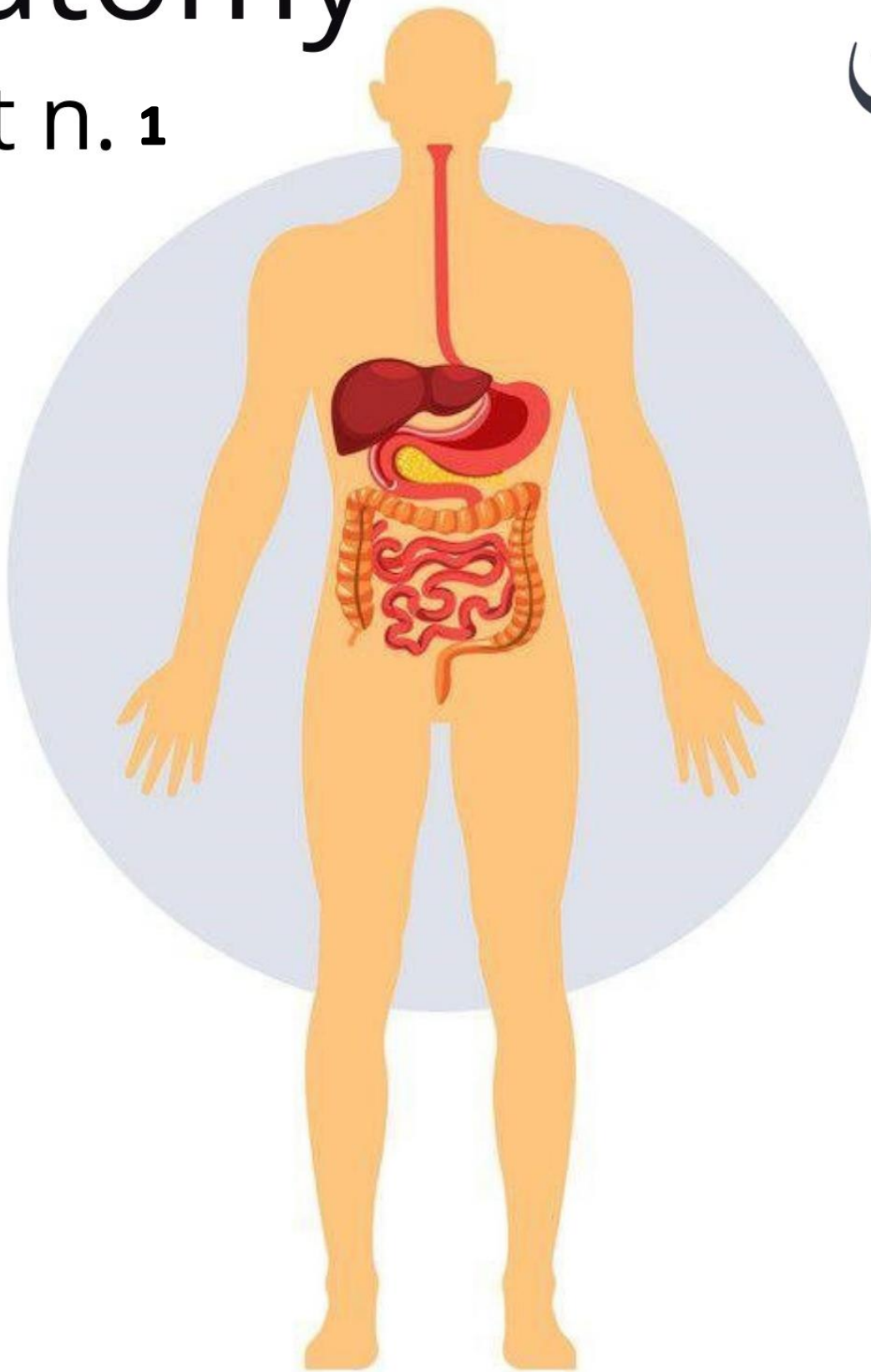


Anatomy

Sheet n. 1



DIGESTIVE SYSTEM

Writer:

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The digestive system of the head and neck

(Hey there!! So, in this sheet, each color indicates as follows: dark blue: slides, black: doctor's words, red: what the doctor mentioned from slides, underlined: important, sky blue: extra info)

For starters we need to know that the digestive system is divided into two parts:

- 1) **Digestive tract** (or alimentary tract): it's like a tube that starts at the mouth and ends at the anal canal (so the sequence is; mouth (oral cavity) → esophagus → stomach → small intestine → large intestine → rectum and anal canal.
- 2) **Association organs**: include the salivary glands in the mouth, the gallbladder, liver and the pancreas, all of them has a duct that opens into the alimentary tract (so the secretions of these association organs must reach the alimentary tract in order to either be absorbed or digested.

Now let's begin with the alimentary tract:

The alimentary tract begins at the mouth which has two openings (anterior and posterior openings).

The **anterior** opening of the mouth is bounded by lips (upper and lower lips) and a muscle called **orbicularis oris** surrounding them.



Orbicularis oris muscle is a circular skeletal muscle supplied by the facial nerve and is bound to the mouth anteriorly.

Action: closing the mouth and is used for whistling.

The **posterior** opening of the mouth (also called the oropharyngeal isthmus or opening) reaches the pharynx. when someone is eating and chewing food , he forms something called **bolus** (لقمة و المقصود بها الأكل الممضوغ), this bolus reaches the dorsum of the tongue then undergoes deglutition (swallowing) to reach the pharynx then the esophagus then the stomach where it undergoes digestion.

So, the oral cavity has an anterior opening bounded by the upper and lower lips and a posterior opening called the oropharyngeal isthmus (or fauces) that reaches the pharynx (oropharynx).

