

Digestive System

University of Jordan
Faculty of Medicine
Batch of 2013-2019



Slide Sheet Handout Other

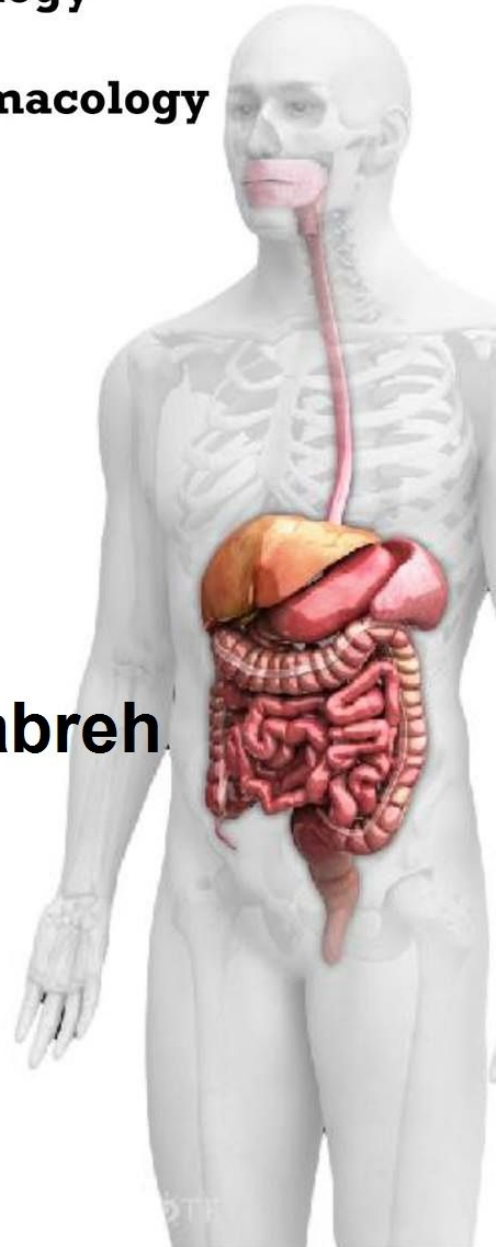
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Done by: Rashid Dahabreh

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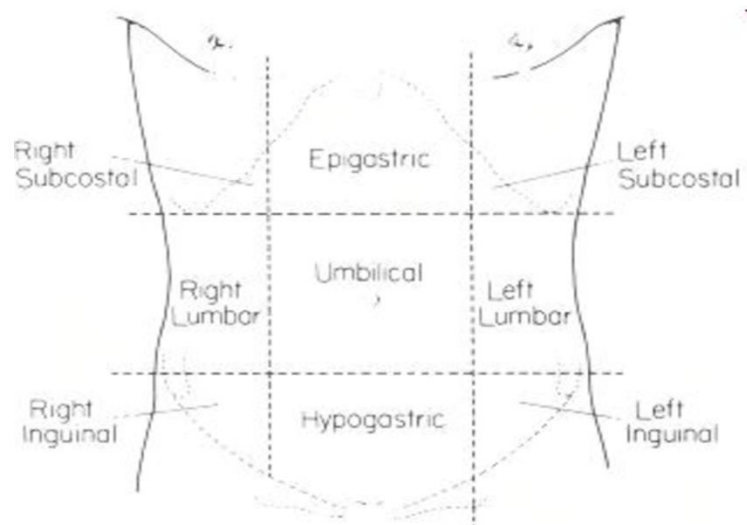
The Digestive System in The Head & Neck

Before we're off to our last Journey with Dr.Mohtsb, I'd like to say for all the newly admitted students that I personally found that the best studying method for Dr.Mohtsb would be studying slides (mainly) and going through sheets quickly to mark any unique pieces of information as he loves everything he says.

Let's start, shall we?

Before we dive into further details, every doctor should know the value of the physical examination of the abdomen. How come? Well because the abdomen simply resembles all of the GI tract, the abdomen contains all of the organs that are included within the GIT.

