



Doctor 021

# GI

## ANATOMY

### Sheet 2



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# Innervation, blood supply and lymphatic drainage of the tongue

The innervation is divided into motor and sensory in general. notice the motor innervation from the picture on the right.

## Sensory Innervation

Anterior two thirds: Lingual nerve branch of mandibular division of trigeminal nerve (general sensation) and chorda tympani branch of the facial nerve (taste)

Posterior third:

Glossopharyngeal nerve (general sensation and taste)

How does the posterior third have taste innervation ?!

Via the circumvallate papillae although they are found in the anterior two thirds but they originated from the posterior third .

## Blood Supply

The lingual artery ( a branch from ECA external carotid artery ), the tonsillar branch of the facial artery (the facial artery is also a branch from ECA ), and the ascending pharyngeal artery supply the tongue

The veins drain into the internal jugular vein opposite to the arteries

The doctor also mentioned that the lingual artery has a tonsillar branch but it is for the tongue .

## Lymph Drainage

Tip: Submental lymph nodes

Sides of the anterior two thirds:

Submandibular and deep cervical lymph nodes

Posterior third: Deep cervical lymph nodes

Structures in the midline drain into the submental lymph nodes like the tip of the tongue , the philtrum , the mid of the lower lip and the tip of the nose

Others directly into submandibular and finally into deep cervical

Motor: Hypoglossal (XII), except Palatoglossus: Pharyngeal branch of Vagus (X)

**Posterior 1/3**

Sensory and Taste:  
Glossopharyngeal (IX)

Sensory: Lingual branch of V3 from Trigeminal (V)

Taste: Chorda tympani branch of Facial (VII), carried by lingual branch

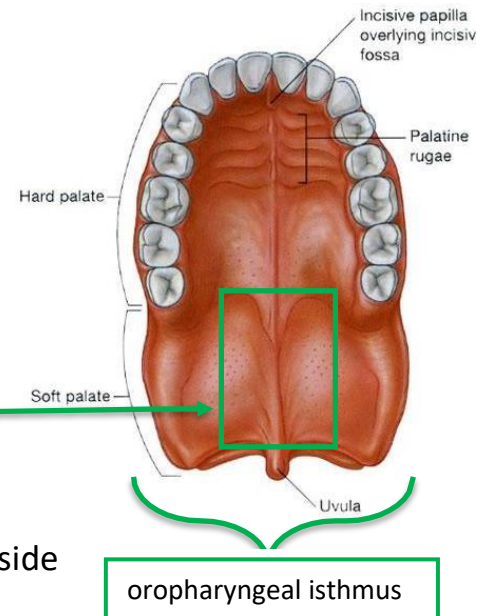
**Anterior 2/3**

## The Palate

- The palate forms the roof of the mouth and the floor of the nasal cavity.
- It is divided into two parts:  
the hard palate in front & the soft palate behind.

### Hard Palate

- The hard palate is formed by two parts the **palatine processes of the maxillae & horizontal plates of the palatine bones**
- continuous behind with the soft palate.
- has a foramen anteriorly the incisive foramen that connects the hard palate with the nasal cavity, nerves & arteries pass through this foramen.  
At the posterior border of the hard palate there is a spine where the aponeurosis is attached forming the soft palate ( و الي هو أصل ال بنلاقي بنلاقي spine يعني على ال soft palate )



### Soft Palate

- Formed by **Palatine aponeurosis** which is the meeting point of the Tensor veli palatini muscles on the right & left side
- The soft palate is composed of .
- Is a muscular structure .

By moving upward and backward it closes the nasopharynx , it moves downward during mastication and swallowing to increase the pressure inside oral cavity .

**1) mucous membrane:** covers the upper and lower surfaces of the soft palate.

**2) palatine aponeurosis:** a fibrous sheet attached to the posterior border of the hard palate. It is the expanded tendon of the tensor veli palatini muscle. (tensor : tenses )

**3) muscles**

- The soft palate is a mobile fold attached to the posterior border of the hard palate
- Its free posterior border presents in the midline a conical projection called the uvula that's seen on the roof of the oropharynx.
- The soft palate is continuous at the sides with the lateral wall of the pharynx.

