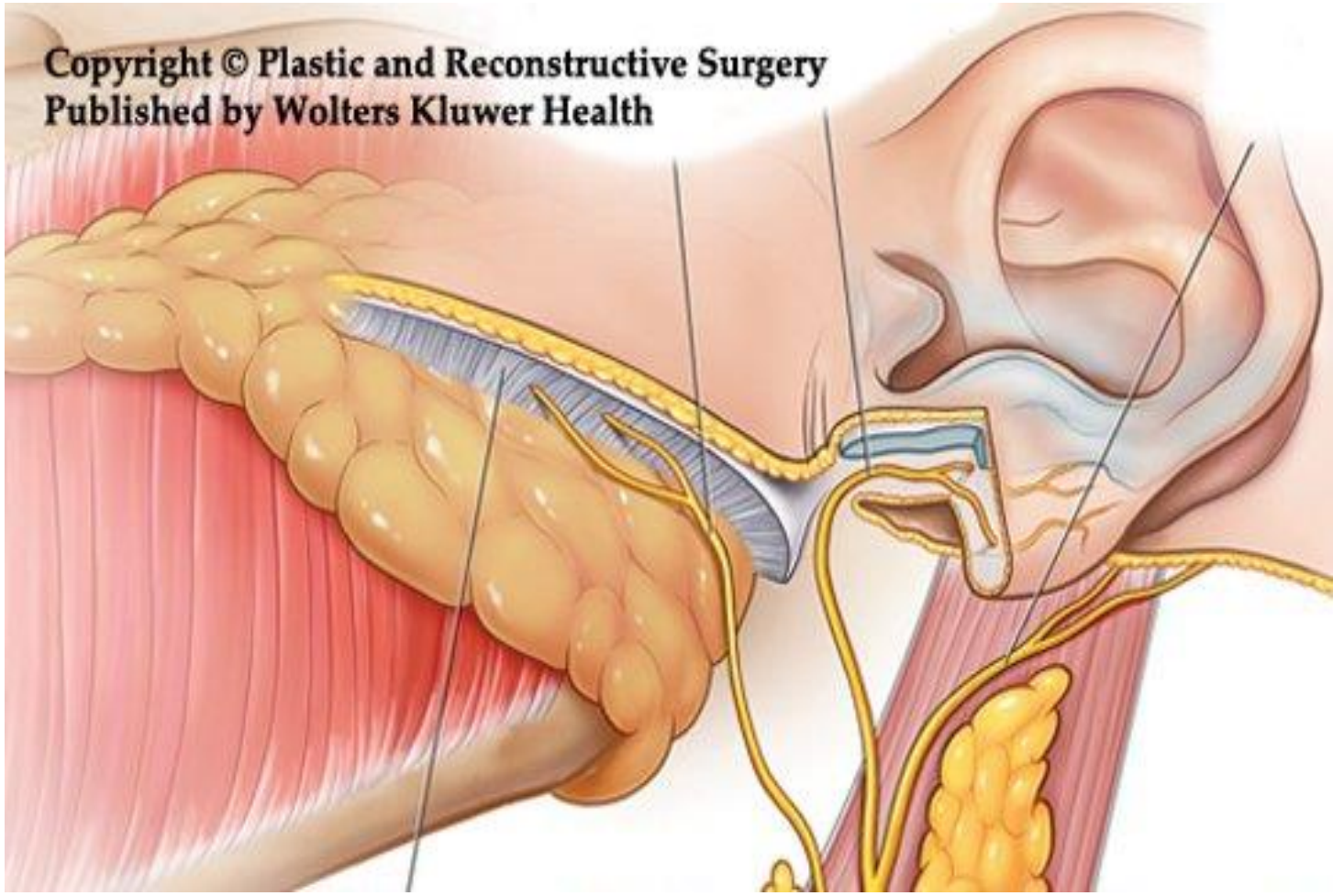


Parotid Tail- **most inferior portion of the superficial lobe**. It is composed of a triangular shaped area of tissue deep to the platysma muscle, posterolateral to the posterior belly of the digastric and anterolateral to the SCM.



Superficial Surface of Parotid

- Concave
- Covered by- partoid fascia, skin and posterior border of platysma.
- Anterior branches of greater auricular nerve, superficial lymph nodes.

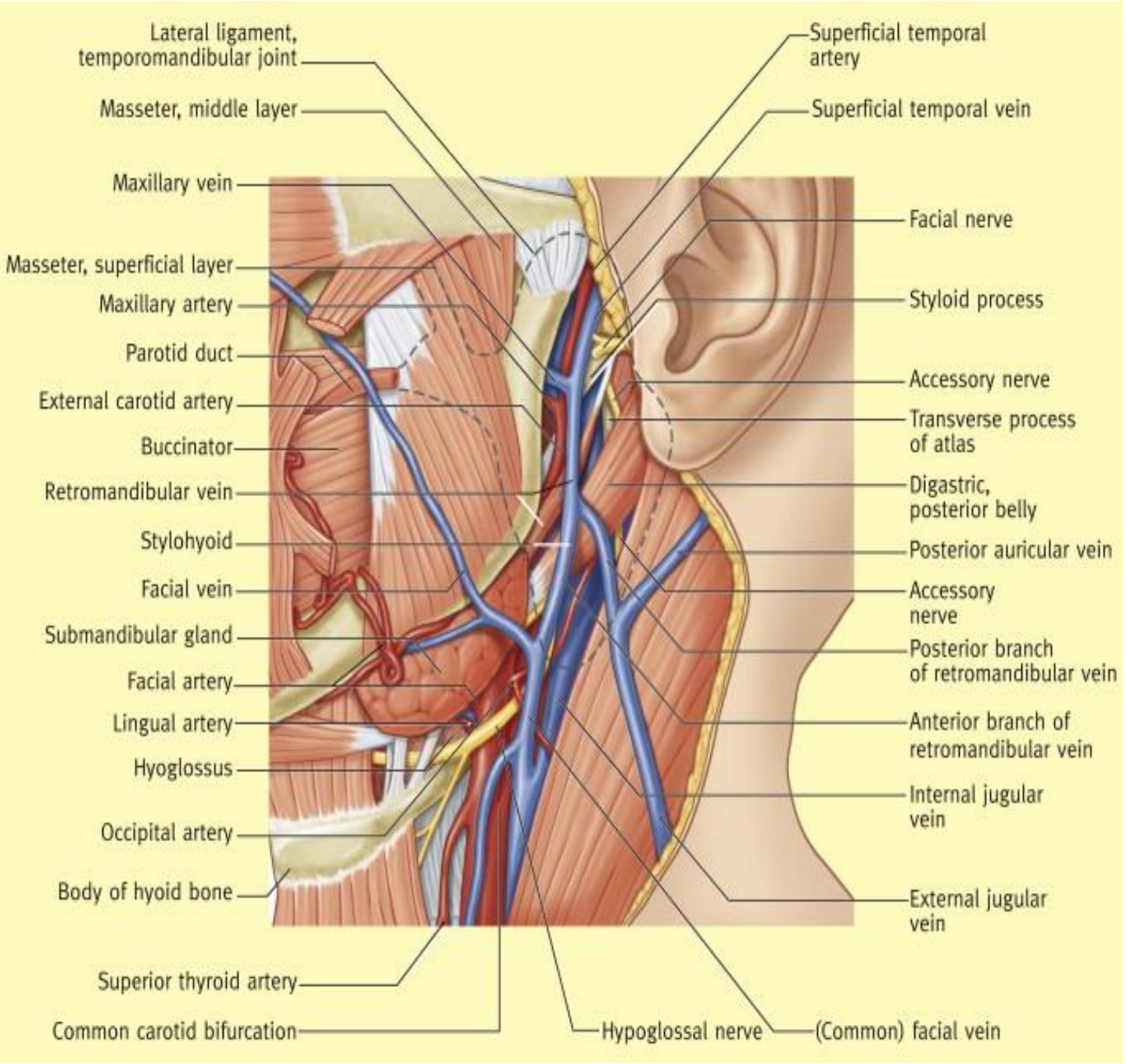


ANTEROMEDIAL SURFACE

- Ascending ramus of mandible and medial pterygoid muscle
- Temporomandibular joint.
- Envelops External carotid artery- divides into maxillary and superficial temporal vessels within gland.
- Auriculotemporal branch of Mandibular N deep to sup. Temp vessels.

POSTEROMEDIAL SURFACE

- Lies over mastoid process
- Posterior belly of digastric and sternocleidomastoid
- Medially- overlies styloid process and stylohyoid, styloglossus and stylophayrngeus.- Separate the gland from Internal carotid artery and IJV.
- Facial N trunk enters the gland high on posteromedial surface between mastoid and styloid tip.

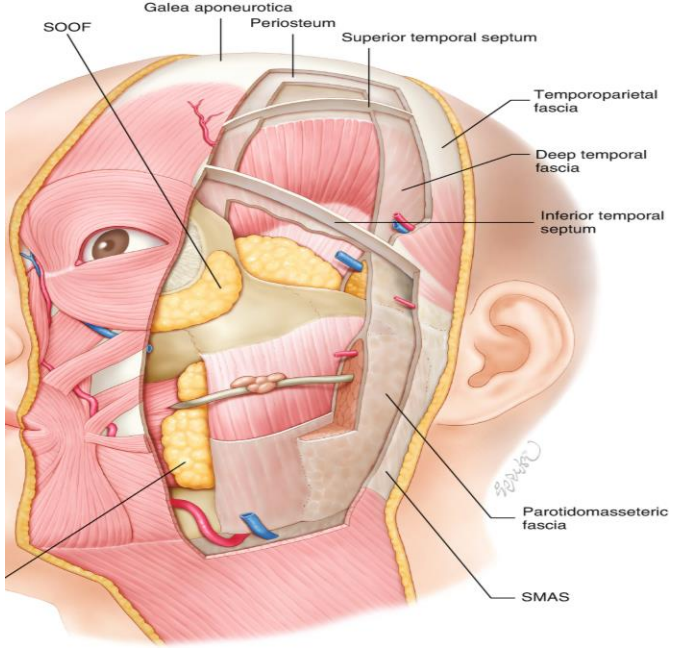


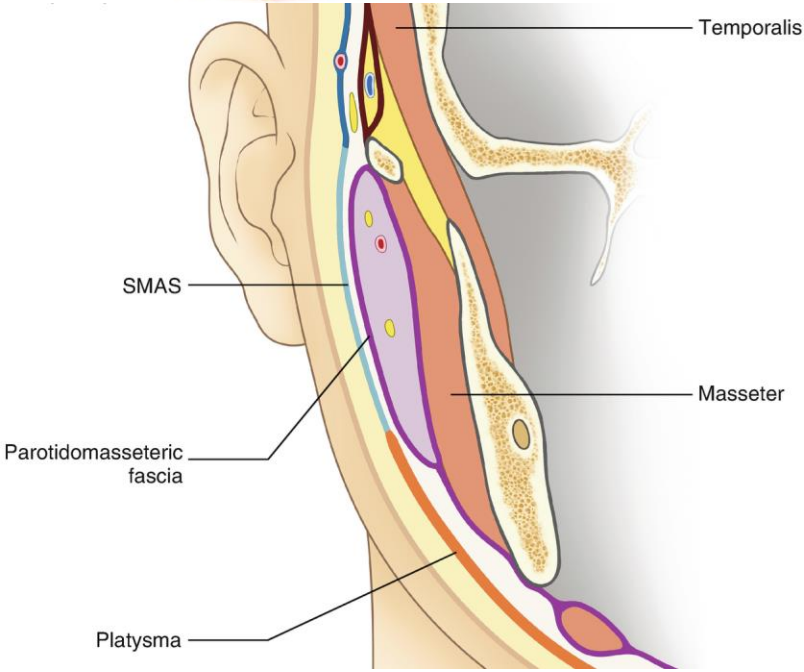
PAROTID CAPSULE

Derived from Investing Layer of deep cervical fascia- Splits to enclose Parotid gland.

Anteriorly- fascia coverig masseter muscle- parotidomasseteric fascia upto zygomatic arch.

- Superficial Musculoaponeurotic System (SMAS) overlying the capsule- adherent in pretragal region, loose as fascia enters cheek.
- Deep part upto skull base.
- Thickened as Stylomandibular Ligament.
- Tough, inelastic- stretched by inflammation and pus collection.
- Thick posteriorly, thin anteriorly and over apex, infection can spread to Parapharyngeal space.

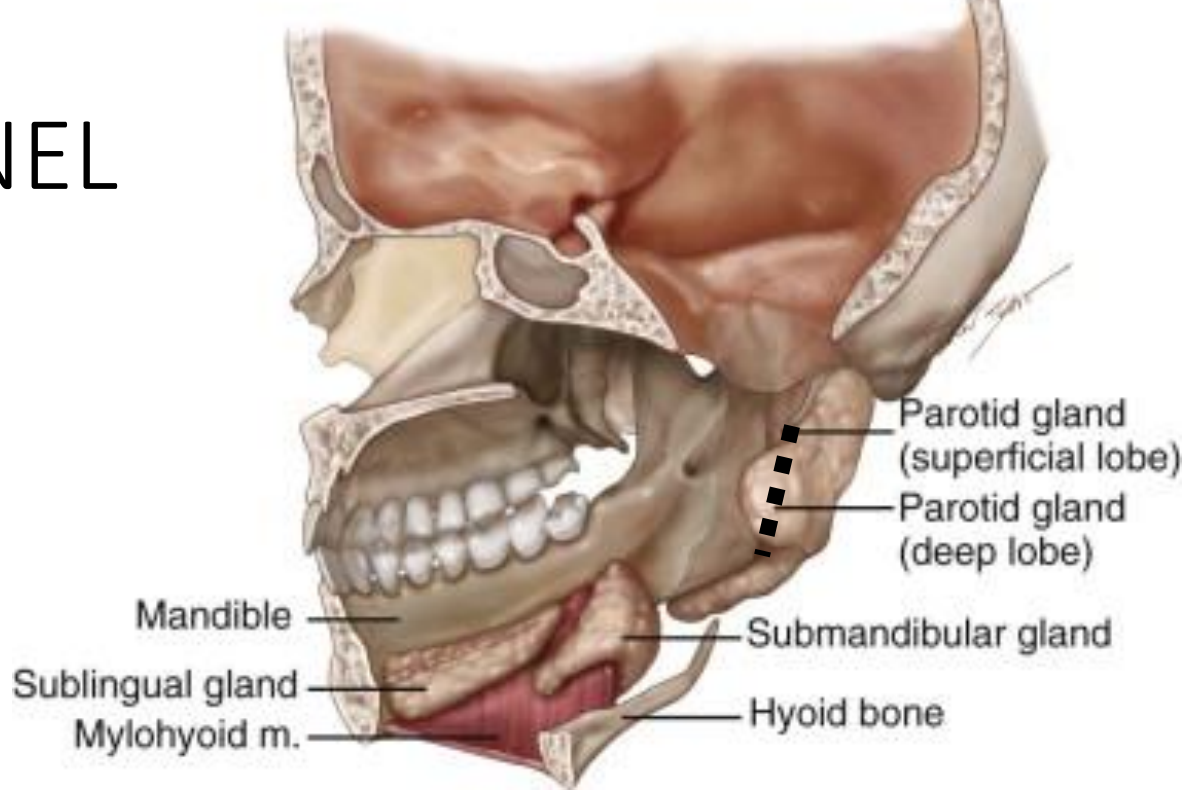


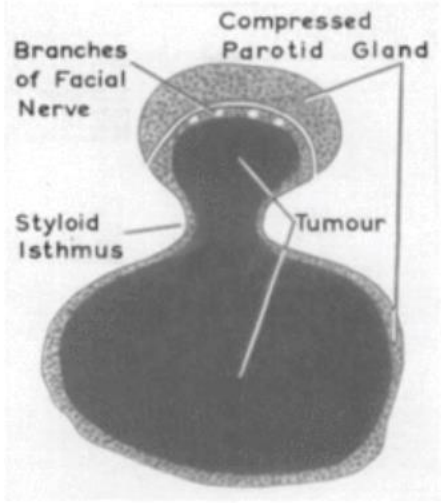


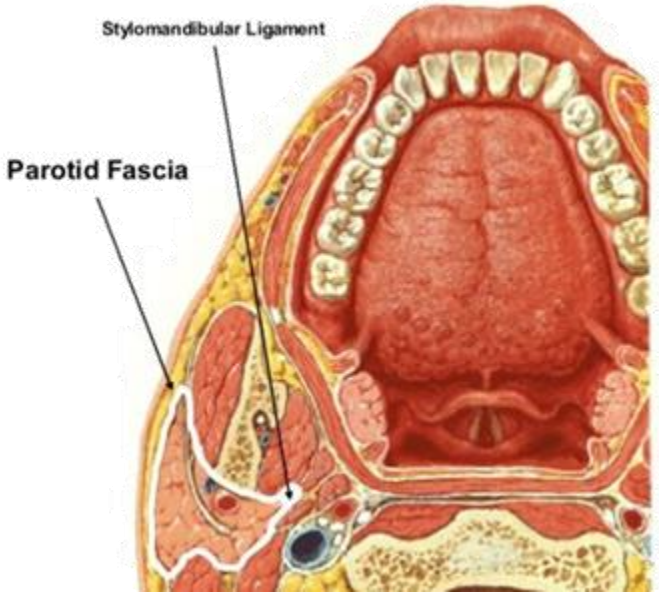
STYLOMANDIBULAR TUNNEL OF PATTEY

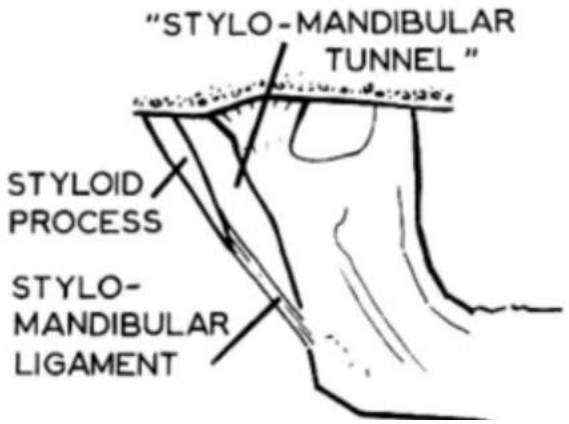
- Base of skull, ascending ramus of mandible, styloid process and stylomandibular ligament laterally.
- Tumor arising from deep lobe of parotid extending retrophayngeally tend to be constricted and fixed at this inextensible opening- thus assume dumbbell shape.