So knowing the value of the abdomen will enable you to run a better physical examination of it, you also need to know the regions on the abdomen in order to run a physical examination of it. This picture is a quick reminder.



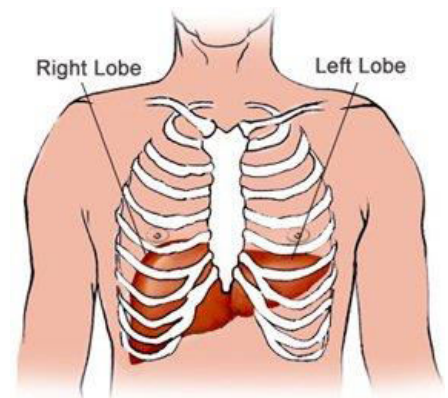
How do you run a physical examination of the abdomen?

the patient should be supine and the bed or examination table should be flat and the patient's hands should be at their sides. The doctor then must stand opposite to the right side of the patient to have a better "internal" picture of the organs located in the abdomen. For instance, you know that the heart is on the left side, the spleen is on the left side as well, and the liver is on the right side.



How do you physically examine the liver?

It's interesting to know how to physically examine the liver especially when it's enlarged (This condition is known as hepatomegaly), You'll start by asking the patient to take a deep breath and hold it in for a while and then you'll ask him to take a deep breath again, only release it immediately this time. Why so? Because when you take a deep breath and then release it, the diaphragm muscle is going to push the lower boarder of the liver enabling you to clearly palpitate it.



How do you physically examine the stomach? You must keep in mind that the stomach is superficial and located underneath the skin in the epigastric region.

How about if a patient presents to you with appendicitis (Inflammation of the appendix)?

The appendix is located in the right iliac fossa of the ilium bone and you examine the appendix by checking that area.



That was a small introduction to the abdominal region, now we will start talking about the anatomy of the GI tract. Let's begin by discussing the anatomy of the mouth.

The Mouth:

The mouth is a cavity (the oral cavity), and by now you should know that any cavity in the body is surrounded by anatomical structures. For the anterior boarder of the oral cavity, it's represented by the lips (anterior orifice of the oral cavity)

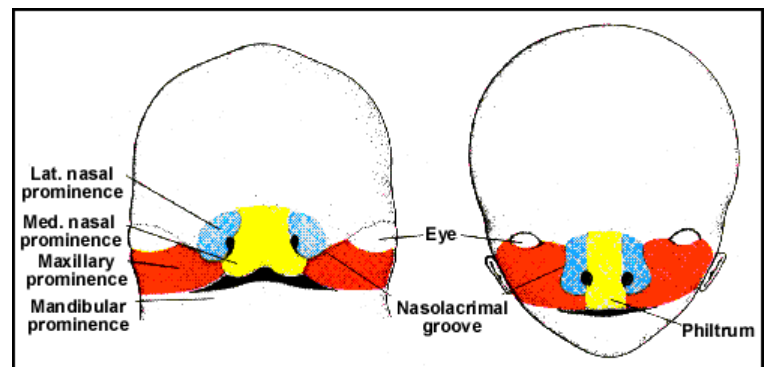
There are two lips, upper lip and a lower one and each lip has an angle.

A shallow vertical groove is seen in the midline on the outer surface of the upper lip and it's called the Philtrum (a groove between two philtral columns).

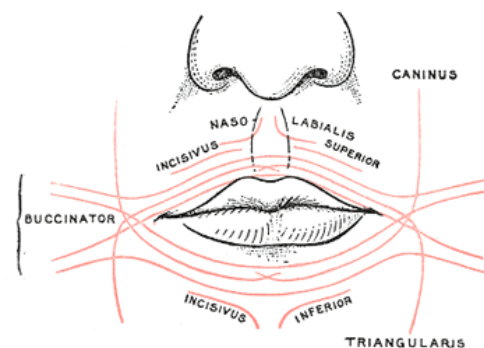


The doctor said something about the development of the Philtrum but didn't explain it, the following is an extra info:

Basically in humans, the philtrum is formed where the nasomedial and maxillary processes meet during embryonic development (Extra Info from wiki)



So far, we still didn't say what is the lip? It's a muscle and its substance is made by The Orbicularis Oris muscle (striated muscle) which is derived from fibers of the Buccinator muscle that cross each other to make the upper lip and the lower lip.