Now, let's talk about the lips

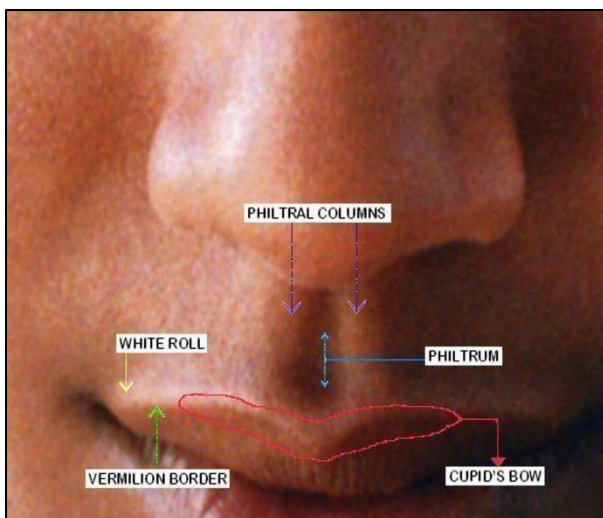
- The lips are two fleshy folds that surround the oral orifice
- They are covered on the outside by skin and are lined on the inside by mucous membrane
- the substance of the lips is made up by the orbicularis oris muscle and the muscles that radiate from the lips into the face

- Also included are the labial blood vessels and nerves, connective tissue, and many small salivary glands.
- The philtrum is the shallow vertical groove seen in the midline on the outer surface of the upper lip. Median folds of mucous membrane "the labial frenulae" connect the inner surface of the lips to the gums.

The upper lip contains the muscle orbicularis oris and is covered by epithelium or skin (the type of the skin is stratified squamous epithelium keratinized).

If we take a cross section of either the upper or the lower lip, we will notice the presence of three zones:

1. The first zone is the skin which contains the hair follicles and sebaceous glands.
2. The second reddish zone is the **vermilion zone** (also called the transitional zone): it's red because it's rich in blood vessels. And the type of epithelium in it is a modified epithelium (so it's not like the skin), it's also rich in nerve terminals, so this zone is highly sensitized.
3. The third zone is the inner surface of the lip (which is related to the oral cavity) and the type of epithelium in it is stratified squamous non-keratinized and it's characterized by containing labial glands that secrete mucous.

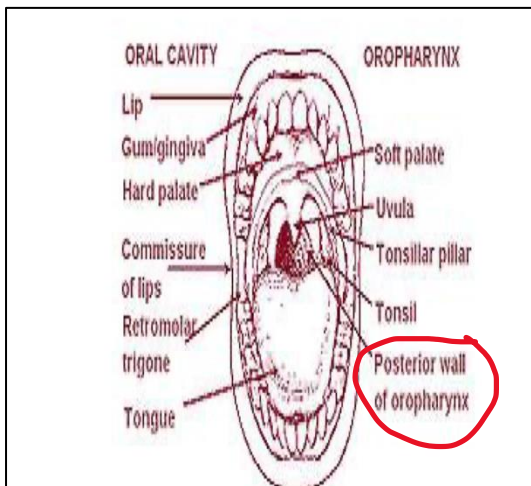


Note: the doctor doesn't go over everything present in each slide, so I colored what he does cover in red, but please read the rest just in case 😊.

The middle part of the upper lip is called the **philtrum** which is the vertical depression that originated embryologically from the union of the two medial nasal processes.

The Mouth Cavity

- The mouth extends from the lips to the pharynx
- The entrance into the pharynx, the oropharyngeal isthmus, is formed on each side by the palatoglossal fold
- The mouth is divided into the vestibule and the mouth cavity proper.



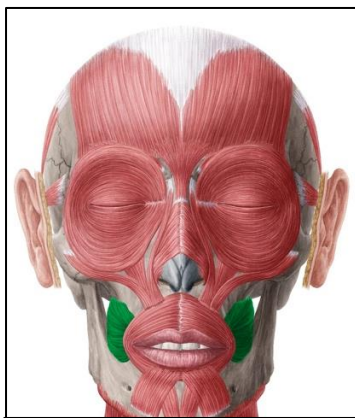
The oral cavity can be said to have boundaries; it has a roof, floor and walls.

Roof: composed of the hard palate and the soft palate (present posteriorly and at its end is the uvula).

Floor: tongue and mucosa.

Note: the mucosa of the oral cavity has two types; one mucosa is attached to the hard palate and the gums or the gingiva (where the teeth is located, socket for teeth), the type of epithelium in it is **dense connective tissue**.

The other part of the oral cavity contains another type of mucosa which is composed of **loose connective tissue**, so the floor of the mouth and the tongue contains a soft mucosa due to the presence of this type of tissue.



Buccinator muscle

On the lateral side of the oral cavity lies the buccinator muscle, which is responsible for blowing, note that the buccinator is covered externally by skin and lined internally by mucous membrane or mucosa.

The oral cavity can be divided into:

- 1) mouth proper
- 2) vestibule

Vestibule

- The vestibule lies between the lips and the cheeks externally and the gums and the teeth internally
- This slit-like space that communicates with the exterior through the oral fissure between the lips

- when the jaws are closed, it communicates with the mouth proper behind the third molar tooth on each side.
- The vestibule is limited above and below by the reflection of the mucous membrane from the lips and cheeks to the gums.
- The lateral wall of the vestibule is formed by the cheek, which is made up by the buccinator muscle and is lined with mucous membrane.
- The tone of the buccinator muscle and that of the muscles of the lips keeps the walls of the vestibule in contact with one another
- The duct of the parotid salivary gland opens on a small papilla into the vestibule opposite the upper second molar tooth

The vestibule can simply be described as where the toothbrush is placed, so when you are brushing your teeth, you put the toothbrush in the vestibule 🍷!, so the vestibule is between closed teeth and the lateral wall.

The importance of the vestibule lies in the fact that the parotid gland (which is a large salivary gland) opens into it through its duct at the level of upper second molar. And the other gland opens in the oral cavity.