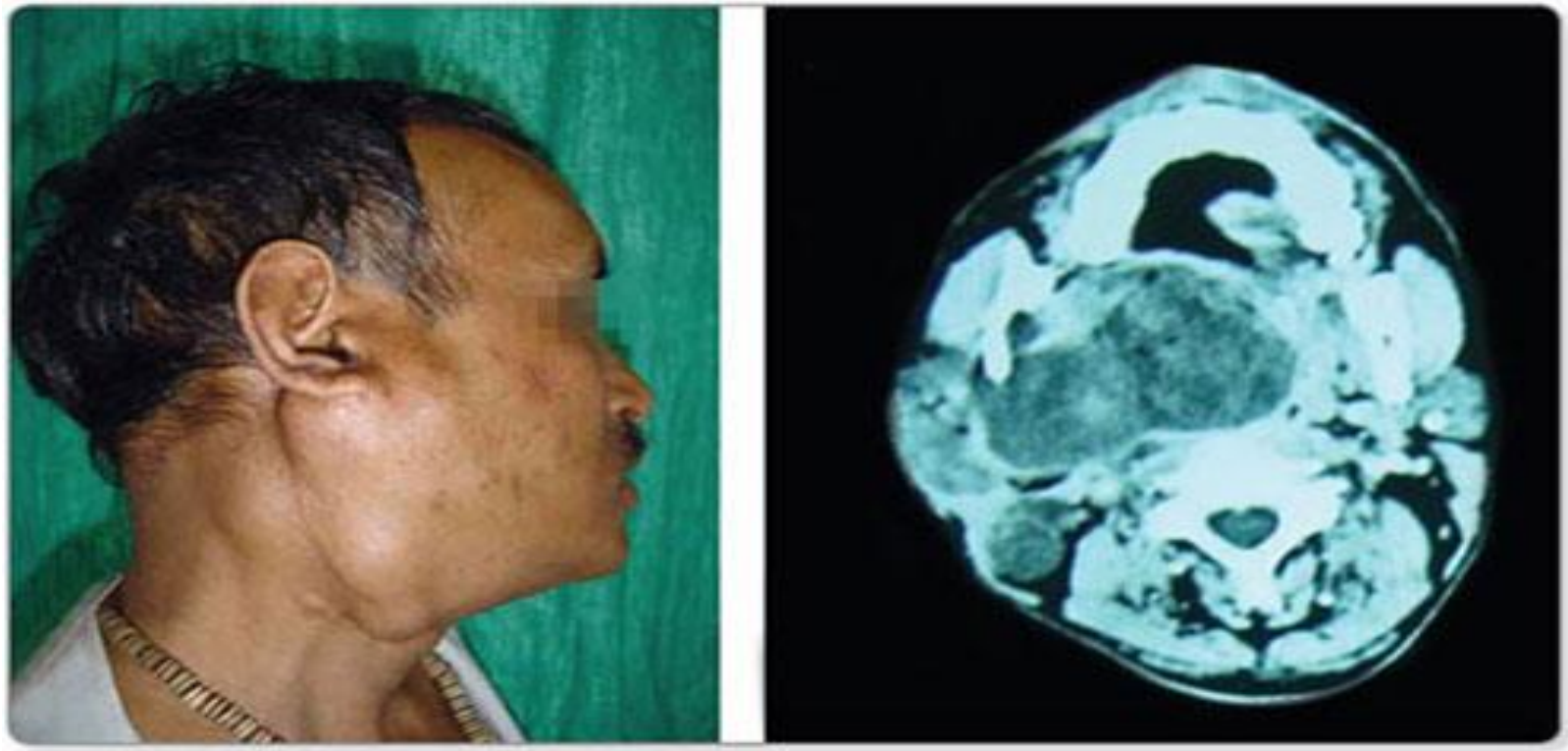
DUMB BELL TUMOR

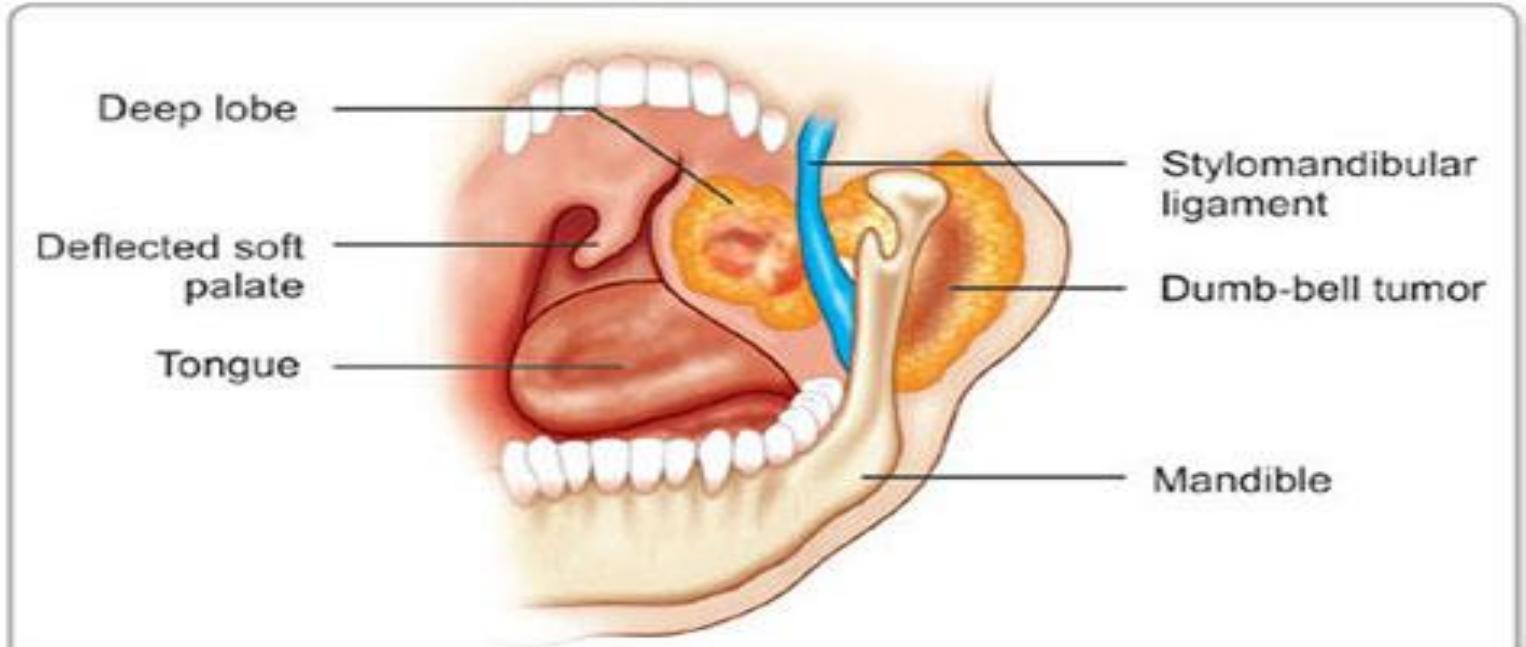










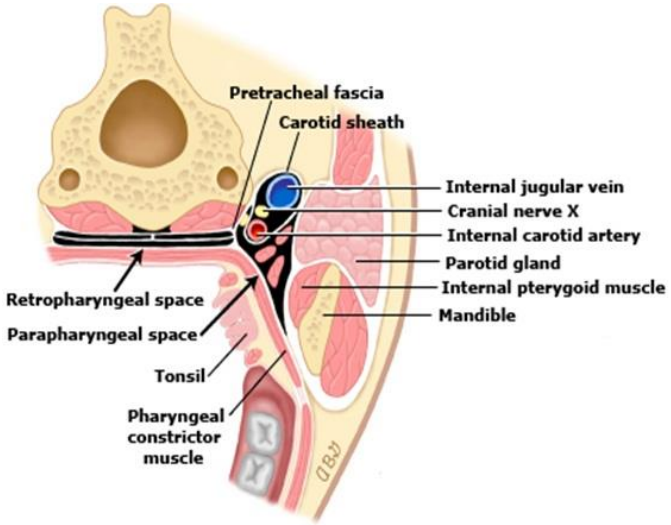

Deep lobe
Deflected soft palate
Tongue
Stylomandibular ligament
Dumb-bell tumor
Mandible

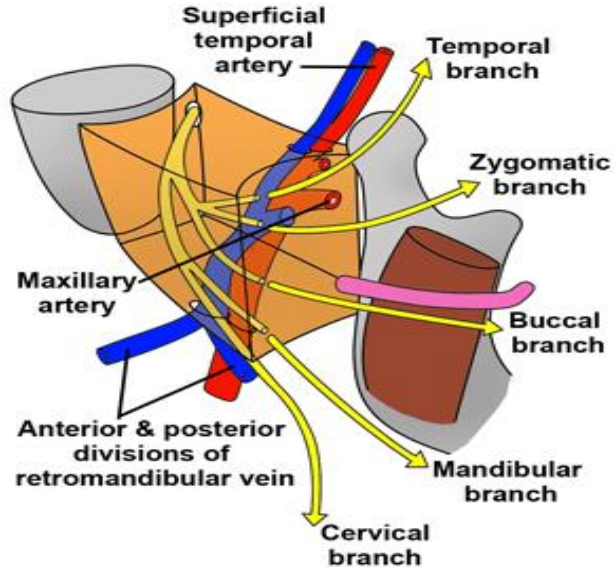
Relation of Vessels in Parotid Substance

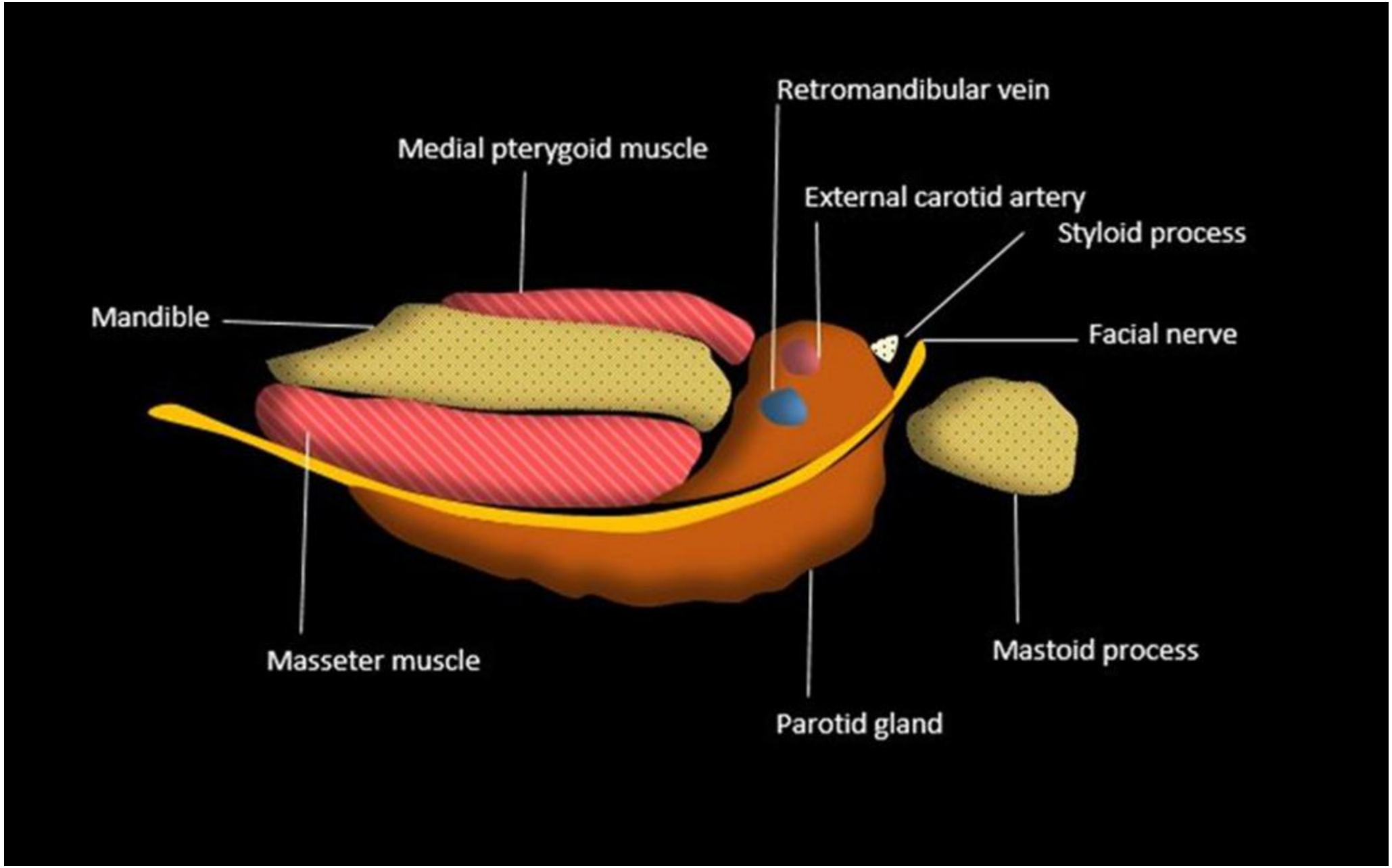
- Superficial to Deep

1. Facial Nerve- enters the gland and divides into temporal and cervical divisions- divide gland into superficial (80%) and deep (20%) and emerge from anteromedial surface.
2. Retromandibular Vein- deep to nerve, radiological marker, emerges from lower pole and divides into post division- joins post auricular v. to form ext jugular vein.
3. External jugular artery- dvides into superficial temporal and internal maxillary artery.
4. Internal carotid and IJV

PATEY'S FACIOVEBOUS PLANE-
Within gland facial N and retromandibular vein lie in 1 plane
In this plane, gland can be spljt into superficial and deep part without injuring N.