### Muscles of the Soft Palate

- The muscles of the soft palate are:
  - 1) tensor veli palatine (tenses increasing the pressure )
  - 2) levator veli palatine (elevates )
  - 3) palatoglossus ( around the palatine tonsils )
  - 4) palatopharyngeus ( around the palatine tonsils )
  - 5) musculus uvulae (the uvula itself)

- How's the palatine aponeurosis formed?

The fibers of the tensor veli palatini muscles meet in the midline as they descend from their origin to form a narrow tendon, which turns medially around the pterygoid hamulus. Then the tendon of both tensor veli palatini muscles from the right & left sides, expand to form the palatine aponeurosis.

- When the muscles of the two sides contract, the soft palate is tightened so that the soft palate may be moved upward or downward as a tense sheet.

## Muscles of the Soft Palate

Muscle	Origin	Insertion	Action	Nerve supply
<b>Levator veli palatini</b>	Petrous part of temporal bone, auditory tube	Palatine aponeurosis	<b>Raises</b> soft palate	Pharyngeal plexus
<b>Tensor veli palatini</b>	Spine of sphenoid, auditory tube	With muscle of other side, forms palatine aponeurosis	<b>Tenses</b> soft palate	<b>**Nerve to medial pterygoid from mandibular nerve</b>
<b>Palatopharyngeus</b>	Palatine aponeurosis	Posterior border of thyroid cartilage	Elevates wall of pharynx, pulls palatopharyngeal folds medially	Pharyngeal plexus
<b>Musculus uvulae</b>	Posterior border of hard palate	Mucous membrane of uvula	Elevates uvula	Pharyngeal plexus

\*All the muscles of the soft palate mentioned in the slides and their details have been written in this table (important).

\*All of these muscles are innervated by pharyngeal plexus except Tensor Veli Palatini muscle

\*The pharyngeal plexus is formed by : glossopharyngeal nerve and the vagus nerve with the cranial accessory nerve

\*Recall from MSS embryo that cleft in the uvula can occur during embryonic development if the fusion of the maxillary processes fails forming a bifid uvula

## Movements of the Soft Palate

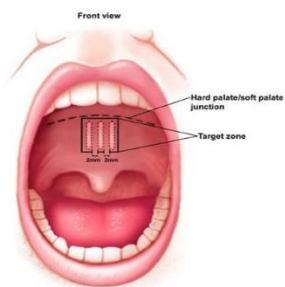
- Normally the soft palate is relaxed to maintain the space between the oropharynx & nasopharynx opened for air inhalation and articulation

## The pharyngeal isthmus

( the communicating channel between the nasopharynx &the oropharynx) is closed by **raising the soft palate**.

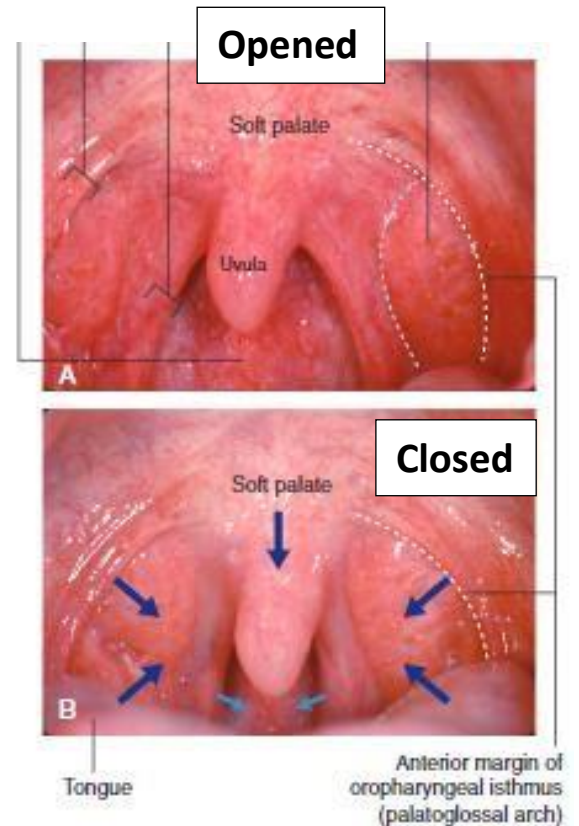
Closure occurs during the production of explosive consonants in speech and during mastication (pressure inside the oral cavity is increased)