Note: The Orbicularis Oris muscle is a striated/skeletal muscle as the other facial muscles. So, the lip is a striated muscle called Orbicularis Oris and the nerve supply for it is the facial nerve.

Each lip consists basically of 3 zones:

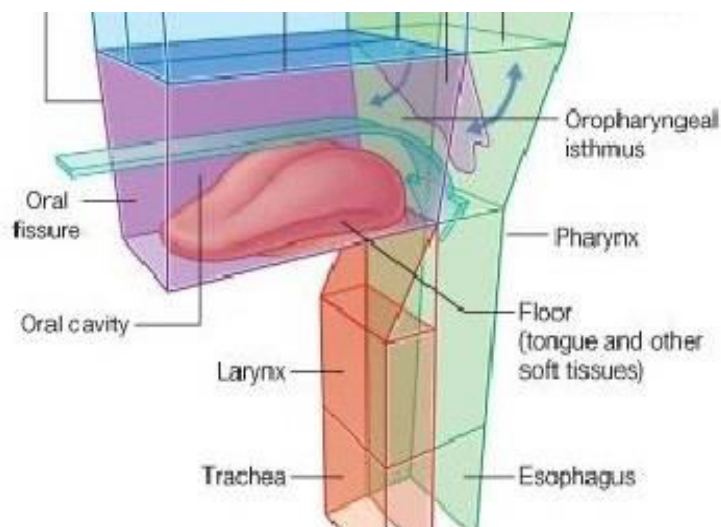
- 1) Normal skin zone: where the hair growth, it represents Keratinized stratified squamous epithelium.
- 2) Vermilion zone (transitional zone): The area which is known for its pinkish or reddish color BECAUSE it's rich in blood vessels. The type of skin in this zone is modified thin skin (It doesn't have any hair follicles, sebaceous glands, or sweat glands).
-This zone is also very rich in nerve terminals that represent a large area of the brain unlike the abdomen which has large organs innervated by nerves that represent a small area of the brain.
- 3) The last zone is inside the oral cavity, it represents non-keratinized stratified squamous tissue like the rest of the oral cavity.

The oral Cavity:

The oral cavity has two openings: -

- 1) anterior opening -
between the lips: For eating and drinking, and talking.

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2) Posterior opening called the Fauces or the Oropharyngeal Isthmus - because this opening leads to the pharynx (Allows passage of bolus to the Pharynx).

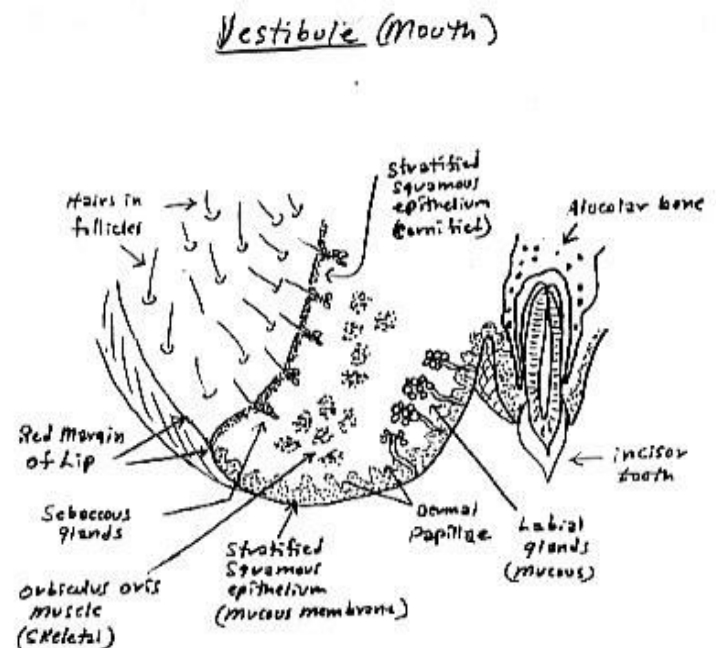
Parts of the oral Cavity: Oral Cavity (Mouth) is divided into two parts: The vestibule and the mouth Cavity proper.