Mouth Proper

- The mouth proper has a roof, a floor and a lateral wall (so closed teeth are the lateral walls).
- The roof of the mouth is formed by the hard palate in front and the soft palate behind
- The floor is formed largely by the anterior two thirds of the tongue and by the reflection of the mucous membrane from the sides of the tongue to the gum of the mandible
- fold of mucous membrane called the frenulum of the tongue connects the undersurface of the tongue in the midline to the floor of the mouth
- Lateral to the frenulum, the mucous membrane forms a fringed fold, the plica fimbriata
- The submandibular duct of the submandibular gland opens onto the floor of the mouth on the summit of a small papilla on either side of the frenulum of the tongue
- The sublingual gland projects up into the mouth, producing a low fold of mucous membrane, the sublingual fold
- Numerous ducts of the gland open on the summit of the fold.

The mouth proper is the cavity inside the closed teeth. Do you think there's a connection between the mouth proper and the vestibule? The answer is yes, behind the last molar (اخر) (طاحونة يكون في وراها مسافة بتوصل).

Note the roof (**red**) , floor (**green**) and lateral walls (**blue**).also note the uvula (**purple**) which as you can see is part of the soft palate.

Notice the presence of the **superior and inferior labial frenulae** (**pink**) which are folds of mucosa that connect the lip with the internal mucosa.

There's another frenula on the tongue called **frenulum linguae** (in **orange**) , it's a fold of mucosa that you can see if you raise your tongue.

Also check out the posterior opening that reaches the pharynx (it's situated somewhat below the uvula if you wanted to locate it on the picture)

So recap of the openings:

The Superior opening is at the soft palate or the uvula

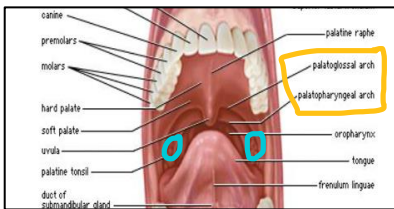
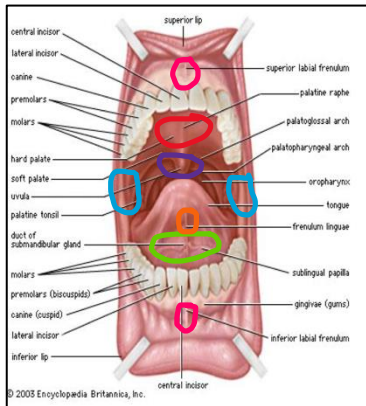
while the inferior opening is at the posterior third of the tongue .

On the lateral side of the mouth proper, we can notice the presence of two folds (**palatoglossal fold (anteriorly)** and **palatopharyngeal fold (posteriorly)**, both are in **yellow**) with palatine tonsils situated in between (**cyan**) and these tonsils are very important for the filtration of foreign bodies and microbes.

These folds contain muscles, **palatoglossus** muscle in palatoglossal fold and **palatopharyngeus** muscle in palatopharyngeal fold.

🧐 Clinical note: palatine tonsils are frequently inflamed in children leading to tonsillitis (since they discover the world with their mouth, literally).

So, again, we have palatine tonsils located on the two side of oropharyngeal isthmus and it's bounded by two folds anteriorly (palatoglossal) and posteriorly (palatopharyngeal). And don't forget the muscles!



Mucous Membrane of the Mouth

- In the vestibule the mucous membrane is tethered to the buccinator muscle by elastic fibers in the submucosa
- Prevent redundant folds of mucous membrane from being bitten between the teeth when the jaws are closed.
- The mucous membrane of the gingiva, or gum, is strongly attached to alveolar periosteum.

So far we have discussed the mouth proper, the vestibule and mucous membranes, now let's talk about **the innervations of the mouth**.

Sensory Innervation of the Mouth "مهم وجاي عليه أسئلة" ⚠

Divided into:

- **Roof:** The greater palatine and nasopalatine nerves from the maxillary division of the trigeminal nerve.
- **Floor:** The lingual nerve (common or general sensation for the tongue & floor of the mouth), a branch of the mandibular division of the trigeminal nerve. General sensations include pain, touch and temperature.
- The taste fibers travel in the chorda tympani nerve, a branch of the facial nerve. (on the dorsum of the tongue we have taste buds to carry out special sensations (taste))
- **Cheek:** The **buccal** nerve, a branch of the **mandibular** division of the trigeminal nerve (**sensory**). The buccinator muscle is innervated by the buccal branch of the **facial** nerve (**motor**). So the buccal nerve is sensory to the mucosa of the cheeks.

The Teeth

The gingivae (gums) are specialized regions of the oral mucosa that surround the teeth and cover adjacent regions of the alveolar bone.

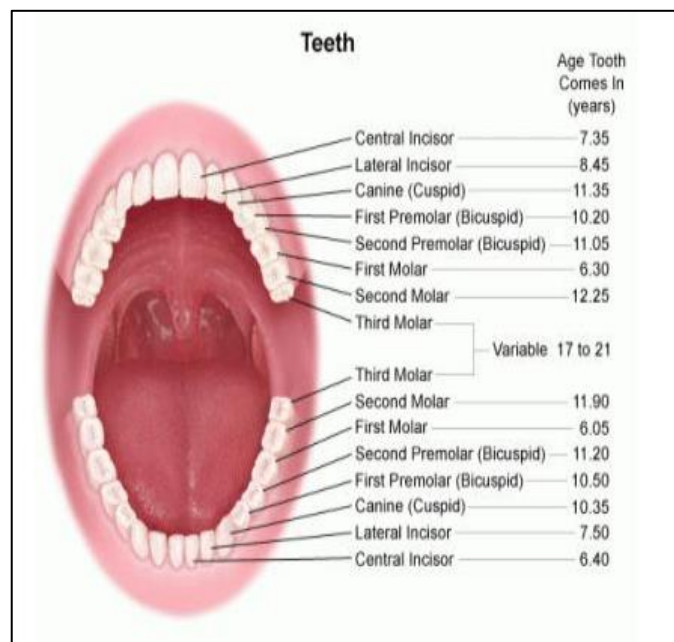
There are Two types of teeth in the human mouth:

1. Deciduous Teeth (milk teeth):

***Number:** There are 20 deciduous teeth

(10 on the upper jaw and 10 on the lower jaw).