- Closure is **important during vomiting** to prevent the vomit from going out of the nasal cavity and restrict its exit via the oral cavity.
- The soft palate is raised by the contraction of the levator veli palatini on each side.
- At the same time, the upper fibers of the superior constrictor muscle contract and pull the posterior pharyngeal wall forward
  - The palatopharyngeus muscles on both sides also contract so that the palatopharyngeal arches are pulled medially, like side curtains.
- By this means the nasal part of the pharynx is Closed from the oral part .



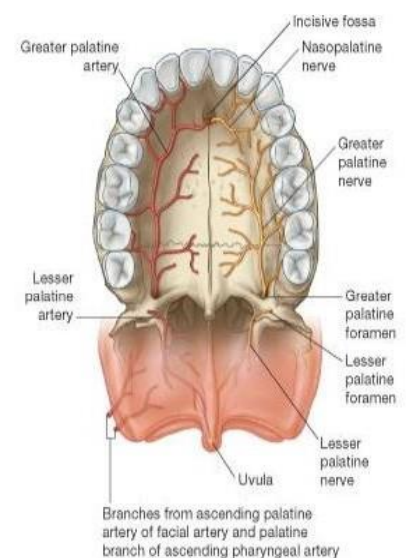
## Nerve Supply of the Soft Palate

- The greater and lesser palatine nerves from the maxillary division of the trigeminal nerve enter the palate through the greater and lesser palatine foramina
- The nasopalatine nerve, also a branch of the maxillary nerve, enters the front of the hard palate through the incisive foramen.
- The glossopharyngeal nerve also supplies the soft palate



### Closure of oropharyngeal isthmus

- Medial and downward movement of palatoglossal arches
- Medial and downward movement of palatopharyngeal arches
- Upward movement of tongue
- Downward and forward movement of soft palate



## Blood Supply of the Soft Palate

- The greater palatine branch of the maxillary artery, the ascending palatine branch of the facial artery, and the ascending pharyngeal artery.

## Lymph Drainage of the Palate Deep Cervical Lymph Nodes

- The palatoglossal arch is a fold of mucous membrane containing the palatoglossus muscle, which extends from the soft palate to the side of the tongue
- The palatoglossal arch marks where the mouth becomes the pharynx.
- The palatopharyngeal arch is a fold of mucous membrane behind the palatoglossal arch
- runs downward and laterally to join the pharyngeal wall.
- The muscle contained within the fold is the palatopharyngeus muscle.
- The palatine tonsils, which are masses of lymphoid tissue, are located between the palatoglossal and palatopharyngeal arches



There are 5 structures between mylohyoid and hyoglossus muscles :Deep part of submandibular gland and submandibular duct, Submandibular ganglia , lingual nerve and hypoglossal nerve .

## The Salivary Glands

- We consider the salivary glands as association organs to the digestive tract, they secrete around 1.5 liters of saliva daily because the mouth should be kept moist, dryness of the mouth will cause an increased susceptibility to infections due to increase in the number of bacteria in the oral cavity.

### We have 2 types of salivary glands:

#### 1. Major salivary glands (our topic for this lecture):

- A. Parotid : Over the ramus of the mandible.
- B. Sublingual gland : Below the tongue.
- C. Submandibular : Below the mandible.

Any gland is surrounded by a capsule of connective tissue that divides the glands into lobes and lobules by septa, it provides protection and blood and nerve supply to the gland.  
\*parotid has two capsules .