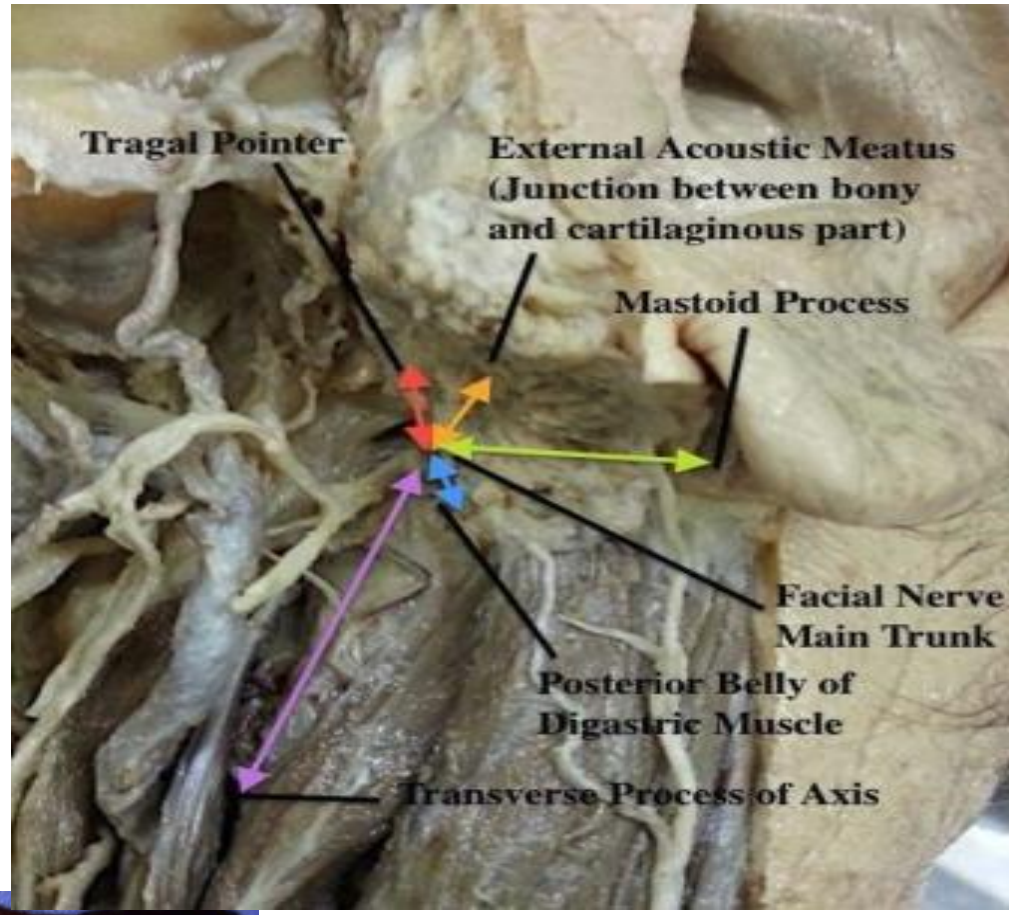


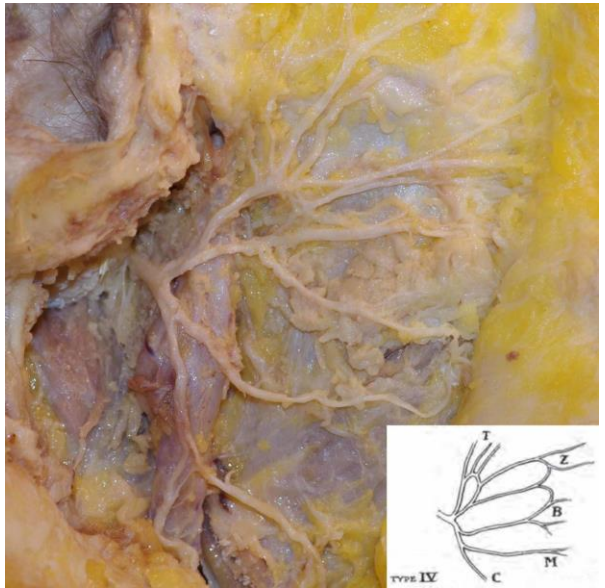


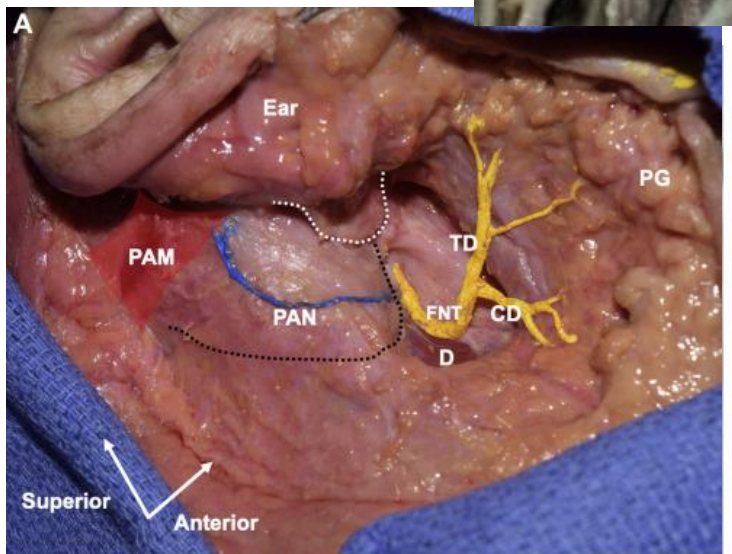

Retromandibular vein
Medial pterygoid muscle
External carotid artery
Styloid process
Mandible
Facial nerve
Masseter muscle
Mastoid process
Parotid gland

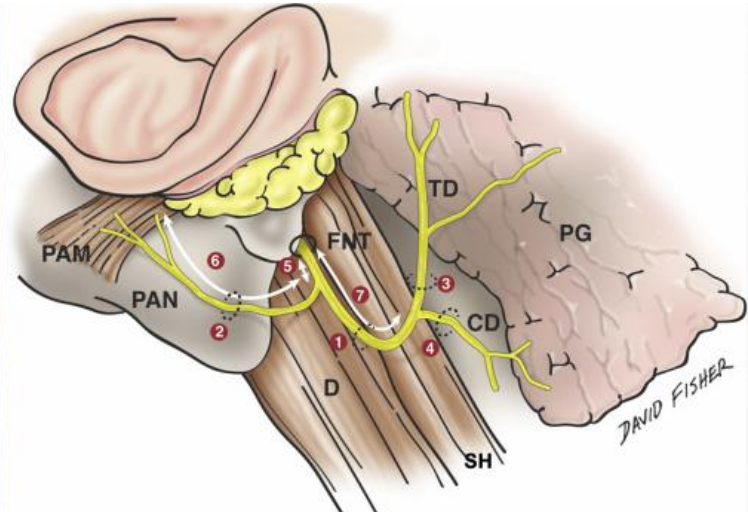
EXTRATEMPORAL COURSE OF FACIAL NERVE

- Emerges from stylomastoid foramen at bony cartilagenous junction of EAC.
- Double trunk in 3-26.7% cases.
- 1 cm above posterior belly of digastric, passes downward and forward over the styloid.
- Gives Post. Auricular N – occipital belly of occipitofrontalis and muscular branch- post belly of digastric and stylohyoid.
- Bends forward to enter substance of parotid.
- Divides into Zygometicotemporal and lower Cervicofacial division- Pes Anserius



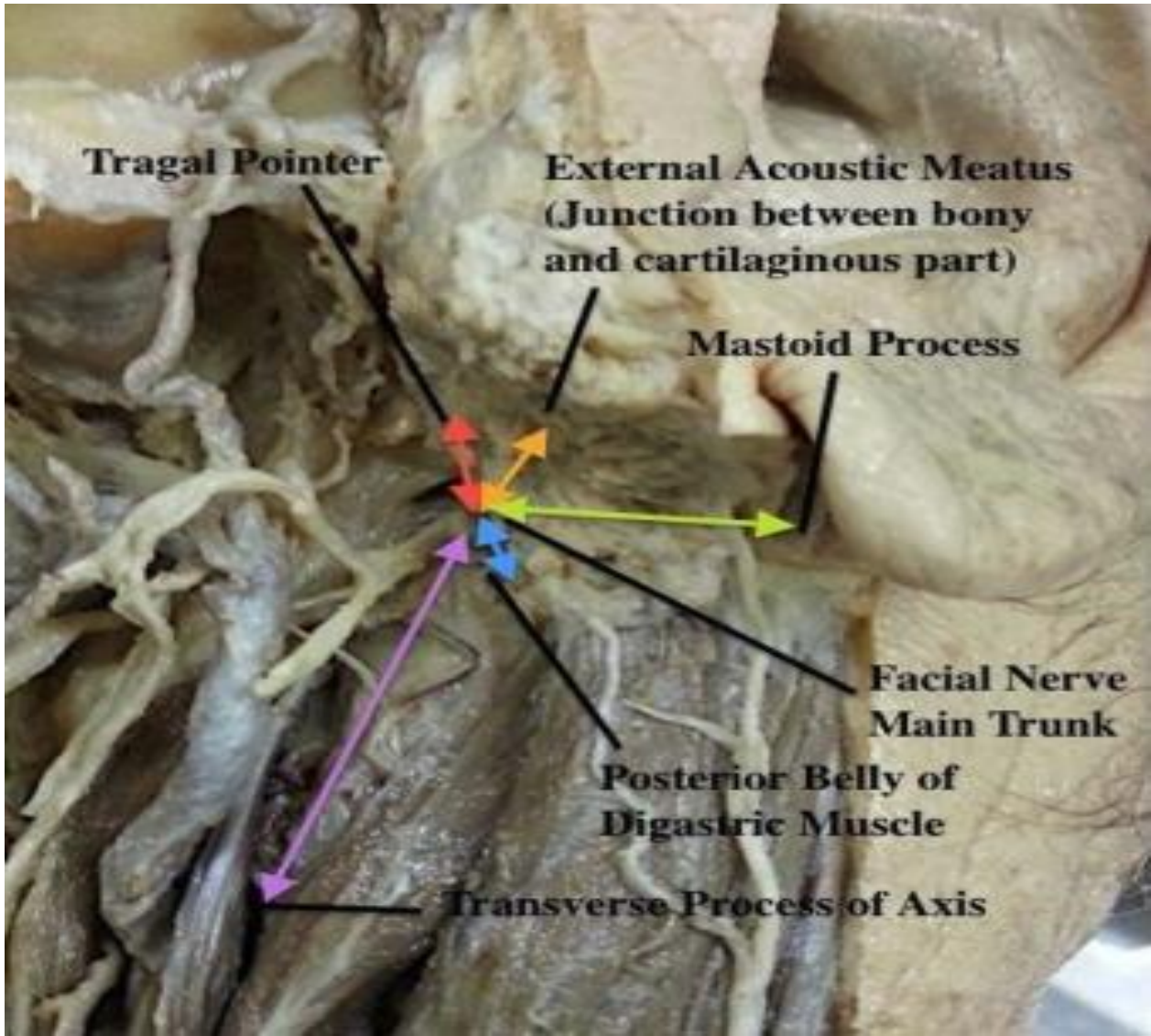






INTRO-OP IDENTIFICATION OF FACIAL NERVE

- Just superior to Digastric muscle's upper border
- The tragal/Conley's pointer is 1 cm superior to and 1 cm superficial to the nerve
- Emerges few millimeters deep to outer edge of Tympanomastoid suture line
- Downward forward over Styloid process and attached muscles
- Retrograde dissection



Katz and Catalano Classification

TYPE 1- Splitting and of reunion of zygomatic or mandibular branches.

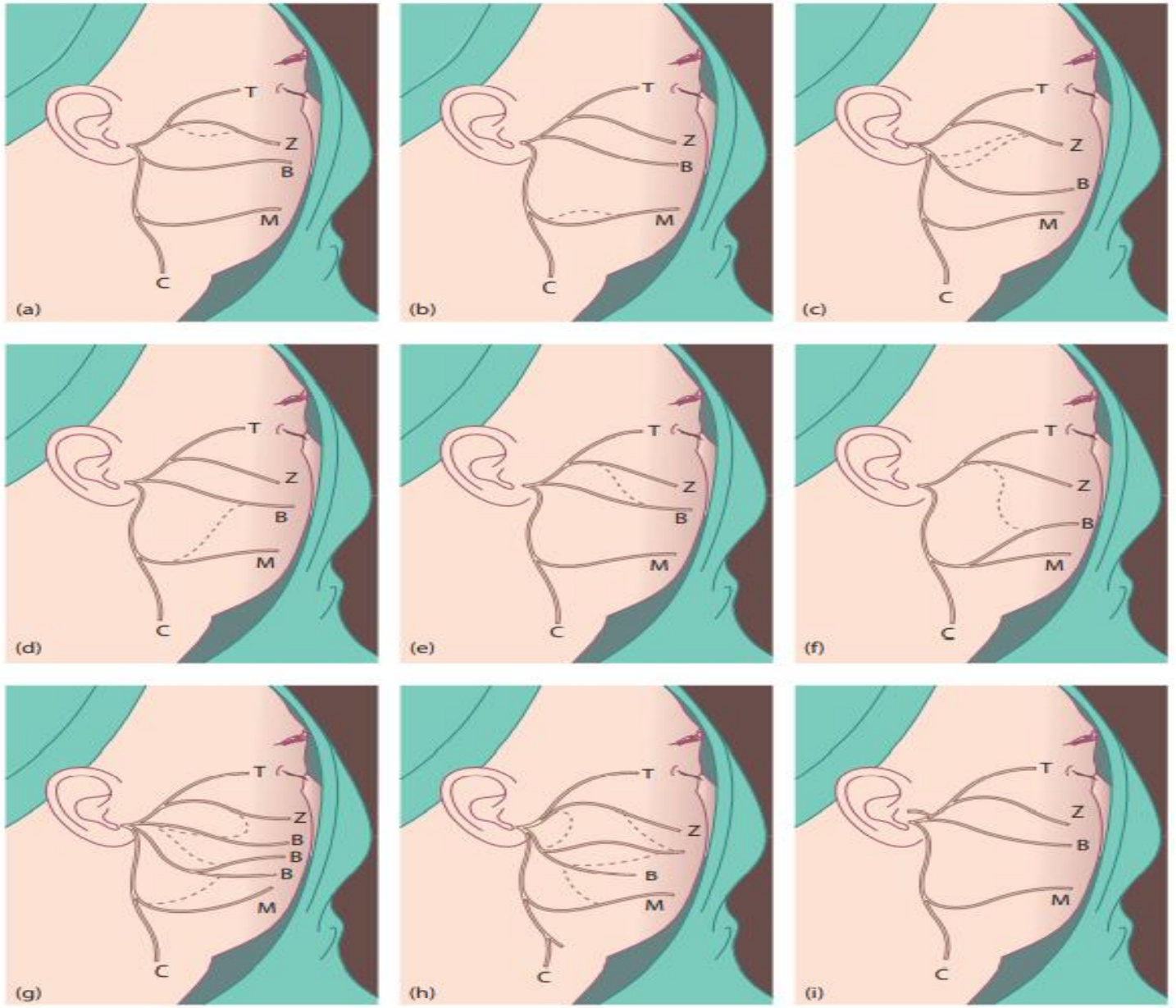
TYPE 2- Subdivision of buccal branch fuse with zygomatic branch.

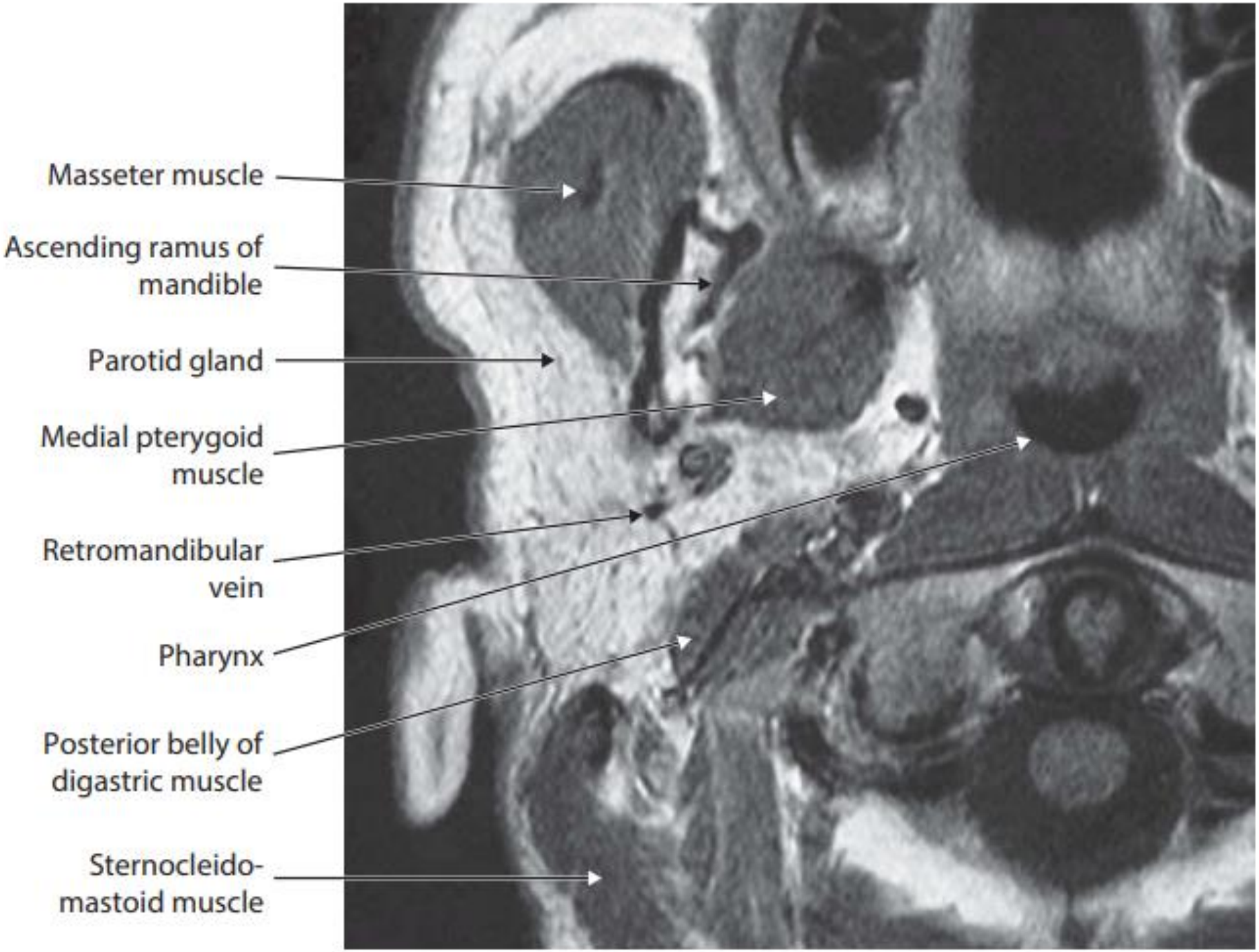
Type 3: Major communication of buccal branch with others.