The 10 deciduous teeth in each jaw are distributed as **four incisors, two canines, and four molars**.



***Eruption:** They begin to erupt about 6 months after birth starting with the two incisors on the lower jaw, followed by the upper jaw.

***Complete eruption:** will all be erupted by the end of 2 years.

2. Permanent Teeth:

***Number:** There are 32 permanent teeth (16 on each jaw). The 16 permanent teeth on each jaw are distributed as four incisors, two canines, four premolars, and six molars.

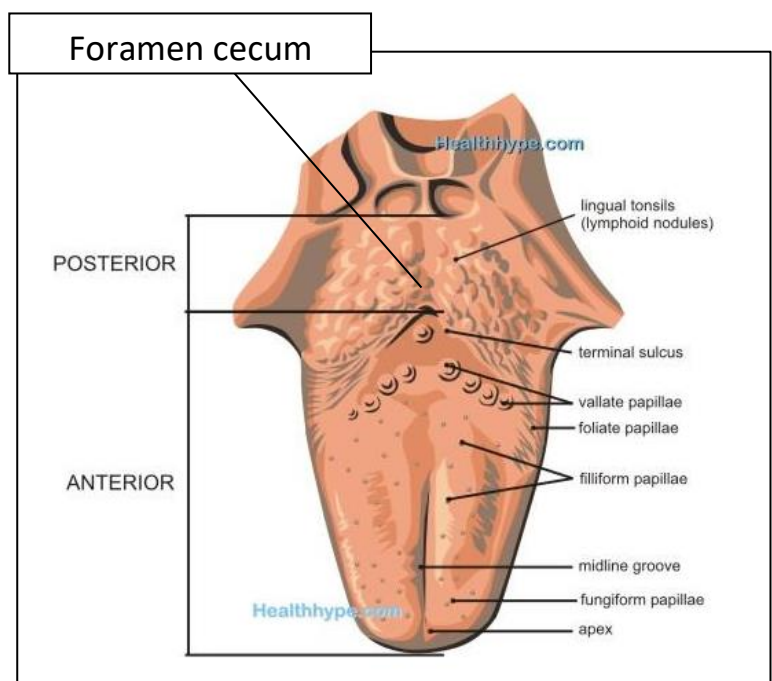
***Eruption:** They begin to erupt at 6 years of age, replacing the milk teeth. The last non-wisdom teeth erupt at 12 years of age.

***Complete eruption:** The last tooth to erupt is the third molar (the wisdom tooth), which may happen between the ages of 17 and 30. This particular tooth presents several challenges. It could emerge either early or late, or it might not appear at all. Additionally, it has the potential to cause abscess, inflammation, and even necessitate surgical removal.

Regardless of the type of the tooth, the teeth of the lower jaw usually appear before those of the upper jaw.

The Tongue

- The tongue is a mass of striated muscle covered with mucous membrane. It is divided into right and left halves by a median fibrous septum (midline), with the midline groove situated on it. It can also be divided into anterior 2/3 and posterior 1/3 by foramen cecum and V-shaped sulcus, the sulcus terminalis (terminal sulcus).
- The apex of the sulcus projects backward and is marked by a small pit, the foramen cecum
- The foramen cecum is an embryologic remnant and marks the site of the upper end of the thyroglossal duct



The anterior 2/3 of the tongue contains taste buds (lingual papillae), three types of papillae are present on the upper surface of the anterior two thirds of the tongue: the filiform papillae, the fungiform papillae, and the vallate papillae. They are responsible for the taste sensation (except filiform papillae).

The mucous membrane covering the posterior third of the tongue is devoid of papillae (taste buds), it is made of lymphoid tissue, therefore it has an irregular surface caused by the presence of underlying lymph nodules, the **lingual tonsil**.

The anterior and posterior also have different developmental origins.

Mucous Membrane of the Tongue

The dorsum of the tongue (the upper surface) is adherent to the muscle of the tongue and is full of taste buds. With continuous swallowing and digesting, the surface of the epithelium gets injured. Therefore, we call the epithelium covering the upper surface of the tongue: modified stratified squamous epithelium or parakeratinized.

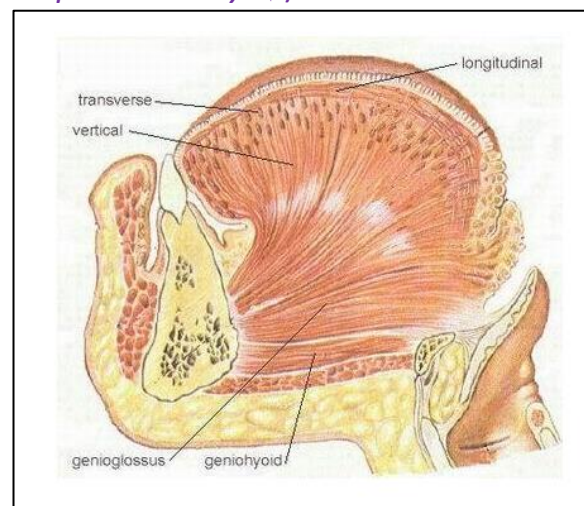
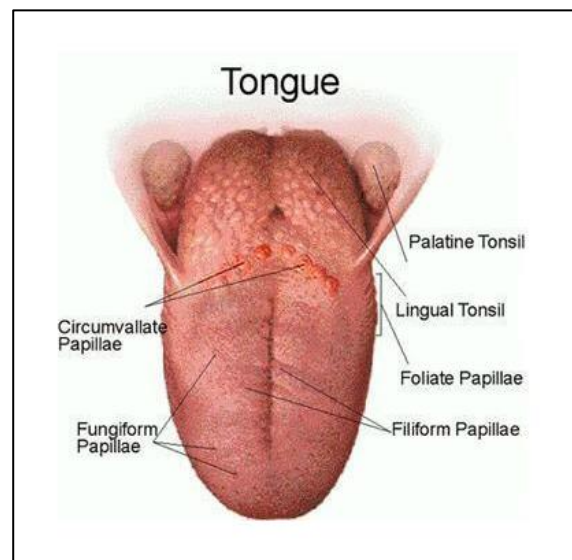
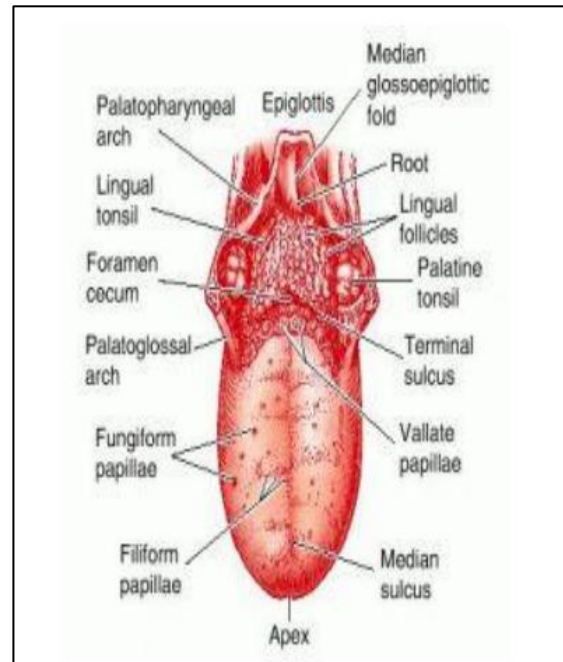
The lower surface of the tongue is covered by mucosa of stratified squamous epithelium non-keratinized type.