#### 2. Minor salivary glands: the oral cavity is filled with minor glands

(labial, lingual, palatal) each one has its own small duct which opens directly into the oral cavity.

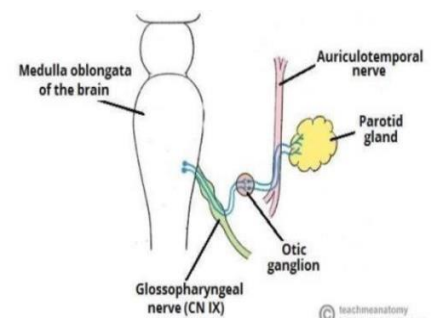
#### 1- Parotid Gland

- The parotid gland is the largest salivary gland and is composed mostly of serous acini  
Secretion : **Serous** Secretion (rich in proteins and enzymes).
- Location : lies in a deep hollow below the external auditory meatus, behind the ramus of the mandible and in front of the sternocleidomastoid muscle
- The facial nerve divides the gland into superficial and deep lobes  
Shape : It is pyramidal in shape its **Base is superficial** and the **apex is deep**, directed towards the pharynx
- The duct :the parotid duct emerges from the anterior border of the gland and passes forward over the lateral surface of the masseter and it pierces the buccinator muscle . It enters the vestibule of the mouth upon a small papilla opposite the upper second molar tooth
- Innervation :

Each gland has 3 types of innervation

1. Sensory
2. Parasympathetic( Secreto-Motor ).
3. Sympathetic (no effect on secretions) affects

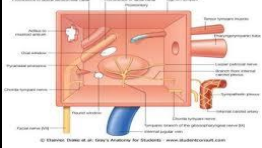
vasoconstriction only via superior cervical sympathetic ganglia hitch hiking the External carotid artery



Parasympathetic innervation :

From brain stem, **inferior salivary nucleus** , the glossopharyngeal nerve emerges along with parasympathetic fibers .

These fibers reach the gland via the following pathway :  
 the tympanic branch of cranial nerve → lesser petrosal nerve → otic ganglia → auriculotemporal nerve.



The otic ganglia is found in the infra temporal fossa directly below foramen ovale which is found in the base of the skull with the mandibular nerve emerging from it. Lesser petrosal nerve is a preganglionic parasympathetic nerve which means it synapses in the ganglia.

Post-ganglionic parasympathetic fibers travel through auriculotemporal nerve which is also SENSORY to the gland (Auriculotemporal nerve is the one that transmits sensations like pain in case of mumps infection and swelling, it is also secreto-motor).

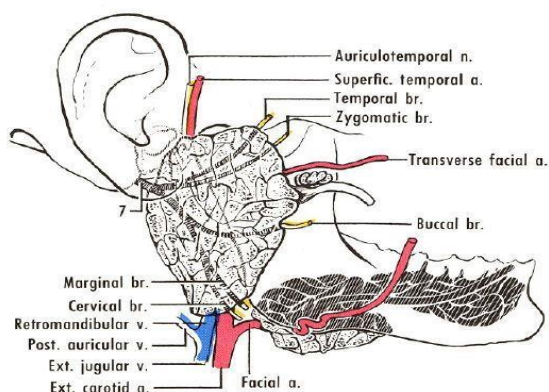
- Parasympathetic secretomotor supply arises from the glossopharyngeal nerve
- The nerves reach the gland via the tympanic branch, the lesser petrosal nerve, the otic ganglion, and the auriculotemporal nerve.
- Capsule: The gland is surrounded by **two capsules** (an exception):

\*The inner one : The regular connective tissue

sends connective tissue septa dividing it into lobes and lobules each lobule has its own duct, at the end they form the parotid duct.

\*The outer one : part of the deep fascia of the neck .

Disadvantage of the capsules : infections like mumps (viral) to the gland can cause it to swell and the capsules prevent expansion leading to severe pain in the gland.