1)the vestibule:

It's the area between the cheeks and the closed teeth, where you move the tooth brush to brush your teeth.

Boundaries of the vestibule:

- 1) externally (anteriorly):
Cheeks and lips
- 2) internally (posteriorly): the
gums and the closed teeth.



What's the importance of the vestibule? It receives the opening of the parotid duct at the level of the upper second molar tooth. (Parotid duct is a duct that transfers Saliva from parotid gland into the mouth)

Note: When the mouth is closed, there's a connection between the vestibule and the mouth cavity proper after the last molar tooth.

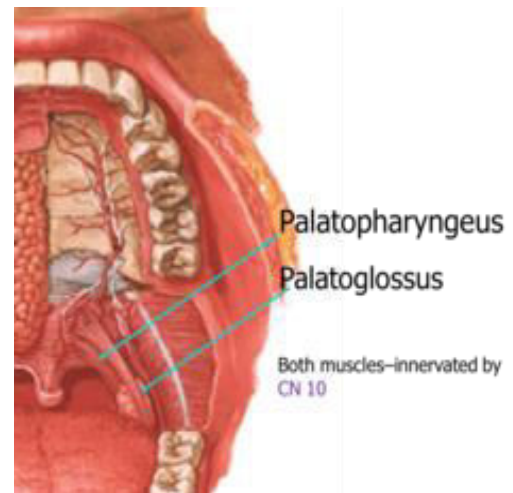
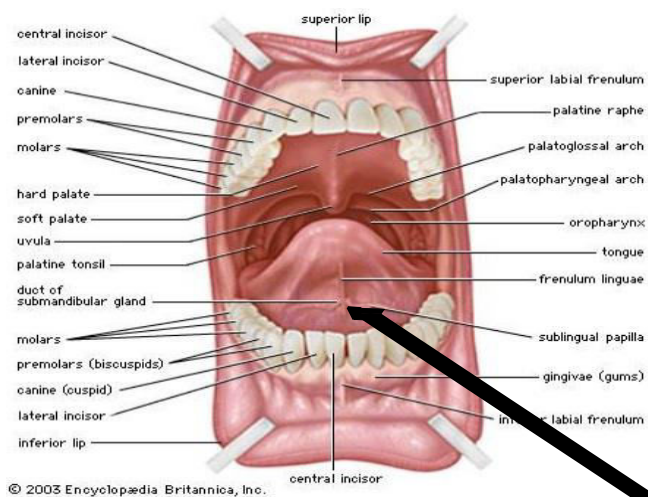
2) Mouth cavity proper:

Mouth proper has a roof and a floor, the roof is formed by the hard palate in front and the soft palate behind. The soft palate continues to form the Uvula (اللُّهَاء).

On the side of the fauces (posteriorly), we have the Palatine Tonsils that are located between two folds of two muscles:

1) The first fold (the anterior fold) is the Palato-glossal arch coming from the Palatoglossus muscle

2) The second fold is the palate-pharyngeal arch coming from the Palatopharyngeus muscle.



There's a fold of the mucous membrane called the **frenulum** of the tongue connects the undersurface of the tongue in the midline to the floor of the mouth. And it divides the tongue into two halves.

-The Submandibular duct of the Submandibular gland opens into a small opening (papilla) on either side at the base of the frenulum (under the tongue).

-The sublingual gland is also covered by a fold of the mucosa under the tongue in the floor of the mouth, the sublingual fold.

Mucus membrane of the mouth:

Mucus membrane of the oral cavity is tough at the dorsum of the tongue and its type is para-keratinized or non-keratinized). Why is it tough? Because the dorsum of the tongue is the one exposed to injuries. That been said, under the tongue the mucosa is soft (non-keratinized).

Sensory innervations of the mouth:

1)Upper jaw is innervated by Maxillary nerve, lower jaw is innervated by the Mandibular nerve (The two are branches of the trigeminal nerve, the 5th cranial nerve).