- In the midline anteriorly, the undersurface of the tongue is connected to the floor of the mouth by a fold of mucous membrane, the frenulum of the tongue.

(Note: study the pictures, the doctor explained them *passionately* ✨)

The doctor didn't talk about the below subjects:

- The mucous membrane on the inferior surface of the tongue is reflected from the tongue to the floor of the mouth.
- On the lateral side of the frenulum, the deep lingual vein can be seen through the mucous membrane.
- Lateral to the lingual vein, the mucous membrane forms a fringed fold called the plica fimbriata.



Muscles of the Tongue

The muscles of the tongue can be divided into:

1. intrinsic muscles: These muscles are confined to the tongue and are not attached to bone, they are responsible for the shape of the tongue. They consist of longitudinal, transverse, and vertical fibers.

Nerve supply: Hypoglossal nerve.

Action: Alter the shape of the tongue.

2. extrinsic muscles: muscles coming from outside the tongue and inserting in it. These muscles are attached to bones and the soft palate, they are responsible for the movement of the tongue.

The muscles attach from styloid process to the tongue (styloglossus), from the soft palate above (palatoglossus), from the mandible (genioglossus) and from the hyoid bone below (hyoglossus).

Origins:

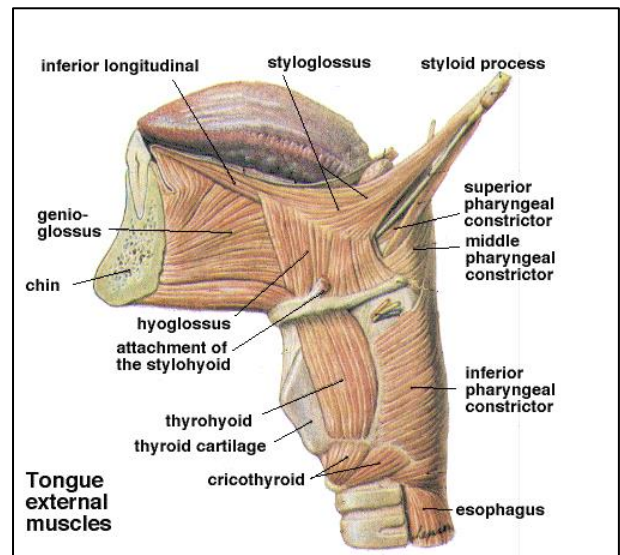
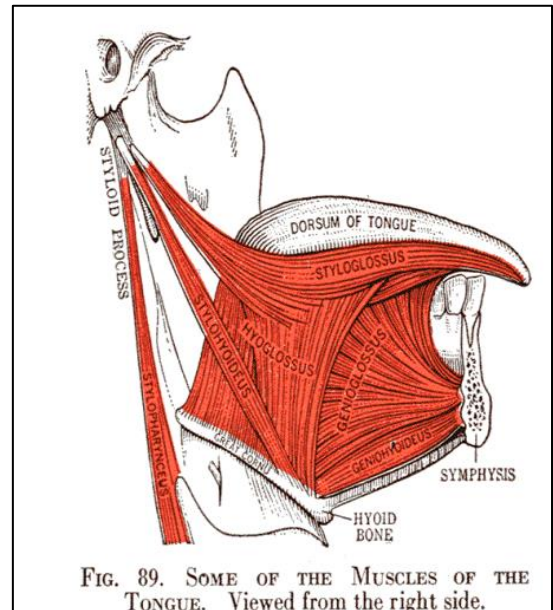
- 1. Genioglossus** originates from Superior genial spine of mandible.

Action: Protrudes apex of tongue straight through mouth.

This muscle is an important muscle, contraction of both muscles (right and left) protrudes the tongue straightly outside the mouth. While the rest of the muscles move it backwards, upwards, downwards.

⚠ So, Injury of the right hypoglossal nerve for example will cause paralysis of the right genioglossus muscle (and all muscles supplied by the right hypoglossal), resulting in right deviation of the tongue (the tongue will be deviated to the paralyzed side). "ممکن یچی علیہ"
سؤال بالامتحان"

Explanation: when only the left side protrudes the tongue (because the right side is paralyzed) the tongue will be pushed towards the paralyzed side because it is not functioning and doing its job (no resistance on the right side).



[Hypoglossal Nerve Palsy during Meningococcal Meningitis \(youtube.com\)](https://www.youtube.com/watch?v=...)