Type 4: complex branching and anastomosing pattern.

Type 5: Facial N exits as more then one branch.

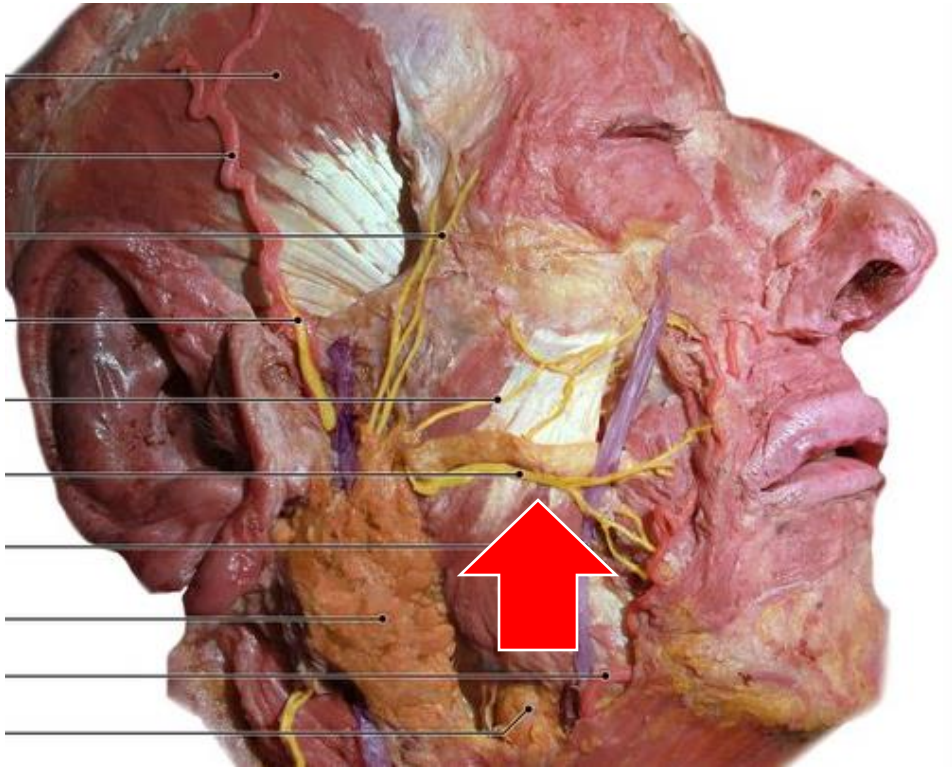
Buccal and zygomatic have pronounced branchings- less midfacial movement abnormality post parotid surgery.

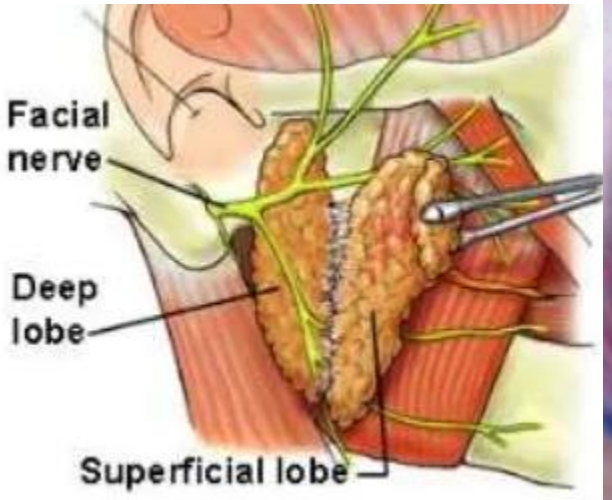



Masseter muscle
Ascending ramus of mandible
Parotid gland
Medial pterygoid muscle
Retromandibular vein
Pharynx
Posterior belly of digastric muscle
Sternocleido-mastoid muscle

PAROTID DUCT/ STENSEN DUCT

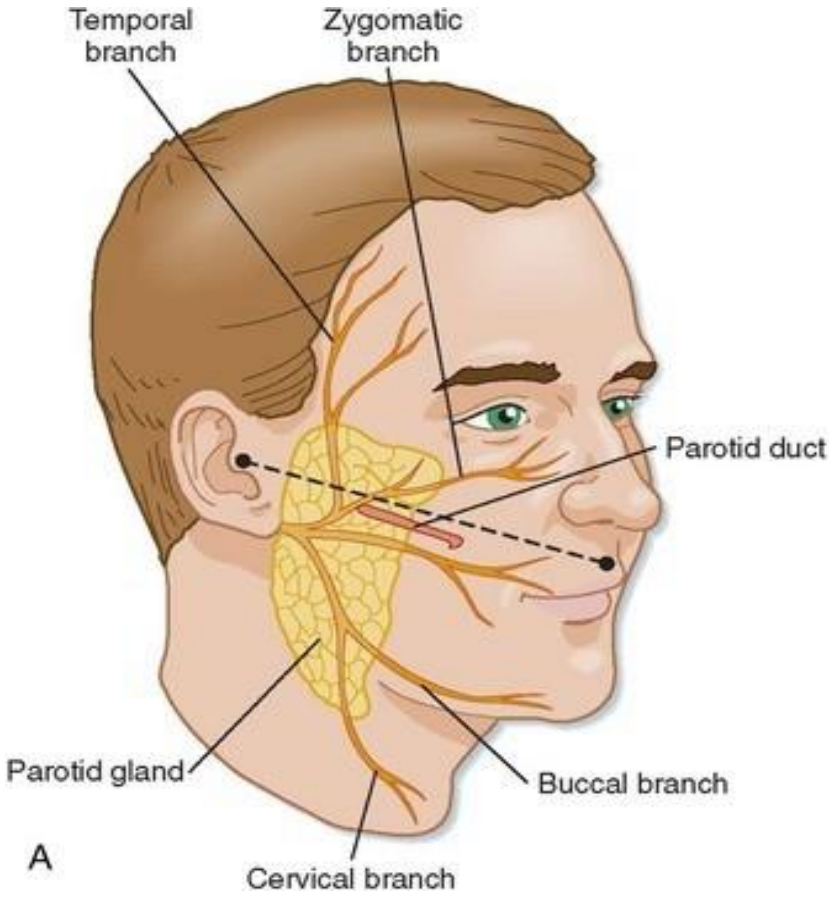
- Length - 5 cm , Internal Calibre – 0.6 mm.
- Originates from deep lobe , only small ductules connect superficial and deep lobe.
- Emerges from anterior Border and travels across masseter.
- Pierces buccal pad of fat, buccopharyngeal fascia, buccinator, runs obliquely between buccinator and oral mucosa
- Opens at parotid papilla opposite upper secon
- Medial to facial vessels.



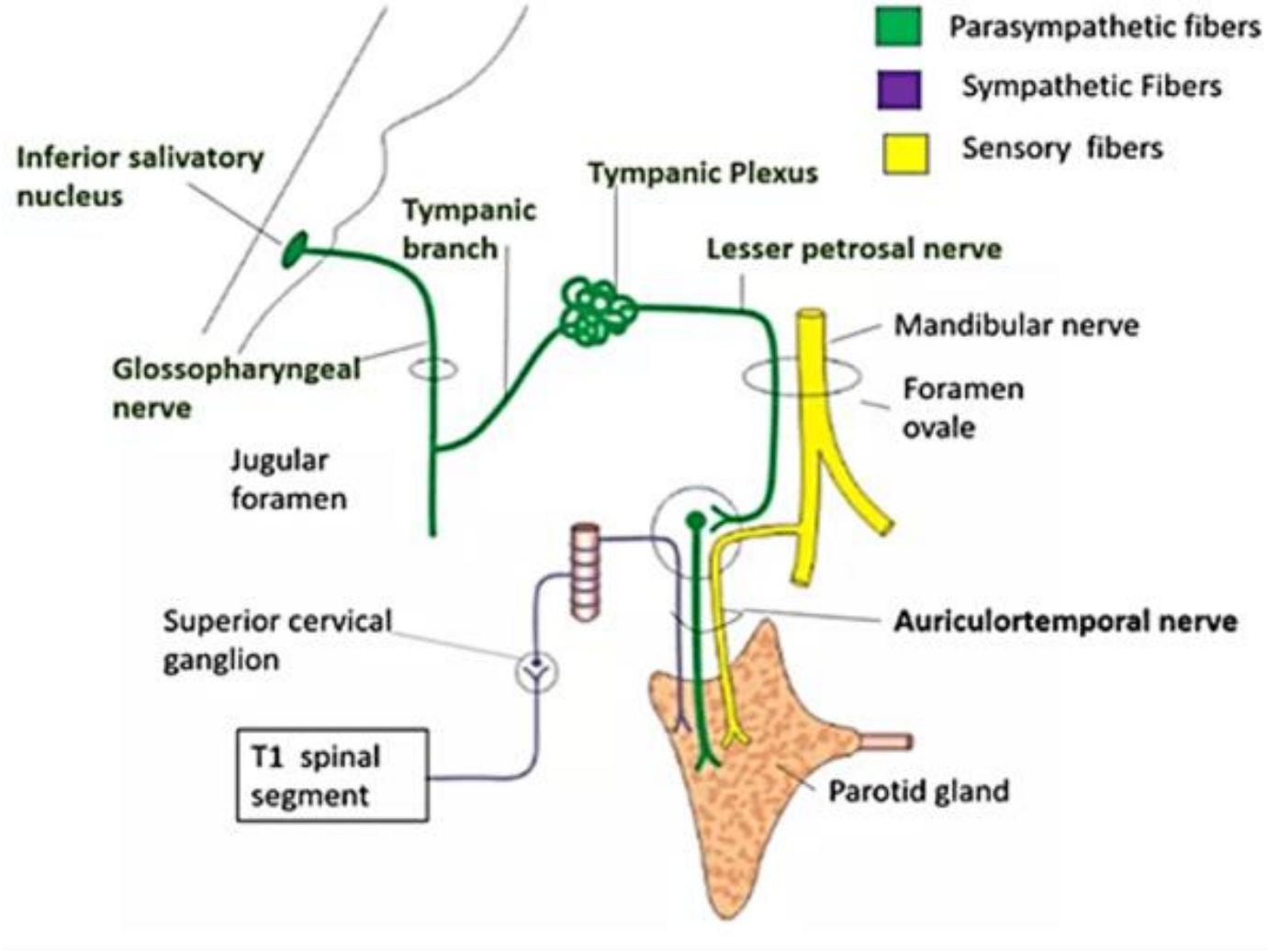


SURFACE MARKING OF PAROTID DUCT –

- Middle of the line between intertragal notch of auricle and midpoint of the philtrum.

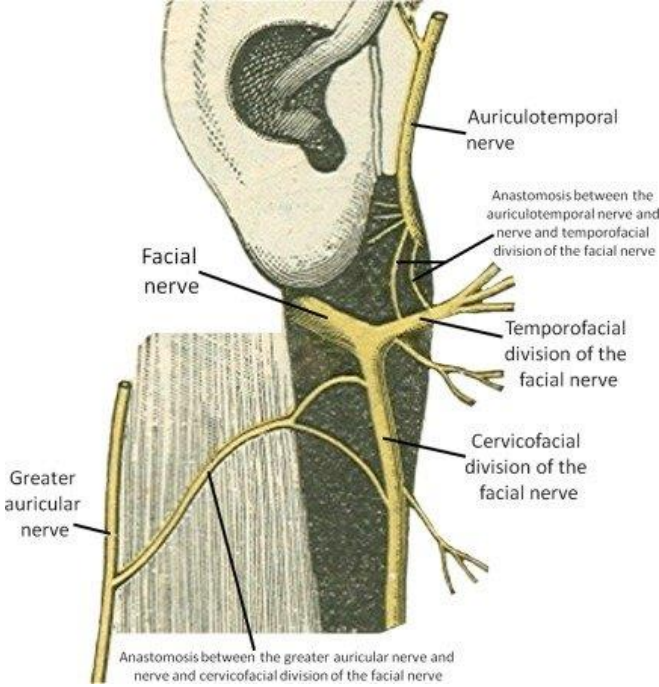


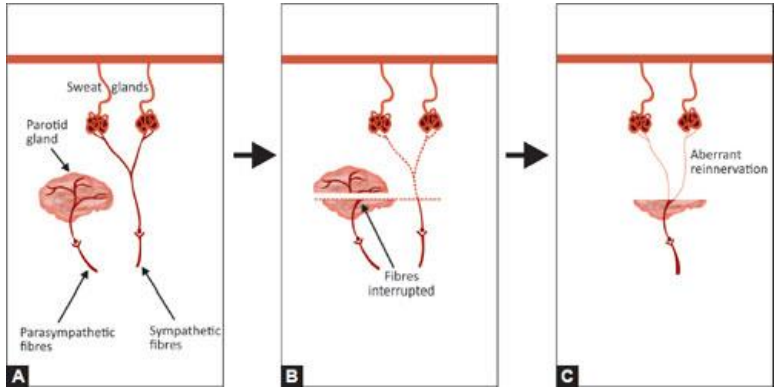
NERVE SUPPLY



FREY'S SYNDROME

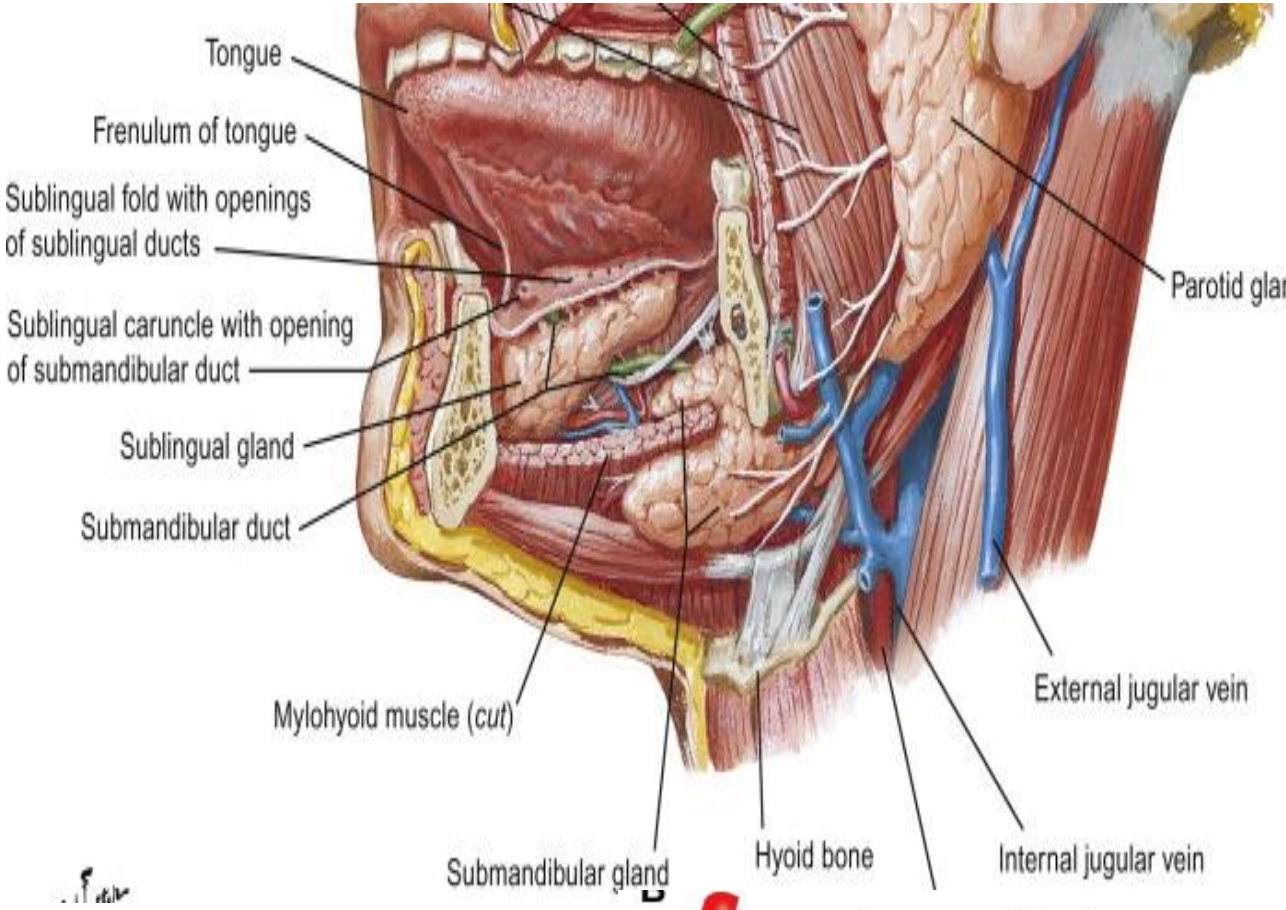
- Gustatory sweating/ auriculotemporal syndrome
- Facial warmth/ sweating, flushing over distribution of auriculotemporal N stimulated by gustatoty stimulus.
- 5 weeks to several months post parotidectomy
- Post trauma/ forceps delivery
- During parotidectomy, postganglionic sympathetic fibres and sympathetic fibres of local sweat glands are cut.
- Misdirected nervous regeneration.
- MINOR;S STARCH IODIDE TEST
- MX- Botulinum Toxin A infiltration