2)Roof: innervated by the greater palatine and nasopalatine nerves from the maxillary division of the trigeminal nerve

3)Floor: innervated by the lingual nerve (common general sensation), a • branch of the mandibular division of the trigeminal nerve. What's the meaning of general sensation? It means sensation of touch, temperature, and pain.

4) Taste fibers on the dorsum of the tongue: Innervated by chorda tympani nerve, a branch of the facial nerve.

5) Cheek: The buccal nerve, a branch of the mandibular division of the trigeminal nerve (the buccinator muscle is innervated by the buccal branch of the facial nerve)

Note: The cheeks from outside are innervated by the facial nerve and from the inside are innervated by the buccal nerve.

The Teeth:

Teeth are impeded in their sockets in the gum (gingivae), notify that the gums are specialized regions of the oral mucosa. They're tough and hard consisting of Perositeum and then tough connective tissue.

Function of teeth: Grinding of food plus lingual articulation to assist in the pronunciation of the "Tongue letters" such as the L letter.

Types of teeth:

	1) Deciduous Teeth (Milk teeth)	2) Permanent teeth
<u>Number</u>	Found in babies and children and they're 20 in number/10 in each jaw	32 in number/16 in each jaw
<u>Classification</u>	four incisors, two canines, and four molars in each jaw	four incisors, two canines, four premolars, and six molars in each jaw.

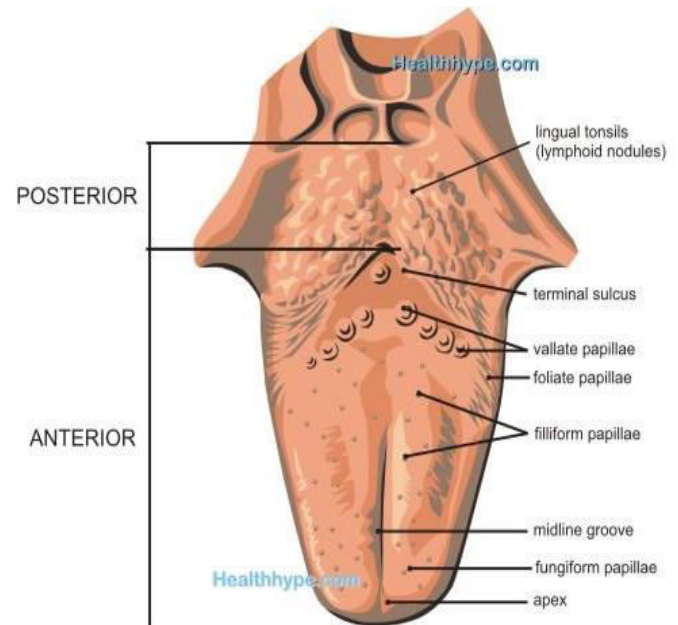
<u>Eruption time</u>	they start to appear after 6 months of birth	They start to erupt at the age of 2 until the age of 12.
<u>Clinical notes</u>	Teeth of the lower jaw usually appear before those of the upper jaw.	<p>The last tooth to erupt is the third molar (wisdom tooth) which may happen between the age of 17 to 30.</p> <p><u>Wisdom tooth</u> is clinically significant because many conditions are related to it; Sometimes it erupts and appear normally without any problems and sometimes it erupts along with an infection and sometimes it doesn't erupt pushing the patient to go to a dentist to perform a surgery to remove it.</p>

The Tongue

-The tongue is a mass of striated muscle covered with mucous membrane.

-It's divided into right and left halves by a midline groove.

-The mucous membrane of the upper surface of the tongue can be divided into anterior two thirds and posterior one third by a V-shaped sulcus, the Sulcus Terminalis



-The apex of the sulcus projects backward and is marked by a small pit, the foramen cecum (an embryologic remnant and marks the site of the upper end of the thyroglossal duct).

- The anterior two thirds of the tongue have the dorsum taste buds (for tasting) whereas the posterior one third have lymphatic nodules (called the lingual tonsils)- Note: The palatine tonsils are located at both sides of the lingual tonsils.