2. Hyoglossus originates from Body and greater cornu of hyoid bone.

Action: Depresses tongue.

3. Styloglossus originates from Styloid process of temporal bone.

Action: Draws tongue upward and backward.

4. Palatoglossus originates from Palatine aponeurosis.

Action: Pulls roots of tongue upward and backward, narrows oropharyngeal isthmus.

Insertion (for the 4 muscles): Blends with each other, the palatoglossus inserts at Side of tongue.

Nerve supply: Hypoglossal nerve, except palatoglossus which is supplied by accessory with the vagus nerve.

Movements of the Tongue

Protrusion: The genioglossus muscles on both sides acting together.

Retraction: Styloglossus and hyoglossus muscles on both sides acting together.

Depression: Hyoglossus muscles on both sides acting together.

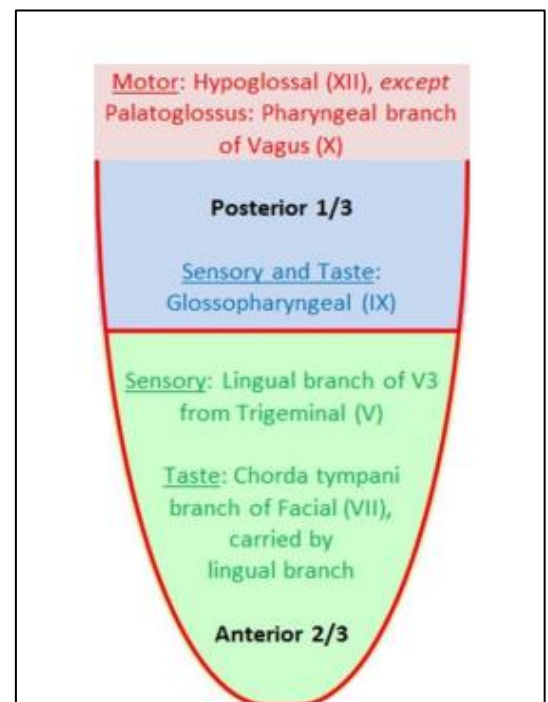
Retraction and elevation of the posterior third: Styloglossus and palatoglossus muscles on both sides acting together.

Innervations of the tongue

- Motor: hypoglossal, except palatoglossus by accessory through the vagus
- Sensory innervations:

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)



You might ask, why do we have taste sensation on the posterior third when it's devoid of any taste buds?

Because vallate papillae which is found in the anterior two thirds in front of sulcus terminalis originates embryonically from the posterior third. So, it is supplied by the nerve that innervated the posterior third (Glossopharyngeal nerve).

The doctor didn't talk about the below subjects:

1. Blood Supply

The lingual artery, the tonsillar branch of the facial artery, and the ascending pharyngeal artery supply the tongue

The veins drain into the internal jugular vein.

2. Lymph Drainage

Tip: Submental lymph nodes

Sides of the anterior two thirds: Submandibular and deep cervical lymph nodes

Posterior third: Deep cervical lymph nodes

The Palate "Will be covered in the online lectures"

The Salivary Glands last topic in this sheet 🤔

Salivary glands can be divided into major and minor salivary glands. Minor salivary glands include labial salivary glands, palatal salivary glands, lingual salivary glands and much more. They all secrete saliva.

Major (large) salivary glands include:

1. Parotid Gland: The parotid gland is the largest salivary gland and is composed mostly of serous acini.

***Location:** lies in a deep hollow below the external auditory meatus, behind the ramus of the mandible and in front of the sternocleidomastoid muscle

***Capsule:** it is the only gland surrounded by two capsules (made of connective tissue), dividing the gland into lobes and lobules.

***Secretion of the gland:** serous secretion.

***Content and relations:** the superficial temporal artery, auriculotemporal nerve and the temporal branch of the facial nerve all emerge from the upper boarder of the gland.

The parotid duct emerges from the anterior border of the gland and passes forward over the lateral surface of the masseter. The transverse facial artery and the buccal nerve also emerge from the anterior border.

The external carotid artery and the retro mandibular vein are located at the lower border of the gland.

The parotid gland encloses the external carotid artery, the retromandibular vein, and the origin of the extracranial part of the facial nerve [VII].

***Innervation of the gland:** each gland has 3 types of innervation.

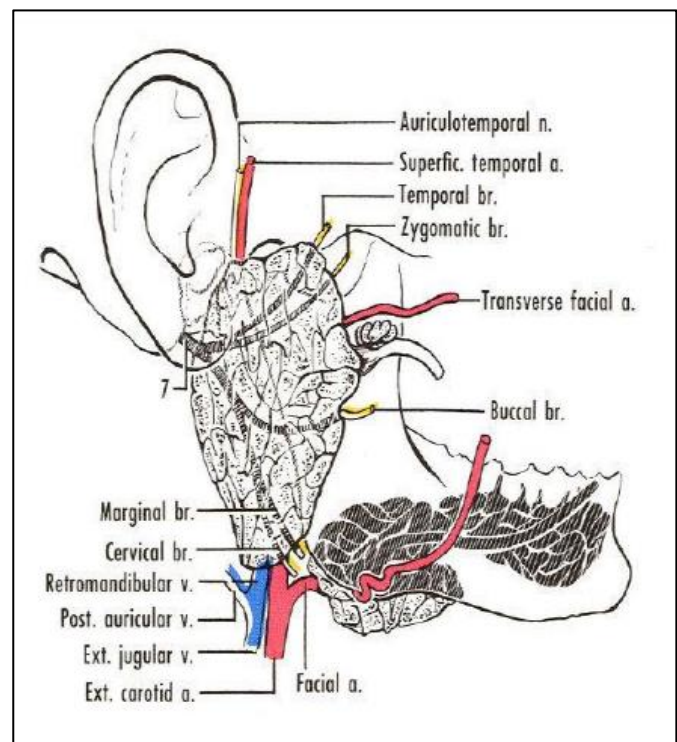
1.sensory: responsible for general sensations of the gland, for example: pain sensation when the gland is swollen.