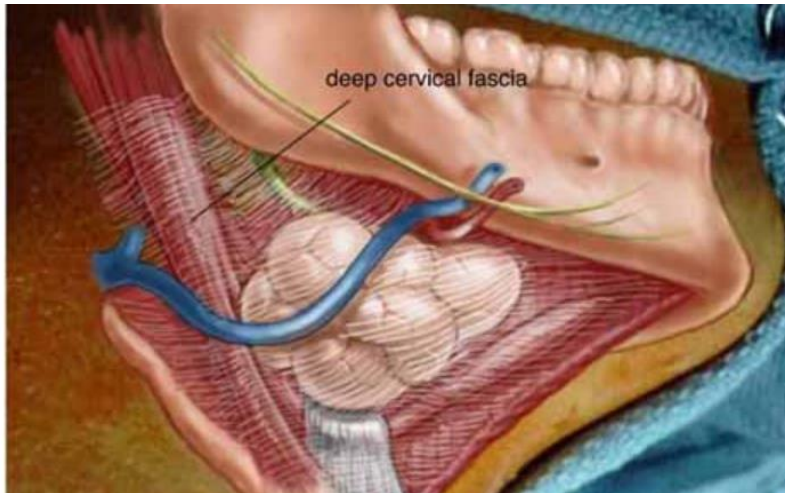


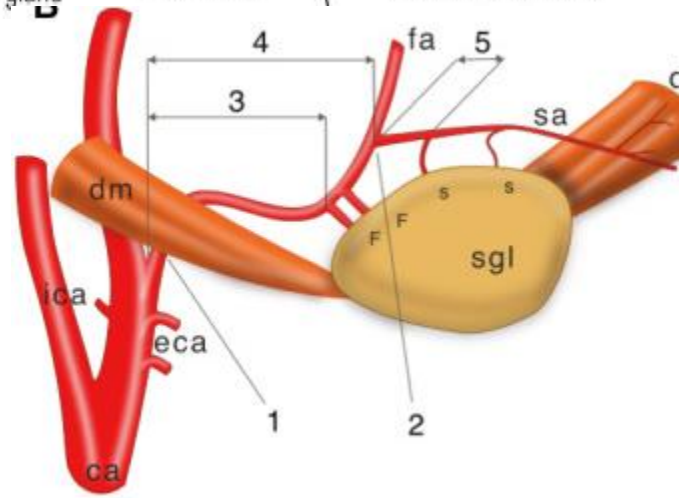


SUBMANDIBULAR GLAND

- Second Largest, Weight - 7-16gm
- Lies in Submandibular triangle.
- Two Parts wrapped around mylohoid muscle- Larger Superficial, Smaller Deep.
- Lateral surface- submandibular fossa of mandible, adjacent to attachment of medial pterygoid.
- Medial Surface- N. to mylohoid and submental Vessels.
- Facial artery- enters and grooves the gland posteriorly and emerges between gland and lower border of mandible.
- Covering- skin, platysma, capsule- derived from deep cervical fascia.





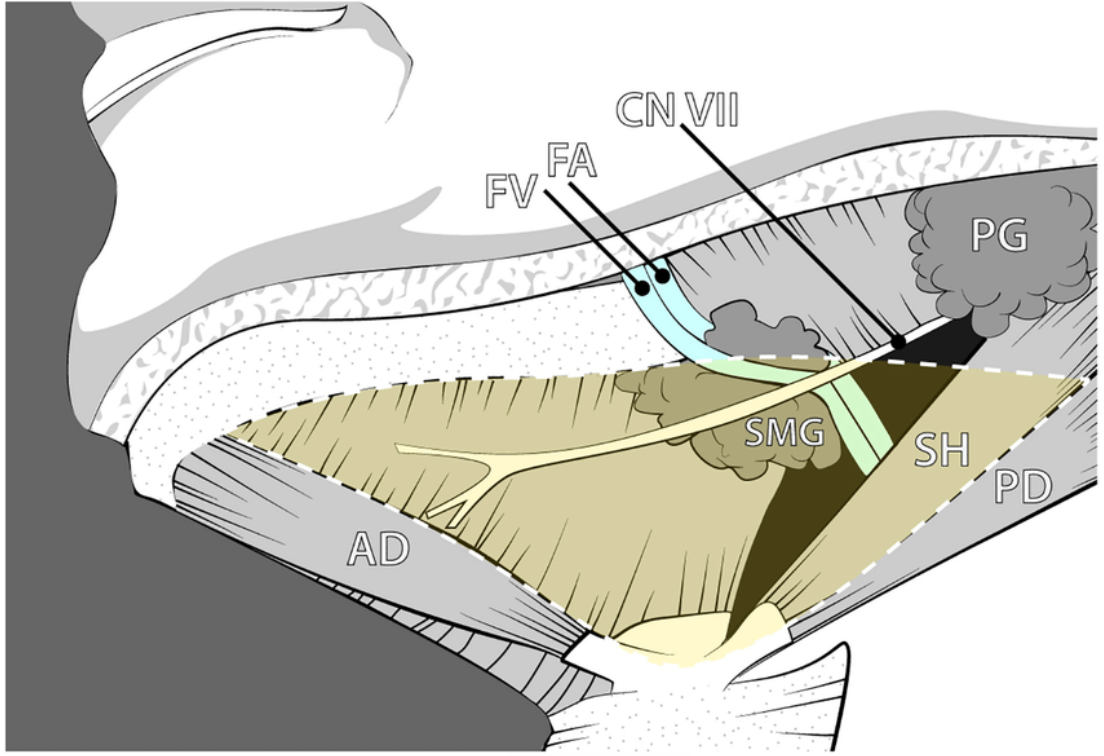


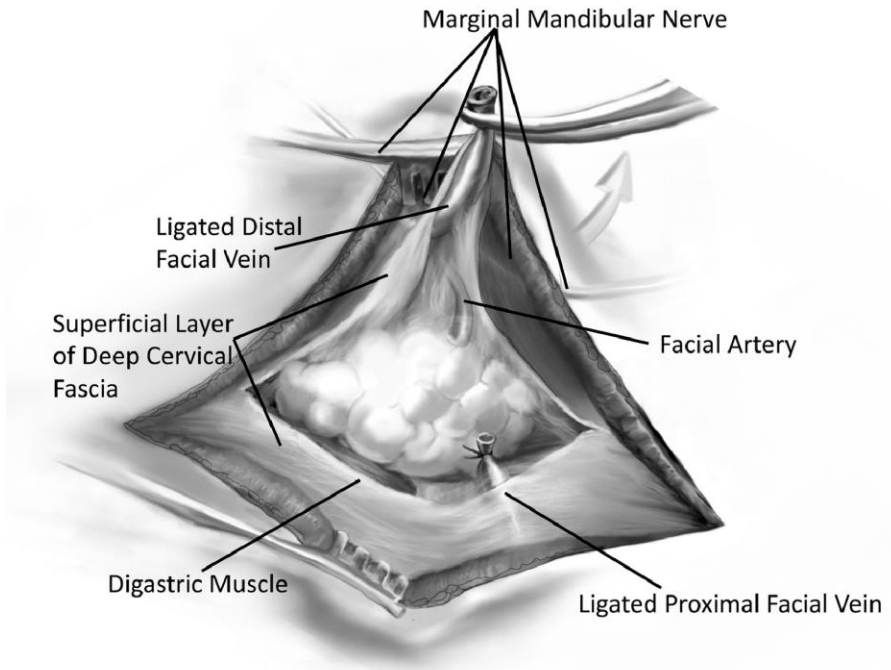
Relation of facial Vein and Facial N.

- Marginal mandibular N overlies facial and crosses it transversely.
- To avoid injury Fascia should be incised at lower border of the gland

-Dissection should proceed right on the gland, deep to the fascia.

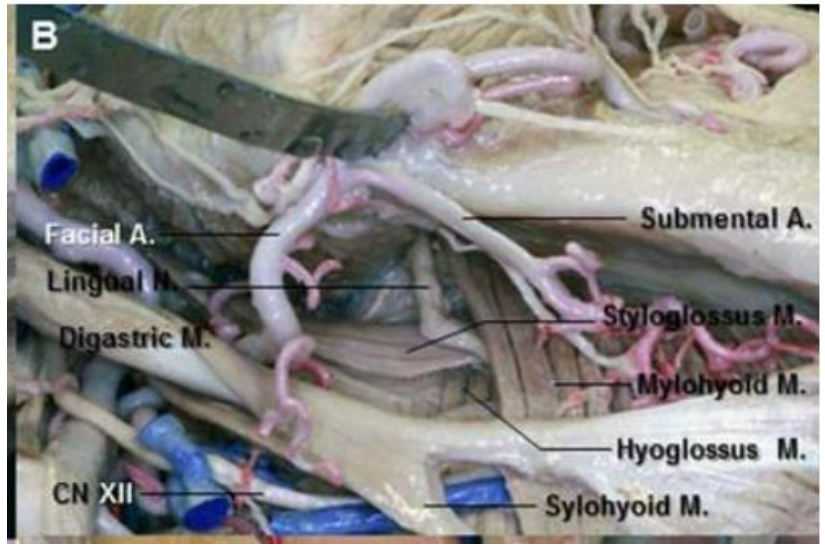
- **Hayes-Martin Maneuver** – Ligation of facial vein inferior to lower border of submandibular gland, Retracting vein and fascia upward

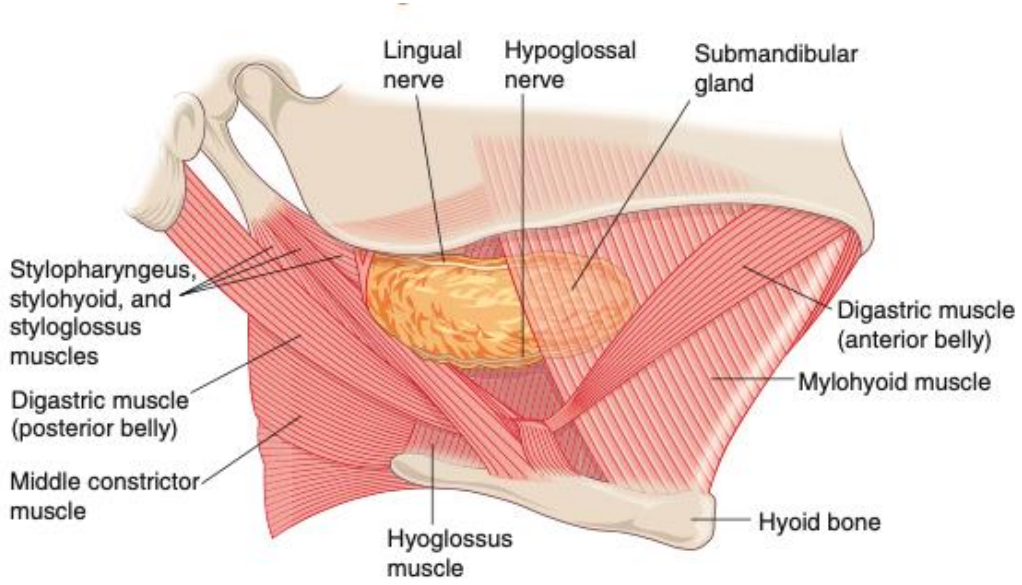


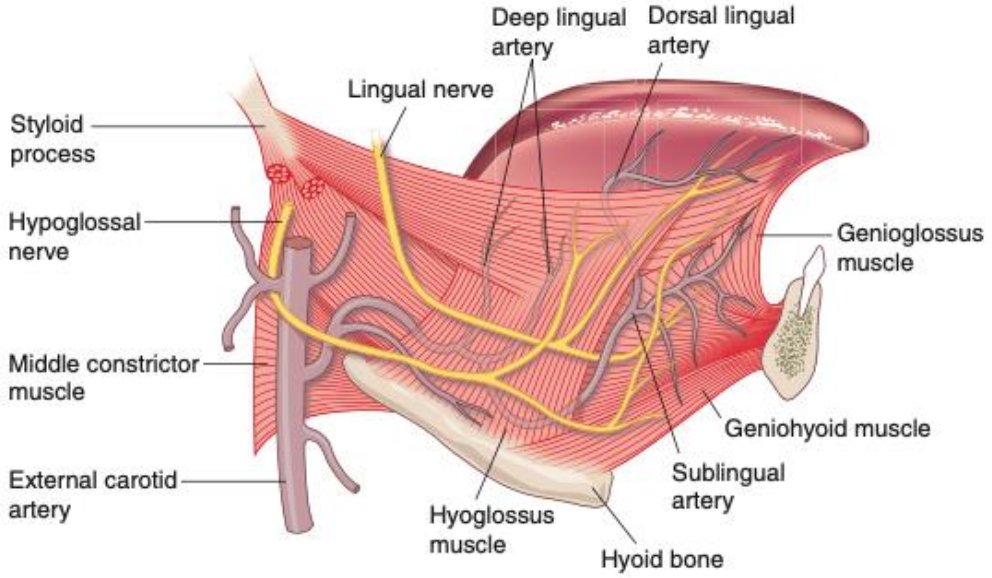


Medially-

- Surface of mylohoid anteriorly with submental vessels and N to mylohoid.
- Posteriorly- hyoglossus, lingual N with submandibular ganglion, stylohoid and post belly of digastric.
- Deep Part- between lingual and hypoglossal nerve.