7 : stem of facial nerve outside the stylomastoid foramen



The contents of the gland :

1) Extra cranial part of facial Nerve and its five branches.

Stem of the facial nerve divides the parotid into superficial and deep parts  
Branches of facial nerve: Temporal, Zygomatic, Buccal, Mandibular, Cervical .All provide **motor** to the muscles of the face (facial expression) and the platysma(cervical ) .

Note: a tumor in the parotid gland causes damage to the structures inside the gland and destroys the anatomy of the parotid.

the first structure the surgeon encounters (**the most superficial structure**), and he needs to be really cautious due to the branches of the facial nerve, as not to cause nerve injuries.

☺ The first thing the doctor will do after surgery is to check the function of the facial nerve by the asking the patient to close his eyes (if one eye does not close it means the temporal nerve on that side is damaged) or to blow (tests the buccal nerve) or if there was dribbling of saliva during eating for example, if there is any issue in the previous actions, it means that one or more of the branches of the facial nerve was damaged (remember the function of the muscles above and their nerve supply).

2- Retromandibular vein (formed inside the parotid from maxillary vein and superficial temporal vein).

3) External carotid artery (as its ascending upwards, it divides at the level of neck of mandible into maxillary artery and superficial temporal artery).

4) Auriculotemporal nerve .

5) Parotid lymph nodes.

6) Lymphatic vessels.

The doctor mentioned in the lecture that it is important to memorize the structures and relations of the parotid bed so ابيضموا:

Anatomical relations :

☺ The parotid gland lies in the parotid bed that is formed by:

Posteriorly : the sternocleidomastoid muscle and the posterior belly of digastric .

Anteriorly : the ramus of mandible .

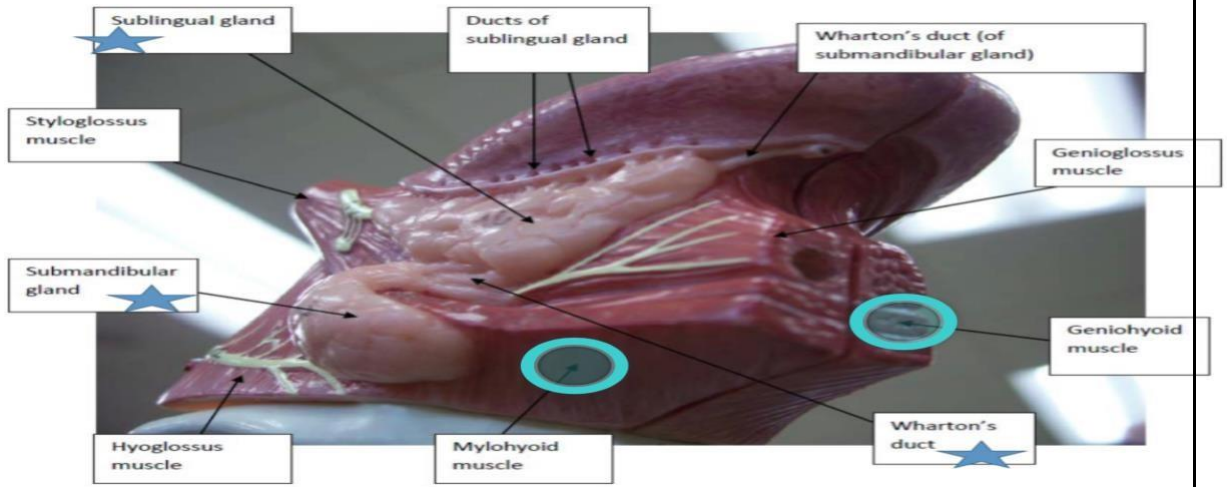
Superiorly : the base of the trench is formed by the external acoustic meatus and the posterior aspect of the zygomatic arch.

Medially :the carotid sheath and its contents (Vagus nerve, CCA, IJV).

It also formed by the facial nerve and the last 4 cranial nerve, styloid process, stylohyoid muscle.