The parotid gland is innervated by the auriculotemporal nerve.

2.sympathatic: the sympathetic innervation works on the blood vessels inside the gland (ext. carotid artery here), it causes vasoconstriction.

The postganglionic sympathetic fibers originate from the superior cervical ganglion and hitch-hike the external carotid artery to reach the gland.

3.parasympathatic: it is a secretomotor innervation, which means it is responsible for secretion.



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.

The parasympathetic innervation of the parotid gland starts from the inferior salivary nucleus in the medulla oblongata, the glossopharyngeal nerve emerges from it carrying preganglionic parasympathetic fibers, it then gives a branch called the tympanic nerve which also branches into the lesser petrosal nerve just around the tympanic drum.

The lesser petrosal nerve which is carrying preganglionic parasympathetic fibers synapses at the otic ganglion just below foramen ovale.

The postganglionic parasympathetic fibers emerge from this ganglion carried by the auriculotemporal nerve. After that, the auriculotemporal nerve supplies the parotid gland with the sensory and parasympathetic innervation.

Q: which of the following nerves is secretomotor or sensory to the parotid?
Auriculotemporal.

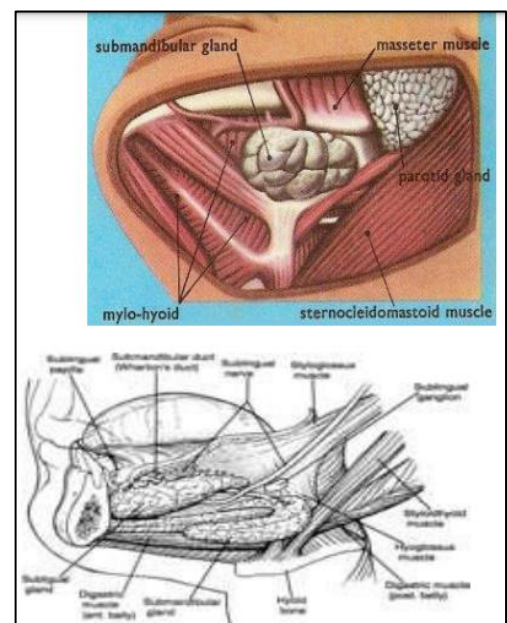
The doctor didn't talk about the below subjects:

***Opening:** The parotid duct passes anteriorly across the external surface of the masseter muscle and then turns medially to penetrate the buccinator muscle of the cheek and open into the oral cavity adjacent to the crown of the second upper molar tooth.

It enters the vestibule of the mouth upon a small papilla opposite the upper second molar tooth.

The parotid gland lies in the parotid bed that is formed by the sternocleidomastoid muscle behind, the ramus of mandible in front. superiorly, the base of the trench is formed by the external acoustic meatus and the posterior aspect of the zygomatic arch.

The facial nerve divides the gland into superficial and deep lobes.



2. Submandibular Gland

***Location:** It lies beneath the lower border of the body of the mandible.

divided into superficial and deep parts by the mylohyoid muscle.

The superficial part can actually be felt just below the mandible.

The deep part of the gland lies beneath the mucous membrane of the mouth on the side of the tongue. It is located between the mylohyoid and the hyoglossus muscles.

***Capsule:** surrounded by one capsule.

***Secretion:** The submandibular gland consists of a mixture of serous and mucous acini. (mixed)

content and relations: The submandibular duct emerges from the anterior end of the deep part of the gland and runs forward beneath the mucous membrane of the mouth.

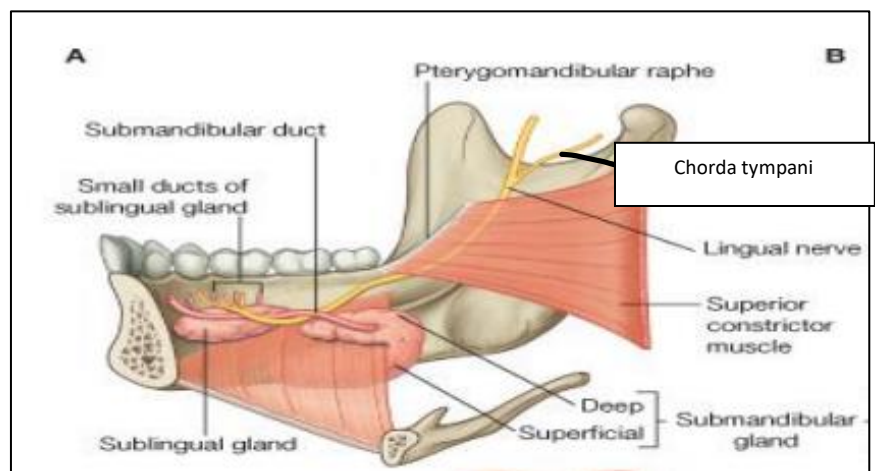
The lingual nerve loops under the submandibular duct,

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. The lingual nerve begins lateral to the submandibular duct then below it and finally medial to it. (triple relation between the lingual nerve and the submandibular duct).

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

The facial nerve emerges from the superior salivary nucleus in the medulla oblongata carrying preganglionic parasympathetic fibers, it gives the branch chorda tympani which joins the lingual nerve and then synapses at the submandibular ganglion (it is located between the mylohyoid and the hyoglossus muscles), the postganglionic parasympathetic fibers can innervate a gland directly or can be carried with the lingual nerve.

In regard to submandibular gland, the postganglionic fibers pass directly to the gland.