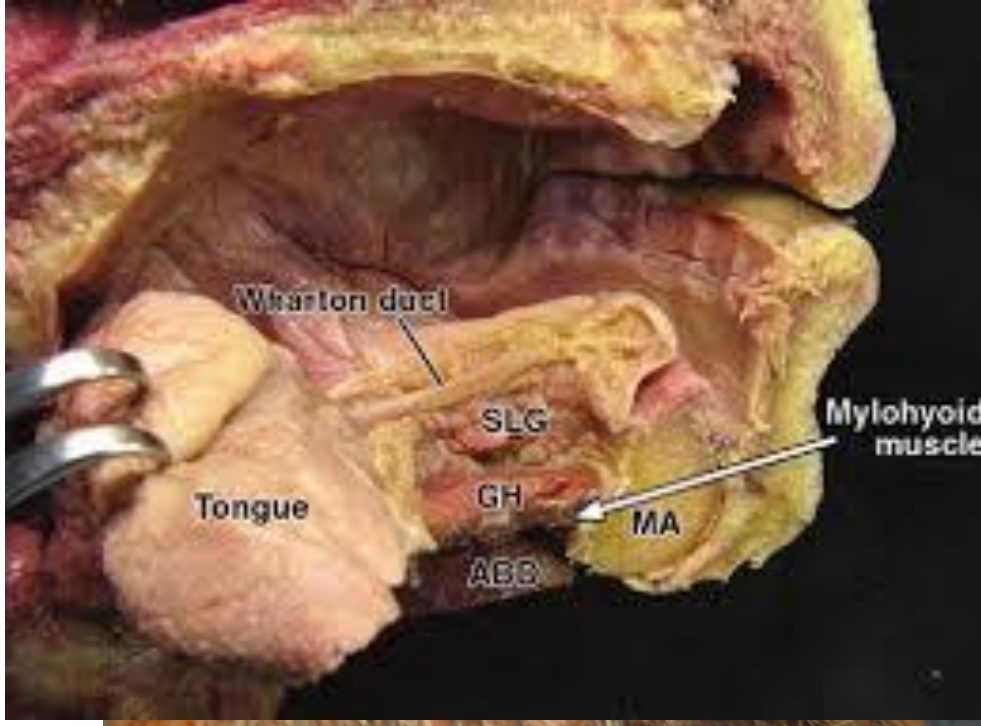


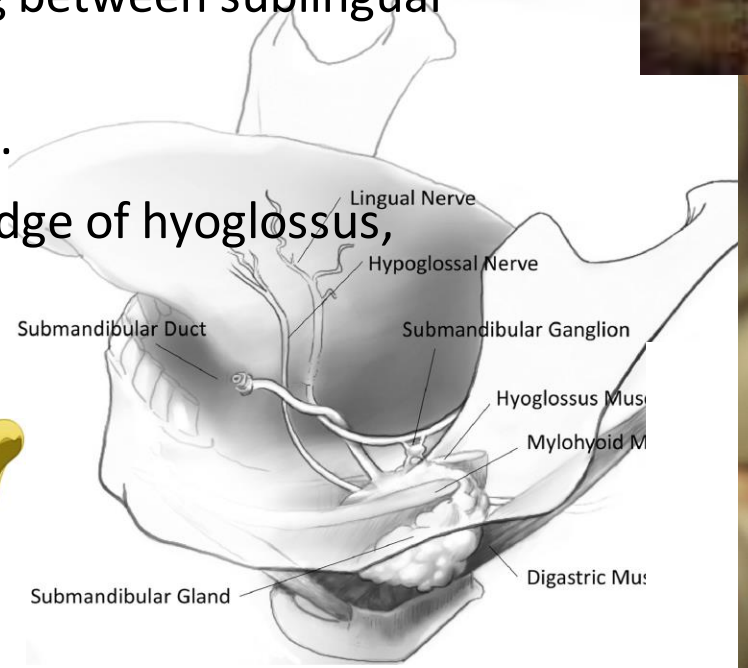


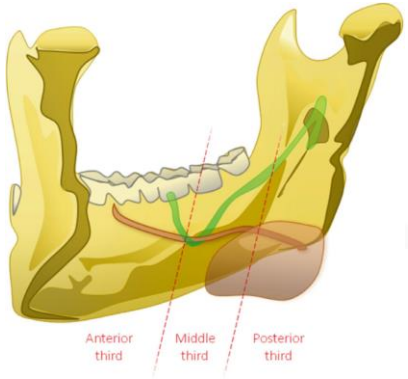
SUBMANDIBULAR DUCT (WHARTON'S DUCT)

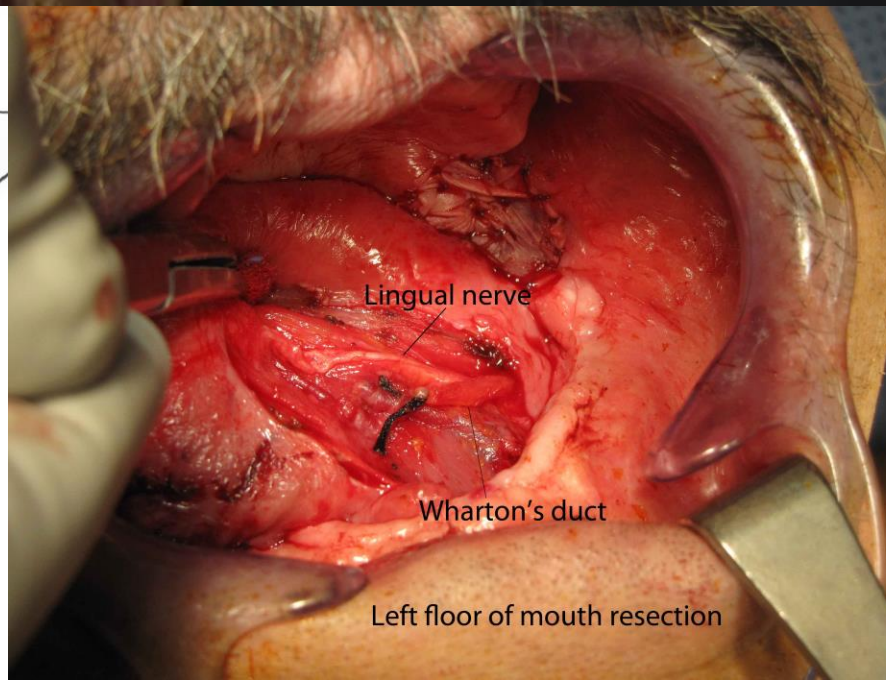
- 5 cm long
- Mean duct diameter range 1.5 mm – 0.5 mm – narrowest at papilla.
- Courses between mylohoid and hyoglossus,
- Open at sublingual papilla after passing between sublingual gland and genioglossus.
- Lies between hypoglossal and lingual N.
- Lingual N crosses duct laterally at ant edge of hyoglossus,

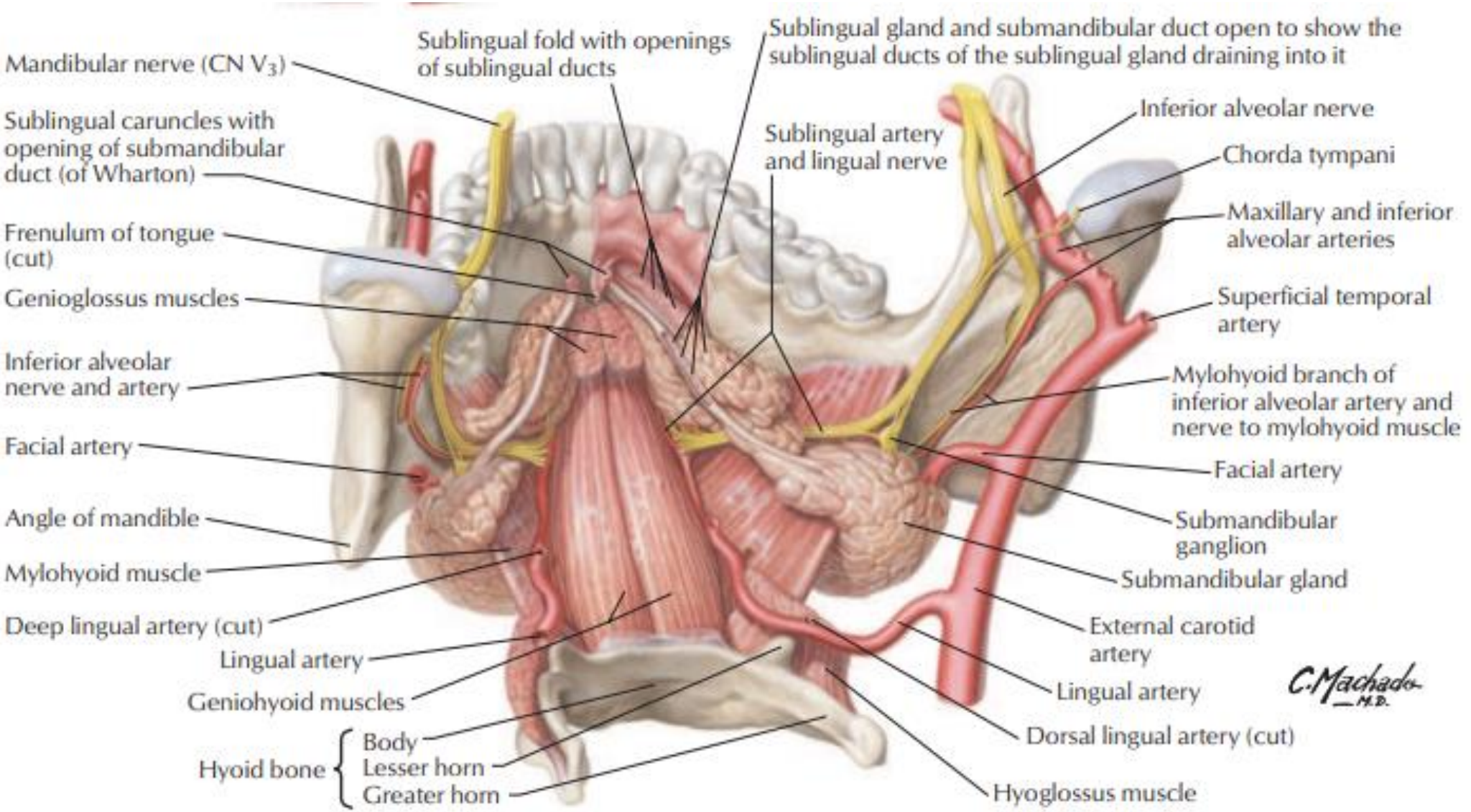
Branches medially to duct.










Mandibular nerve (CN V3)
Sublingual fold with openings of sublingual ducts
Sublingual gland and submandibular duct open to show the sublingual ducts of the sublingual gland draining into it
Sublingual caruncles with opening of submandibular duct (of Wharton)
Sublingual artery and lingual nerve
Inferior alveolar nerve
Chorda tympani
Frenulum of tongue (cut)
Maxillary and inferior alveolar arteries
Genioglossus muscles
Superficial temporal artery
Inferior alveolar nerve and artery
Mylohyoid branch of inferior alveolar artery and nerve to mylohyoid muscle
Facial artery
Facial artery
Angle of mandible
Submandibular ganglion
Mylohyoid muscle
Submandibular gland
Deep lingual artery (cut)
External carotid artery
Lingual artery
Lingual artery
Geniohyoid muscles
Dorsal lingual artery (cut)
Hyoid bone
Body
Lesser horn
Greater horn
Hyoglossus muscle
C. Machado M.D.

VESSELS AND NERVES –

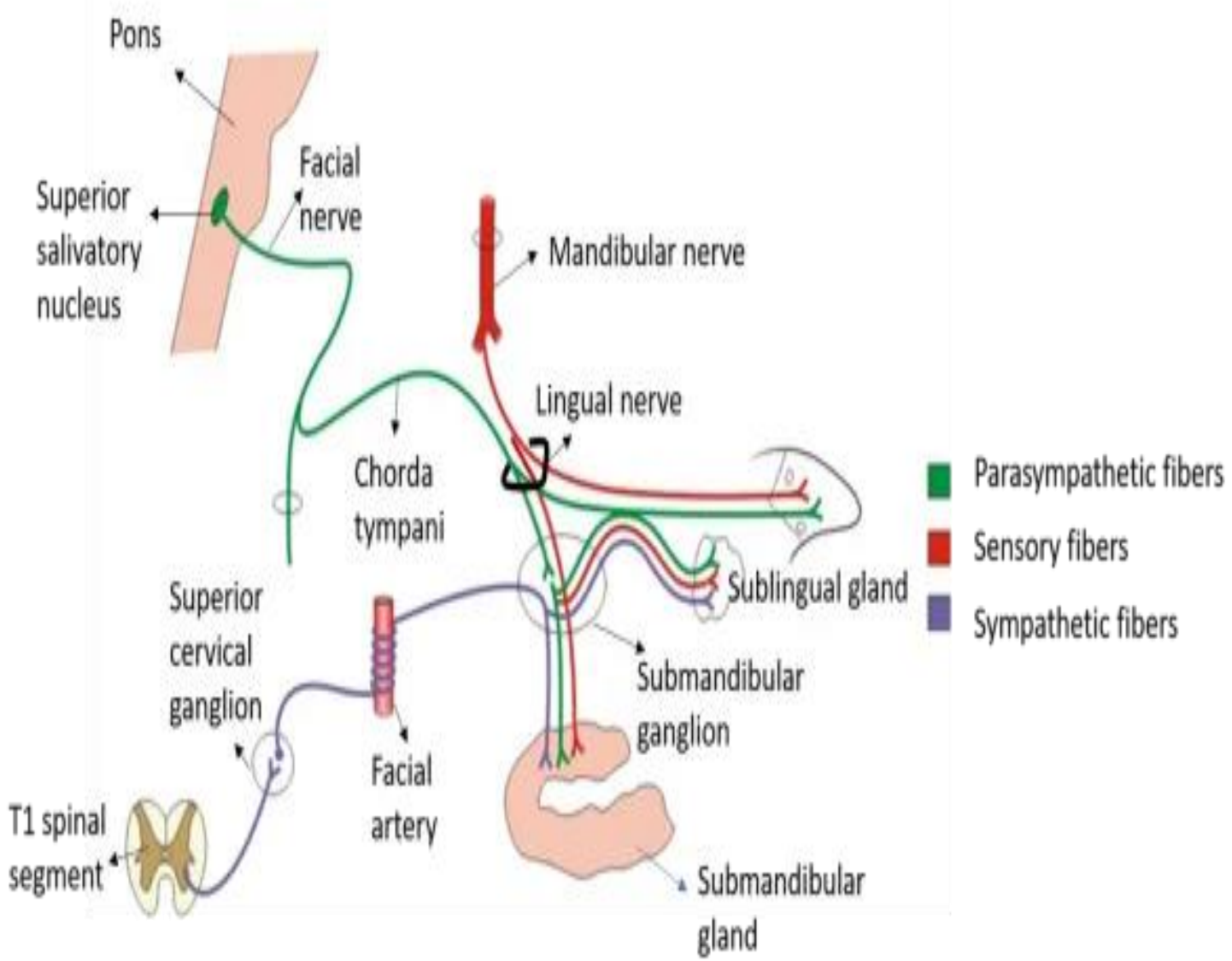
ARTERIAL SUPPLY – Submental Artery

VENOUS DRAINAGE– Facial Vein

LYMPHATIC DRAINAGE – Deep Cervical Group
Particularly Jugulo – Omohyoid

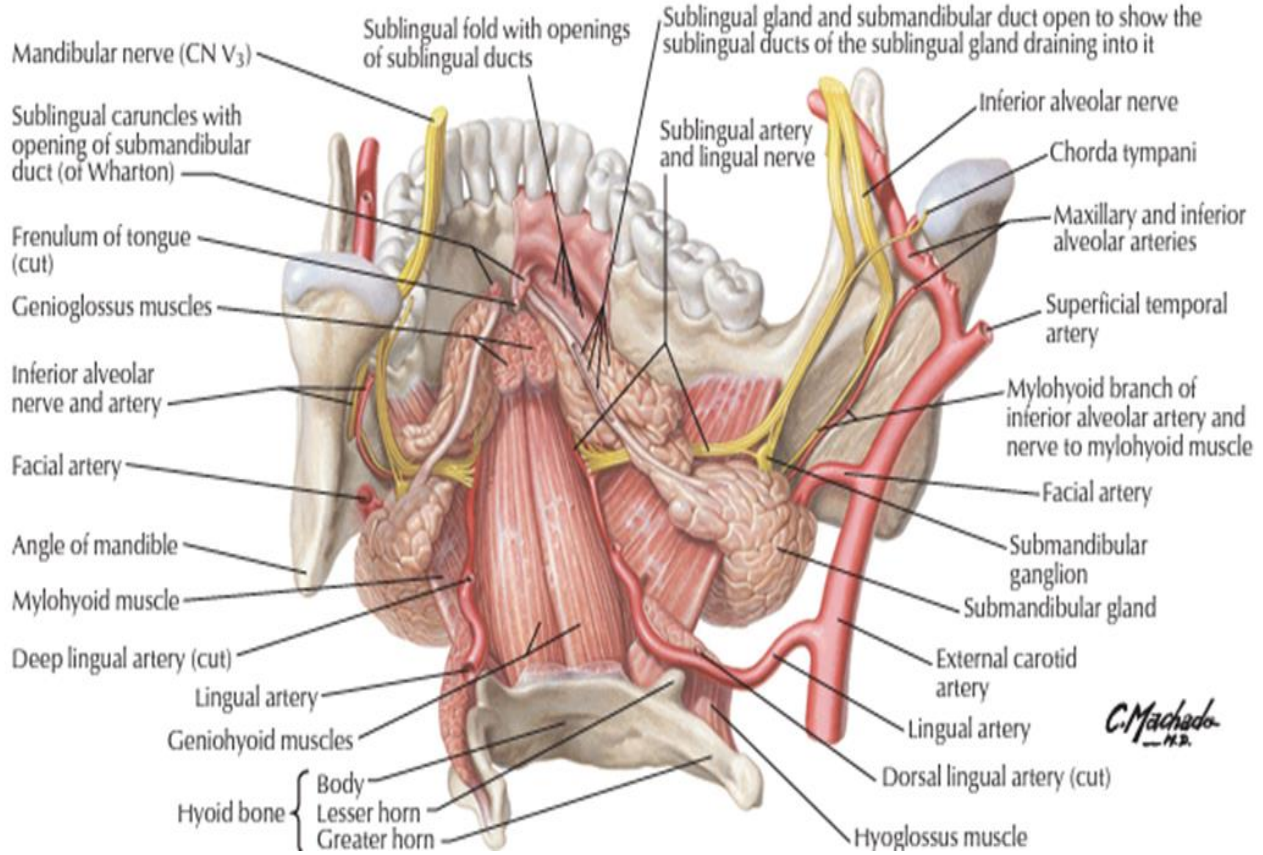
SYMPATHETIC INNERVATION– Superior Cervical Ganglion via Lingual artery

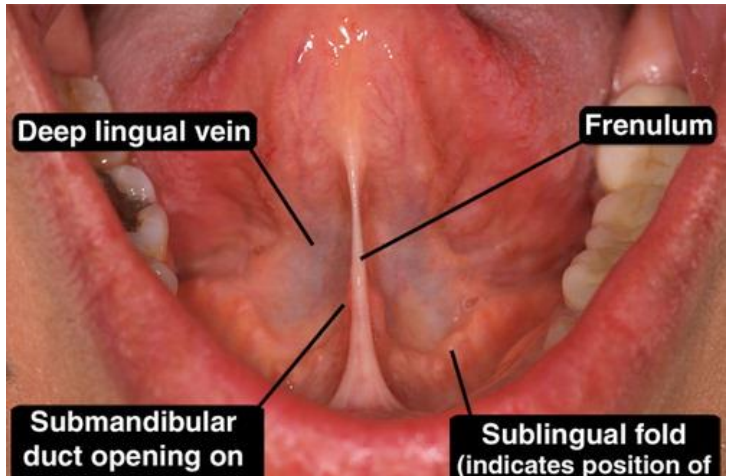
PRE SYNAPTIC PARASYMPATHETIC INNERVATION – Lingual Nerve to Submandibular Ganglion



SUBLINGUAL GLANDS

- Smallest
- No true fascial capsule
- Almond Shape
- Lie between Mandible and Genioglossus Muscle
- Inferiorly bounded by Myelohyoid
- Weighs – 4gm.
- Open via Small excretory ducts- duct of rivinus- 8-20 - in floor of mouth.
- May open into submandibular duct- Bartholin Duct.
- Drainage- SubmaNerve supply- submandibular ganglion
- ndibular lymph nodes.