Submandibular gland :

it lies beneath the lower border of the body of the mandible (between anterior and posterior belly of digastric **mylohyoid muscle**, the mylohyoid muscle separates between the deep and superficial parts of the submandibular gland .



The deep part of the gland lies beneath the mucous membrane of the mouth on the side of the tongue.

Secretion : the submandibular gland consists of a mixture of serous and mucous acini (seromucous)

Capsule: Surrounded by one capsule.

The duct :

-It emerges from the anterior end of the deep part of the gland and runs forward beneath the mucous membrane of the mouth.

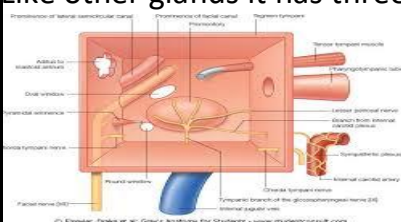
-It opens into the mouth on a small papilla, which is situated on the side of the frenulum of the tongue .

The innervation :

Parasympathetic secretomotor supply is from the facial nerve via the chorda tympani, and the submandibular ganglion

The postganglionic fibers pass directly to the gland.

Like other glands it has three types of innervation : parasympathetic , sympathetic and sensory



**\*Parasympathetic (secreto-motor) :** via the facial nerve Originate from **superior salivary nucleus** found in the medulla oblongata. Then the facial nerve gives the chorda tympani branch at the posterior border of the middle ear ( remember what we have taken in MSS)

When chorda tympani \_leaving the anterior wall of middle ear \_ joins the lingual the fibers never get mixed together; because lingual fibers are sensory, and chorda tympani are parasympathetic, so the lingual nerve only carries chorda tympani fibers to the submandibular ganglia. Chorda tympani branch from facial nerve which also transmits taste fibers. In the infratemporal fossa, chorda tympani joins the lingual nerve which leads it to the submandibular ganglion (located in the submandibular triangle) where the preganglionic fibers synapse with the postganglionic fibers

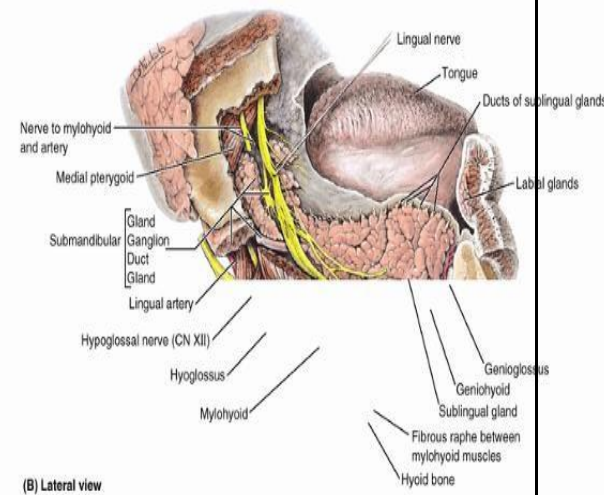
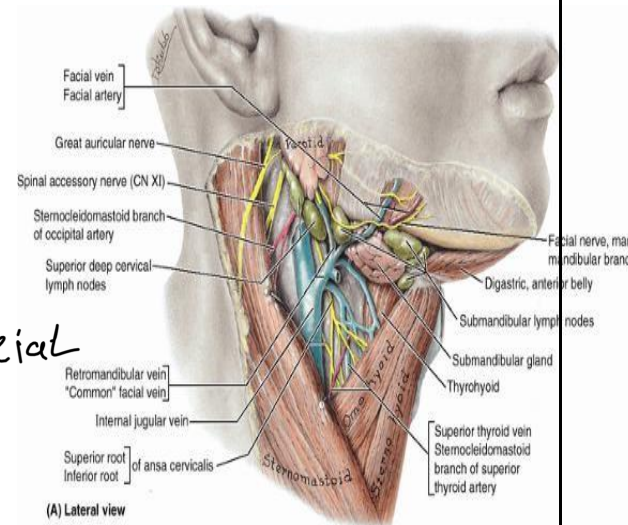
**\*parasympathetic postganglionic fibers :**

Directly from the ganglia to the gland or via the lingual nerve , supplying both the submandibular and sublingual gland.