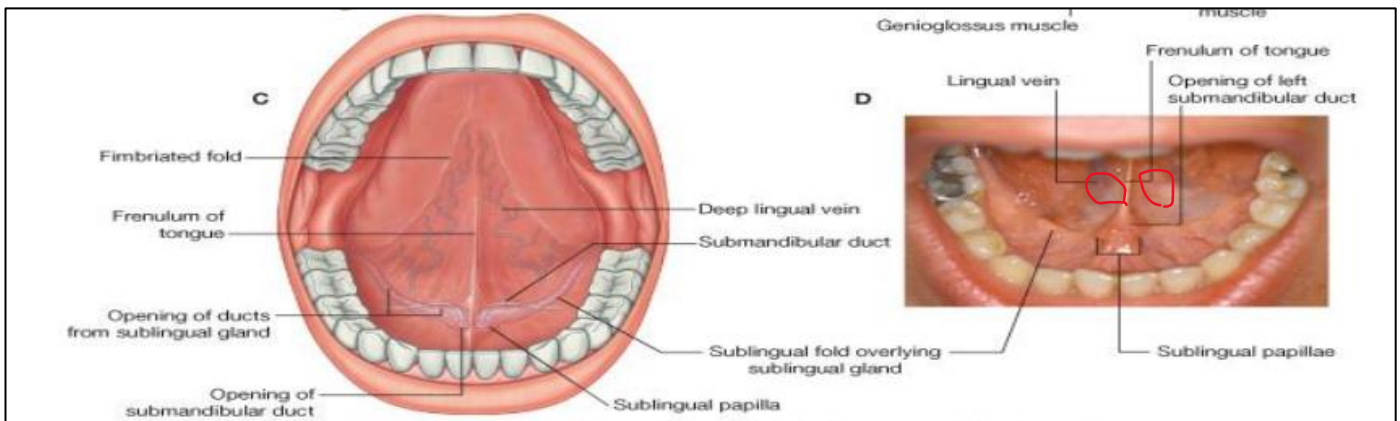


***Opening:** It opens into the mouth on a small papilla called the submandibular papillae, they are two in number located at the two ends of the two submandibular ducts, they are situated at the side of the frenulum of the tongue.

The doctor didn't talk about the below subjects:

the larger arm of the hook (or the superficial part) 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.

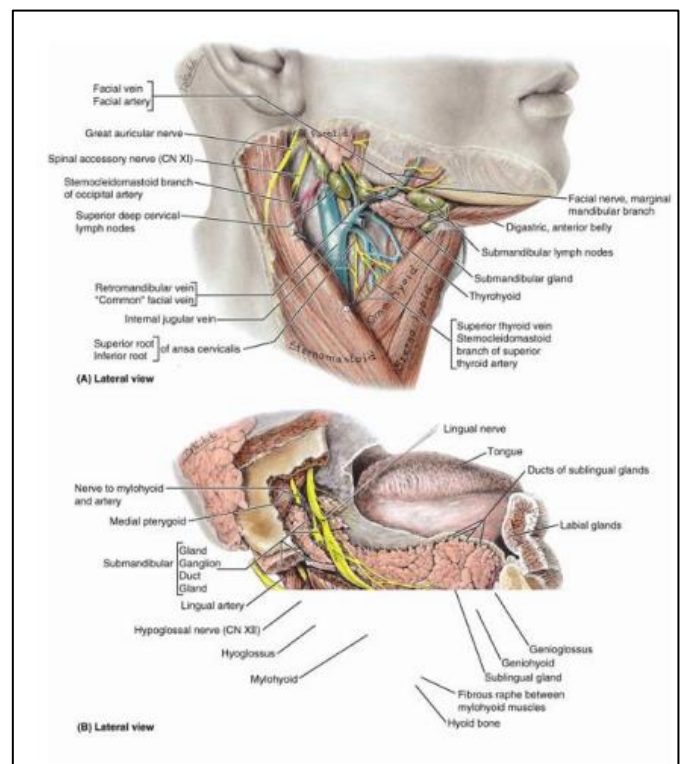
the smaller arm of the hook (or deep part) of the gland loops around the posterior margin of the mylohyoid muscle to enter and lie within the floor of the oral cavity where it is lateral to the root of the tongue on the lateral surface of the hyoglossus muscle.



3. Sublingual Gland

***Location:** the sublingual gland lies beneath the mucous membrane (sublingual fold) of the floor of the mouth, close to the frenulum of the tongue. It is located just below the tongue.

***Secretion:** It has both serous and mucous acini, with the latter predominating. (mostly mucous and very little serous).

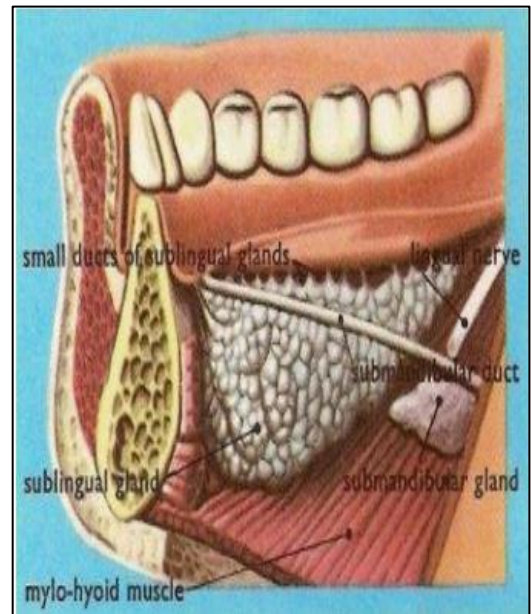


***Capsule:** surrounded by one capsule.

***Innervation** ركزوا عليه (same as submandibular gland): from the superior salivary nucleus in medulla oblongata. **Parasympathetic secretomotor supply is from the facial nerve via the chorda tympani**, which synapses with the lingual nerve in the infratemporal fossa forming an acute angle into the **submandibular ganglion** (between mylohyoid and hyoglossus). **While the postganglionic fibers pass either directly to the gland or through the lingual nerve.**

So, chorda tympani serves for both taste (mentioned previously) and for parasympathetic preganglionic innervations

Opening: The sublingual ducts (8 to 20 in number) open into the mouth on the summit of the sublingual fold or it can open into the submandibular gland.



Thank you!



V2 → page 13 (Artery instel of Nerve)