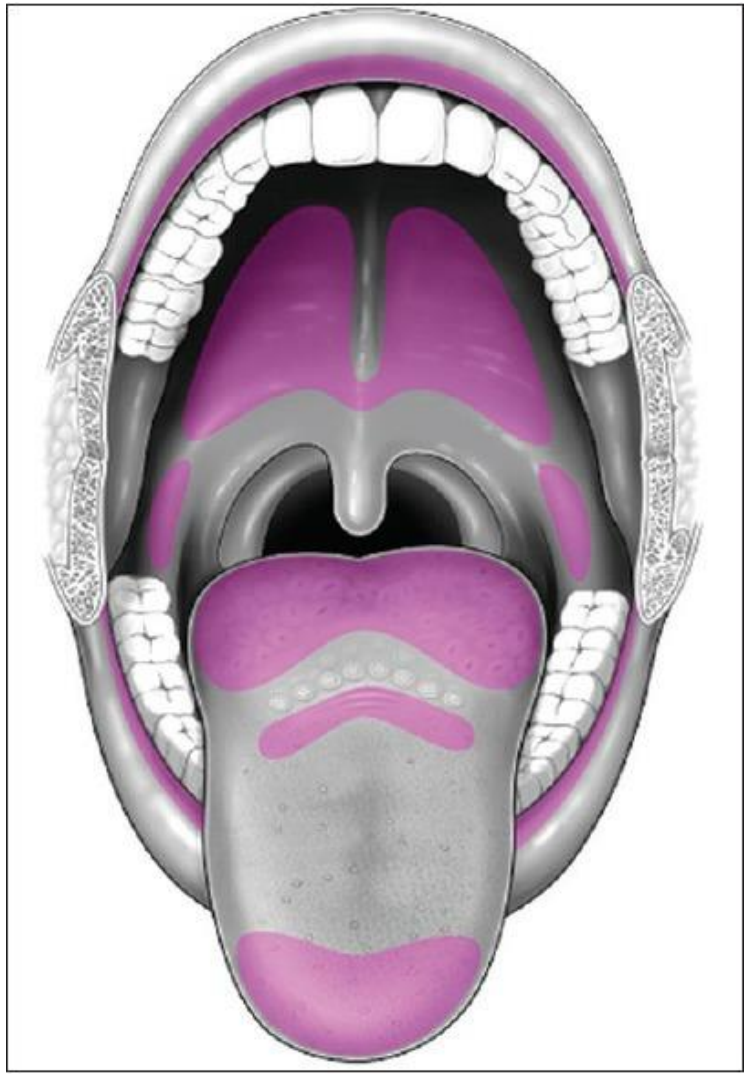
MINOR SALIVARY GLANDS

- 800-1000
- Dispersed throughout submucosa of sinonasal cavity, oral cavity, phayrnx, larynx, trachea, lungs, middle ear cavity.
- Contribute to 5-10% of saliva.
- Most concentrated in buccal mucosa

1. LABIAL- LIPS- mixed
2. BUCCAL- CHEEK- mixed
3. GLOSSOPALATINE- Ant faucial pillar, glossopalatine fold- mucous
4. PALATINE- HARD, SOFT PALATE- mucus
5. LINGUAL- Anterior- mixed

   -Circumvallate papillar (Von ebner's gland)- Pure serous

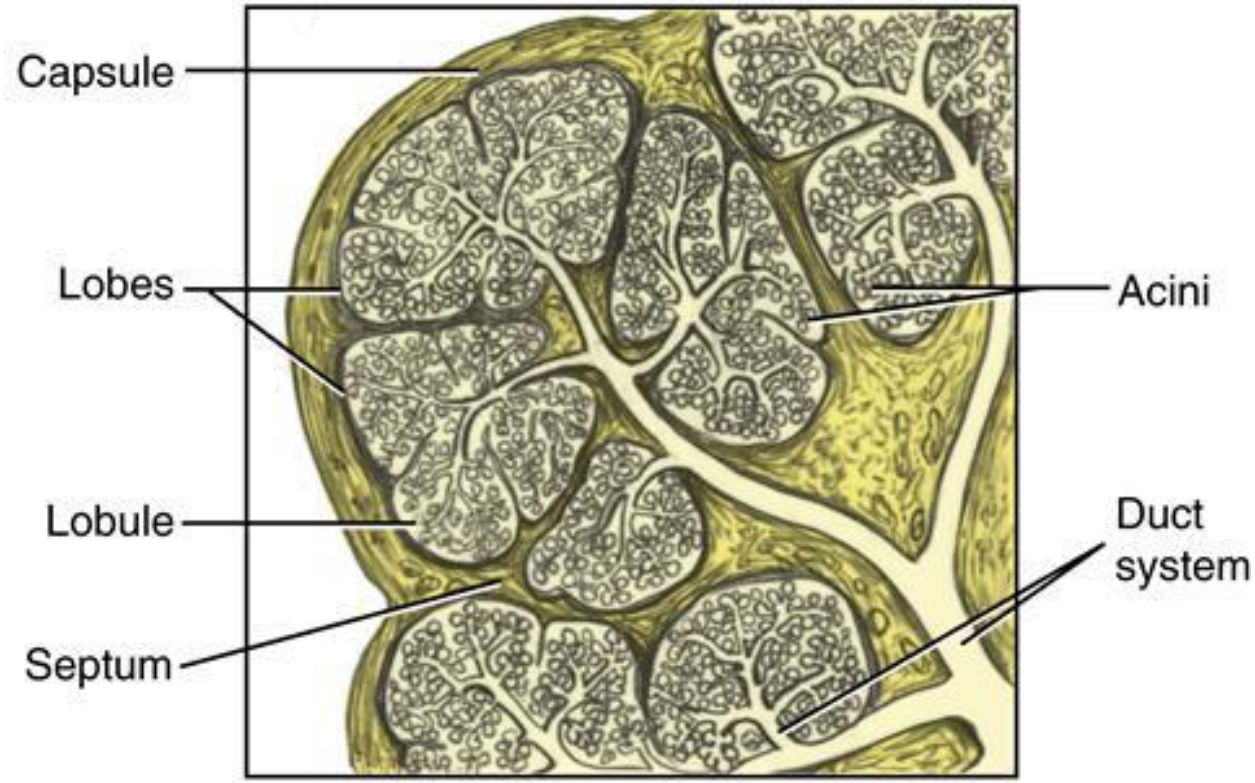
   -Posterior- pure mucous



PHYSIOLOGY OF SALIVA PRODUCTION


Lobes
Acini
Septum
Duct system
Capsule

A


Capsule
Lobes
Lobule
Septum
Acini
Duct system

B

MICROSCOPIC ANATOMY OF SALIVARY GLANDS

Secretory acini and ducts

- **ACINI**

Secretory Cells –

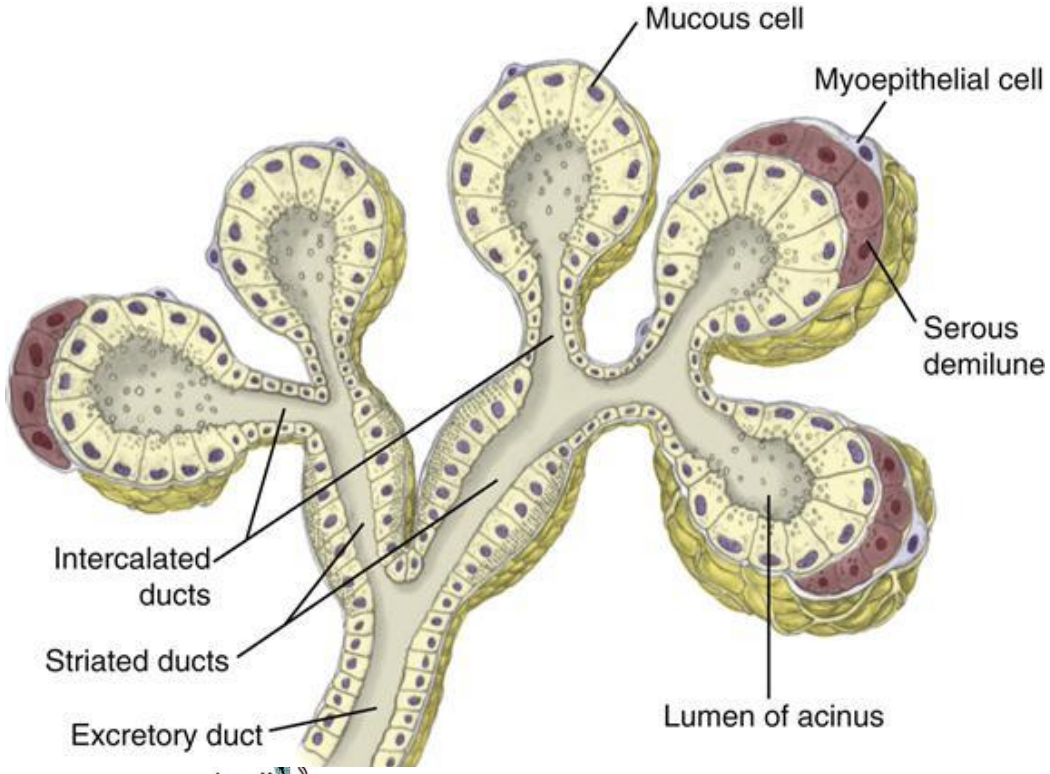
✓ Serous –spherical cells- Zymogen Granules- produce salivary proteins and enzymes.

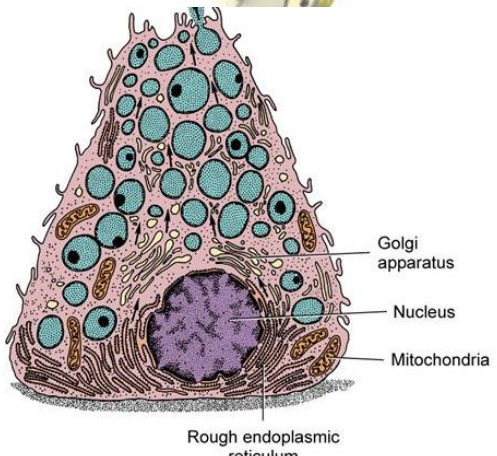
✓ Mucous –Tubular cells- Mucin Granules- mucorproteins.

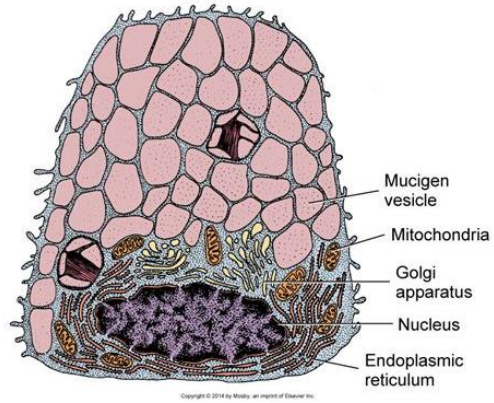
✓ Mixed- variable proportion of serus and mucous cells.

✓SEROUS DEMILUNE- Serous cells at end of mucous acini, a staining artefact, where mucus cells swell and formalin fixation where serous cells form demilune.

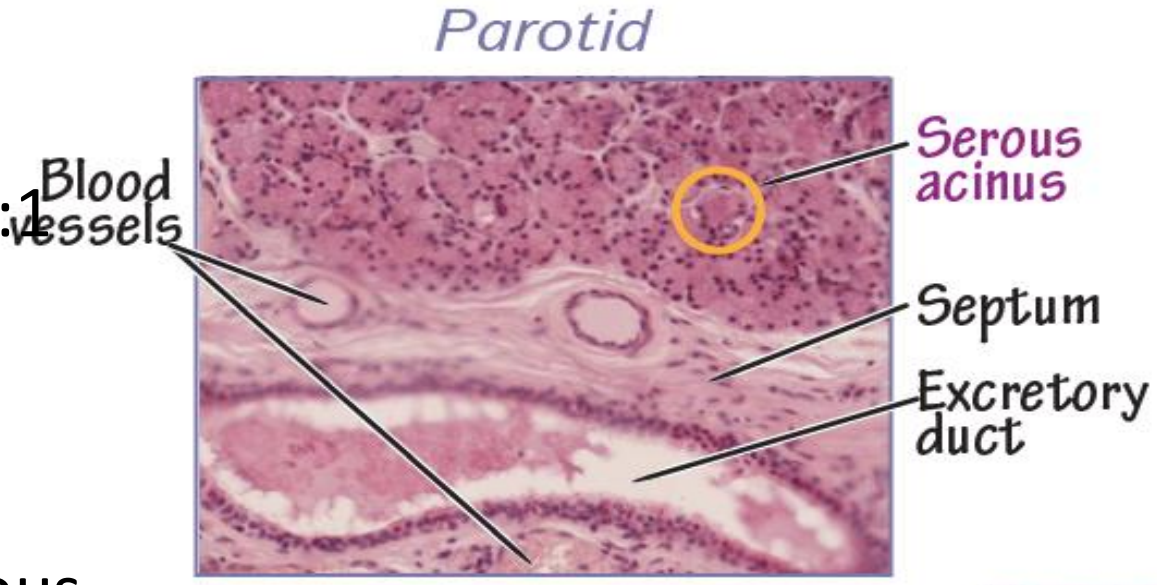
- **MYOEPITHELIAL CELLS**
- **STROMA- Lymphocytes and plasma cells- IgA**