**\*sympathetic :**

Sympathetic branches along blood vessels like the *Facial* artery

Sensory innervation via the **lingual nerve.**



the larger arm of the hook is directed forward in the horizontal plane below the mylohyoid muscle and is therefore outside the boundaries of the oral cavity-this larger superficial part of the gland is directly against a shallow impression on the medial side of the mandible (submandibular fossa) inferior to the mylohyoid line;

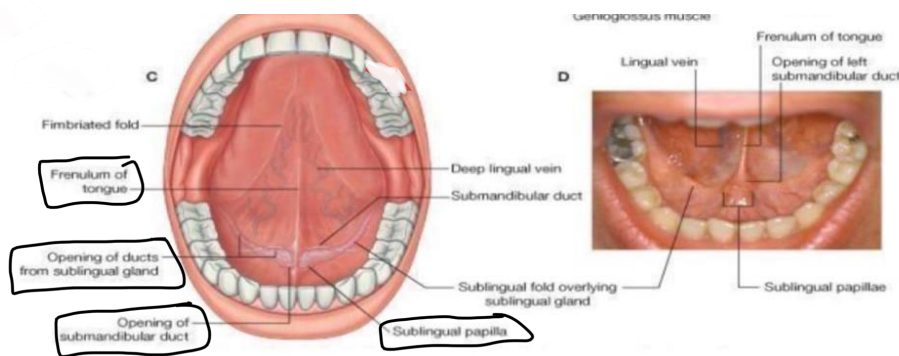
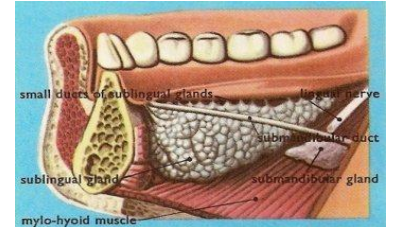
the smaller arm of the hook (or deep part) of the gland loops around the posterior margin of the mylohyoid muscle to enter and lie within the floor of the oral cavity where it is lateral to the root of the tongue on the lateral surface of the hyoglossus muscle.

The lingual nerve loops under the submandibular duct, crossing first the lateral side and then the medial side of the duct, as the nerve descends anteromedially through the floor of the oral cavity and then ascends into the tongue.

**Sublingual Gland**

- 1 The sublingual gland lies beneath the mucous membrane (sublingual fold) of the floor of the mouth, close to the frenulum of the tongue
- 2 It has both serous and mucous acini, with the latter predominating.

- 3 The sublingual ducts (8 to 20 in number) open into the mouth on the summit of the sublingual fold
- 4 Parasympathetic secretomotor supply is from the facial nerve via the chorda tympani, and the submandibular ganglion. Postganglionic fibers pass directly to the gland. Same as submandibular .



When tongue is raised up, papilla is visible with an opening for the submandibular duct .

- Visible blue lines are the lingual veins (picture C above)
- Medial to lingual vein are the lingual artery and nerve .

**Important:**

-Lingual nerve has triple relations with the submandibular duct (picture A above)  
Lateral → below → anteromedial (deep)  
Then ascends into the tongue .

Medial relation to submandibular gland :  
Submandibular duct , lingual nerve, genioglossus muscle, lingual vessels.

This block of pictures(A,B,C&D) is very important :

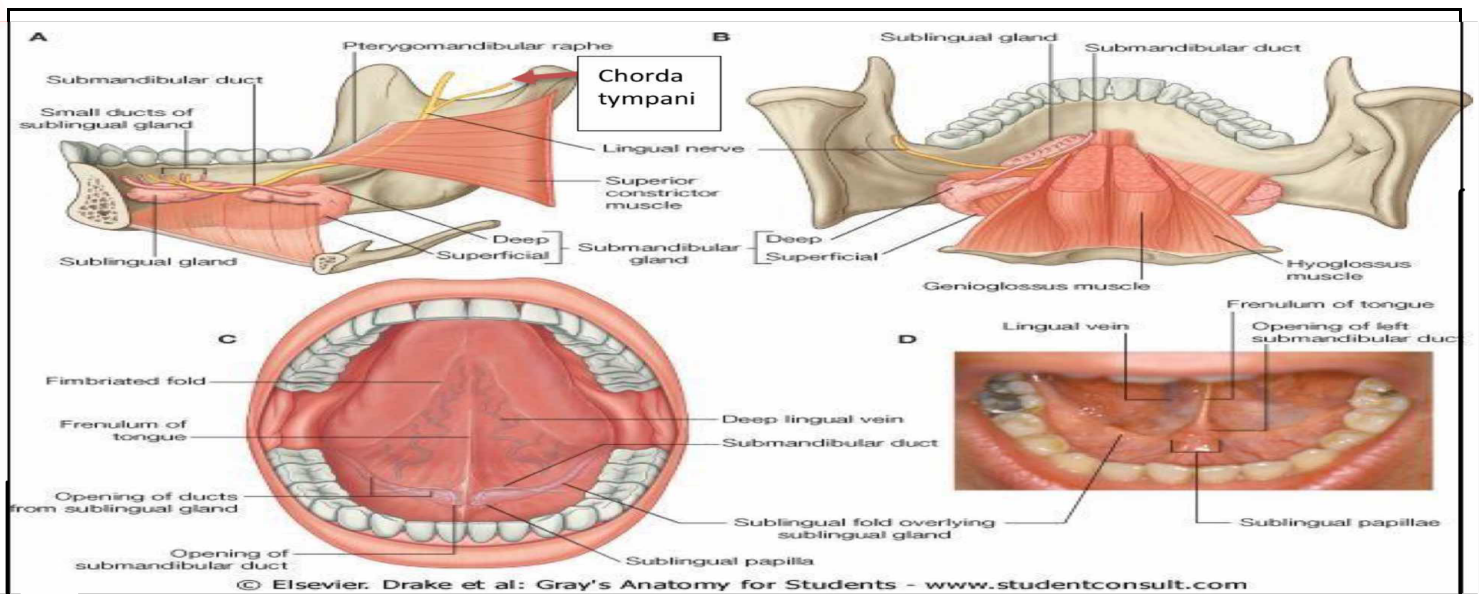
A:The submandibular duct leaves the deep part of the gland and it is the most medial of all structures next to it like lingual nerve .

Mylohyoid muscle also separates sublingual from submandibular .

Chorda tympani joins the lingual nerve but the fibers don't get mixed !

B: notice the sublingual ducts

The facial nerve only passes through the parotid but does not innervate it .



## Questions

\*Circumvallate papillae is innervated by chorda tympani nerve (T/F)  
 False , circumvallate is innervated by glossopharyngeal nerve although it is found in the anterior two thirds but it follows the posterior third in development

\*Between the hyoglossus and mylohyoid, all correct except

- submandibular ganglia
- submandibular duct
- hypoglossal nerve
- deep part of submandibular gland

lingual artery

V2 →

page 6 →

→ Some structures have been added

There are 5 structures between mylohyoid and hyoglossus muscles: Deep part of submandibular gland, submandibular duct, Submandibular ganglia, lingual nerve and hypoglossal nerve.

page 9 → parotid bed instead of carotid bed  
(إسفة إسة)

page 7 the name of the artery has been added

5. Sympathetic (no effect on secretions) affects

vasoconstriction only via superior cervical sympathetic ganglia hitch hiking the External carotid artery

vasosympathetic  
nerve (CN IX)

teachmeanatomy

+ past paper questions (the last page)

V3 →

\* Salivary glands secrete 1.5L daily instead of 8.

\* page 1 (added 2 important topics).