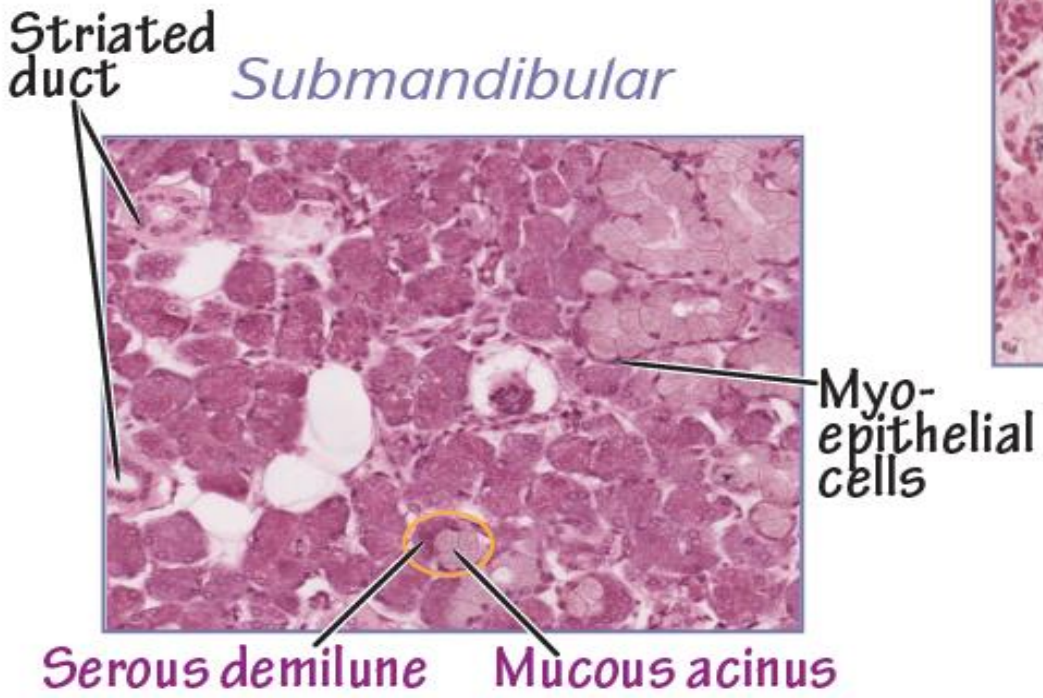


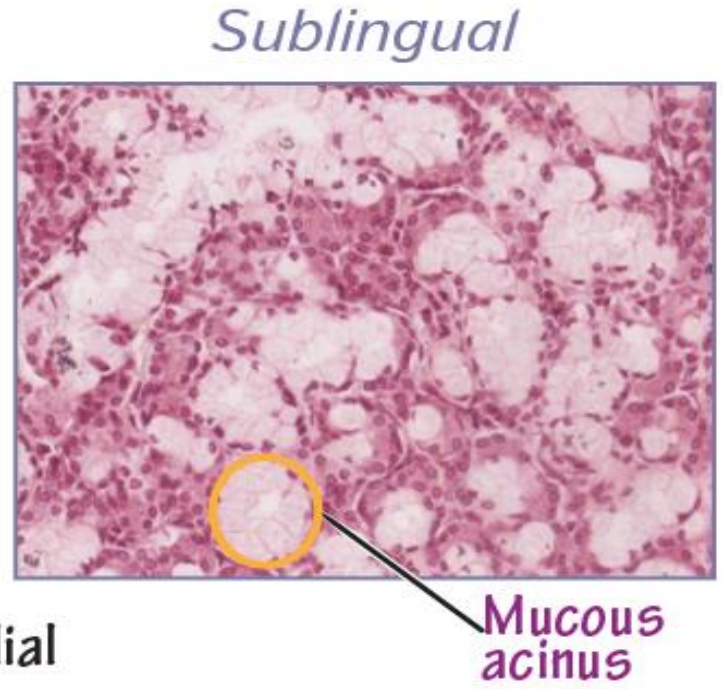




- PAROTID- serous, mucinous acini ratio 1:1
- Submadibular- mixed, predominantly serous.
- Sublingual- mixed, predominantly mucinous





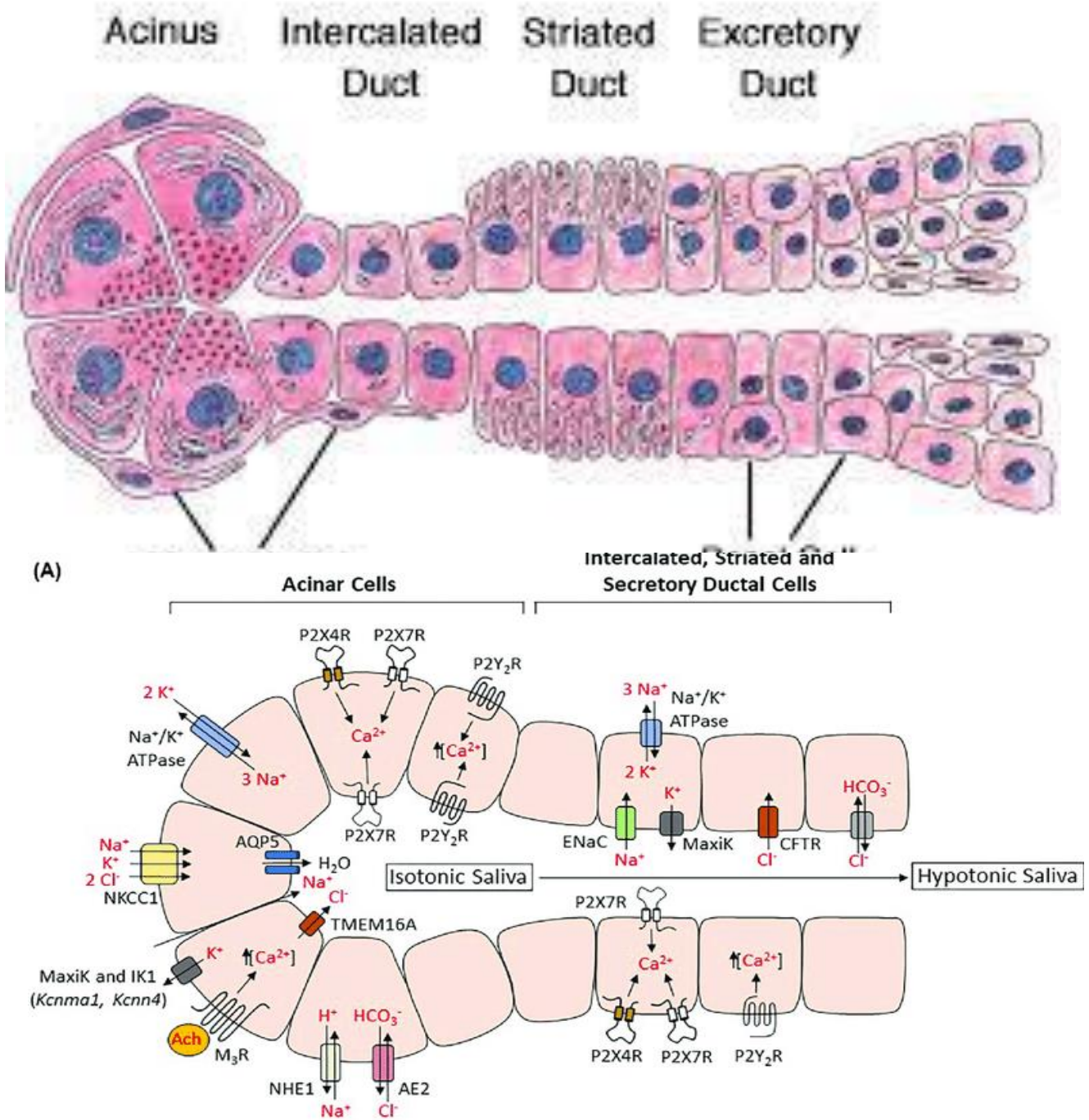


DUCT

1. Intercalated Duct- low cuboidal epithelium and myoepithelial cells, carbonic anhydrase rich, secrete HCO3, absorb chloride.

Poorly developed in mucus glands.

2. Striated Duct- folded basal and basolateral membrane, with numerous mitochondria, absorb sodium and secrete potassium from lumen – hypotonic saliva. Well developed in serous gland.
3. Main Excretory Duct- tall cuboidal cells proximally, pseudostratifed columnar epithelium.



SALIVARY COMPOSITION

- 99.5% water
- K+- 7x that of plasma
- Na+- 1/10th of Plasma
- Calcium, phosphorus, chloride, thiocyanante
- PH 5.6-7
- 1-1.5L per 24 Hrs
- Basal Salivary flow- 0.001-0.2mL /min/gland- Submandibular gland (69%), Parotid (26%), Minor salivary gland (7-8%), Sublingual Gland (5%)
- Stimulated flow -0.18-1.7 mL/min/gland. Parotid (69%), Submandibular gland (26%), Sublingual Gland (5%)
- Stimulated flow -0.18-1.7 mL/min/gland

COMPONENTS AND FUNCTIONS OF SALIVA

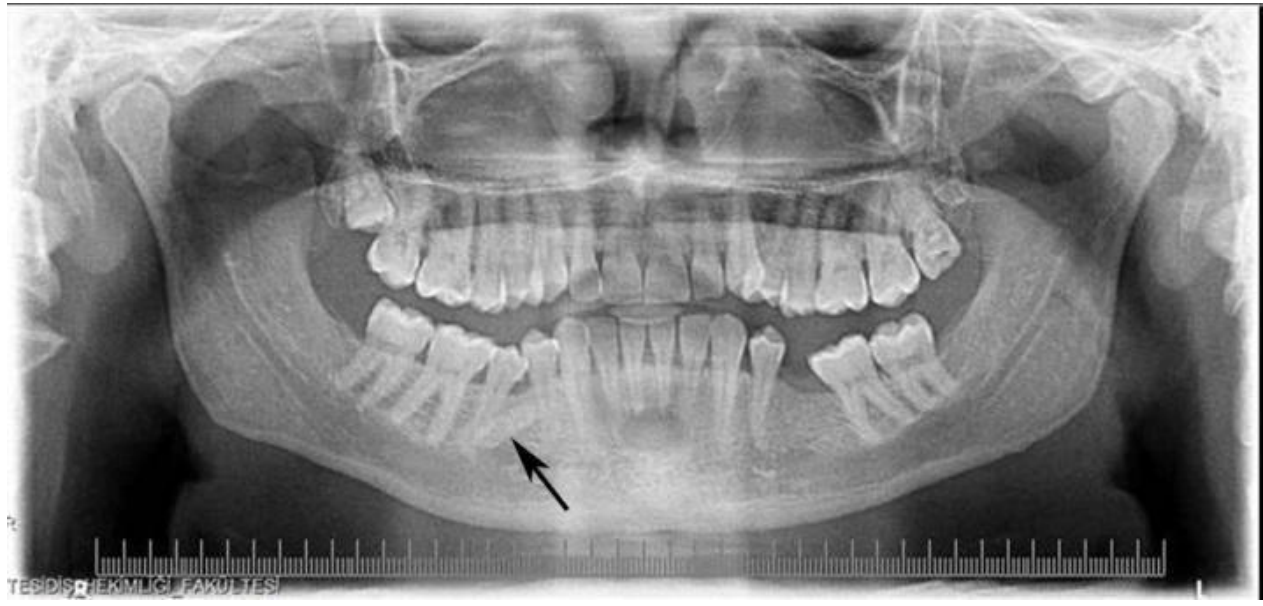
Function		Responsible component
Oral protection	• Lubrication • Antimicrobial • Growth factors • Mucosal integrity • Lavage/cleansing • Buffering • Remineralization	• Mucins, proline-rich glycoproteins, water • Amylase, complement, defensins, lysozyme, lactoferrin, lactoperoxidase, mucins, cystatins, histatins, proline-rich glycoproteins, secretory leukocyte protease inhibitor, statherin, thrombospondin • EFG, TGF-$_{x}$,TGF-β, FGF, IGF-1 and IGF-2, NGF • Mucins, electrolytes and water • Water • Bicarbonate, phosphate ions, proteins • Calcium, phosphate, statherin, anionic proline-rich proteins
Digestion and speech production	• Alteration of food constituency • Digestion • Taste (Food solute) • Speech (oral cavity lubrication)	• Water, mucins • Amylase, lipase, ribonuclease, proteases, water mucins • Water, gustin • Water, mucins

SIALOLITHIASIS

Calculus formation in ductal system in gland

Submandibular- 83%> Parotid 10%>Sublingual 7%> minor salivary gland in upper lip.

- Abundant in calcium conc, Alkaline pH, strong basal salivary flow rate, Wharton's duct is longest, has 2 sharp curves and small punctum.
- 30% od parotid sialoliths radiolucent
- Factors contributing-
- Dehydration
- Reduced flow/stasis
- Mucosal inflammation- retention of cellular and bacterial debris.
- MX- manual expressing and removing via transoral route, ECSWL, Sialendoscopy.



SIALOGRAPHY

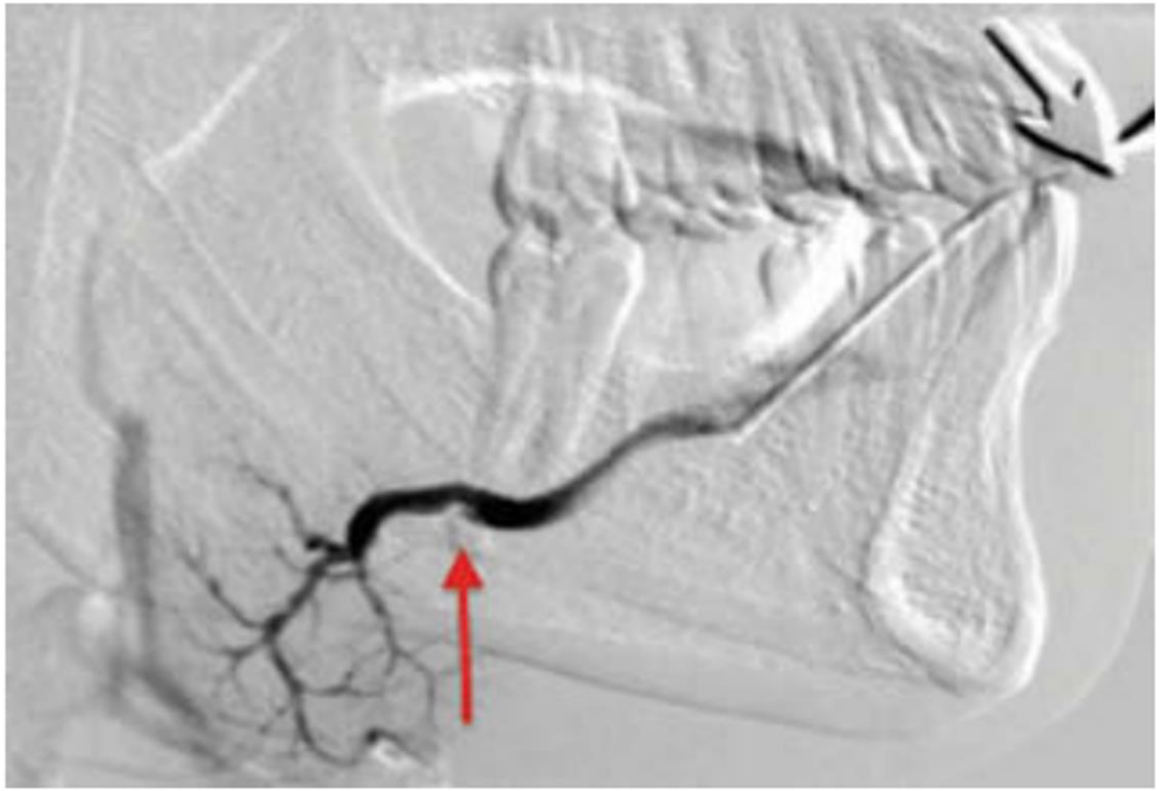
- Performed with water soluble contrast material
- Defines ductal anatomy well
- Used to detect –

✓Perforations

✓Fistula tract

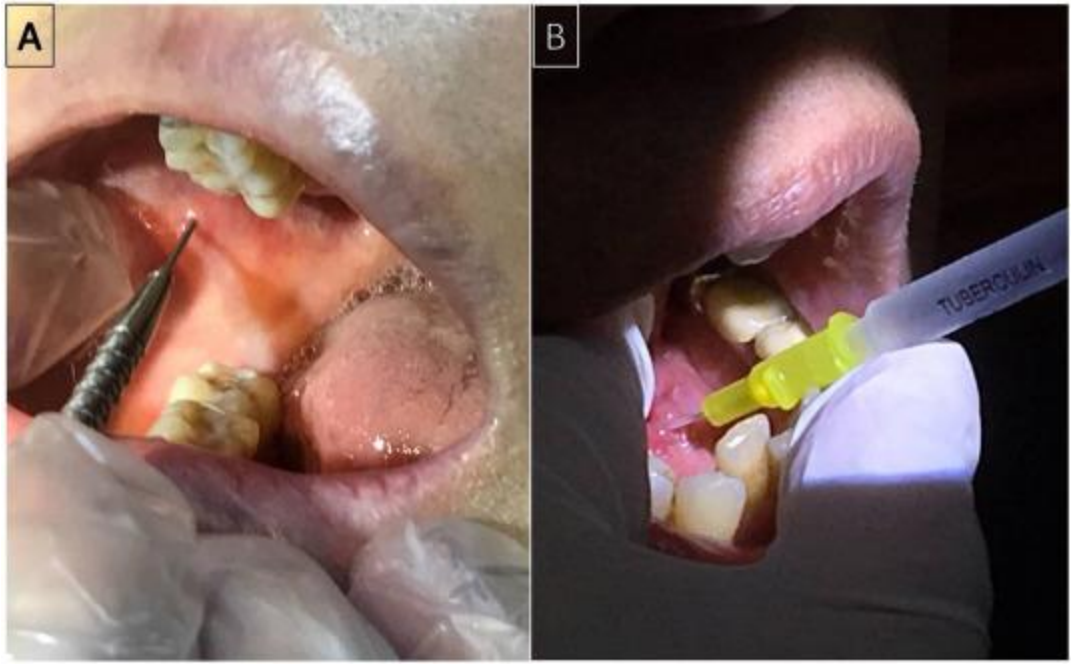
✓Calculi

✓Tumor



PAROTID DUCT CANNULATION –

- Cannulate intraoral parotid duct papilla with a small (19-gauge) silastic tube
- Observe If tube is visible in wound
- Small amount of saline injected and flow observed
- Avoid Methylene blue



THANKYOU