Remember: 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.

Circum Vallate Papillae is located within the anterior 2/3 (although during development, it's in the posterior 1/3) and it's also innervated by glossopharyngeal nerve, the same nerve that innervates the posterior 1/3 of the tongue.

Sensory innervations of the tongue:

	Sensory	Taste
Posterior 1/3	Glossopharyngeal nerve	
Anterior 2/3	Lingual nerve branch of mandibular division of trigeminal nerve (general sensation)	chorda tympani branch of the facial nerve

What's the difference in the development of the parts of the tongue?

The anterior 2/3 of the tongue develops from the first pharyngeal arch of the embryo and the posterior 1/3 develops from the third pharyngeal arch. So, Vallate Pappillie as we said earlier comes from the third pharyngeal arch and innervated by glossopharyngeal nerve.

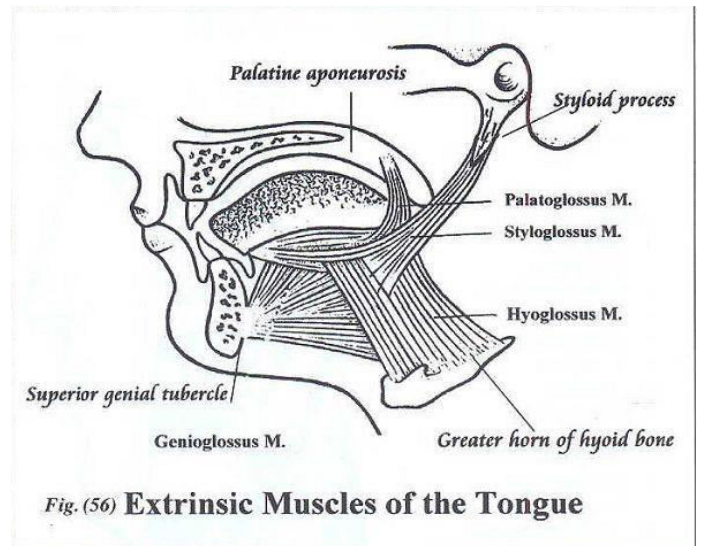
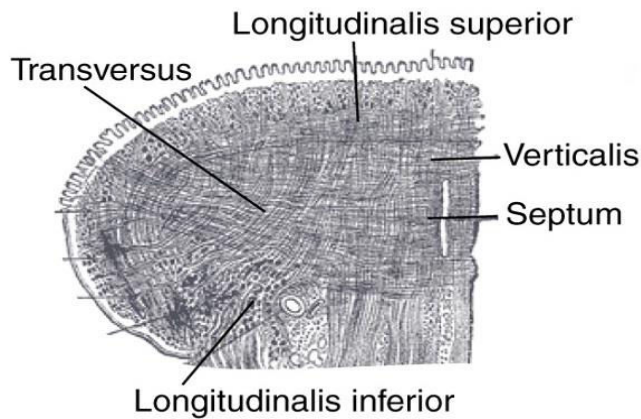
Remember again, the tongue is a muscular tissue and there's a general misunderstanding that the tongue has a bone within it and that's absolutely incorrect.

Due to its muscular tissue, it has many important functions that includes formation of the bolus, swallowing, articulation for correct pronunciation, and the taste buds on it are important for tasting.

Muscles of the tongue: Intrinsic and extrinsic.

	Intrinsic muscles	Extrinsic muscles
Description	confined to the tongue and are not attached to bone	These muscles are attached to bones and the soft palate
Include	They consist of longitudinal, transverse, and vertical fibers	They are: 1) Genioglossus: coming from the mandible (origin) 2) the hyoglossus: coming from the hyoid bone (origin) 3) the styloglossus: coming from Styloid process of temporal bone (origin) 4) palatoglossus: which arises from the palate (origin) <u>Insertion:</u> Blends with each other, the palatoglossus inserts at Side of tongue
Nerve supply	Hypoglossal nerve (12 th cranial nerve) except for Palatoglossus muscle (innervated by the pharyngeal plexus of the vagus nerve)	

<p>Action</p>	<p>Alter the shape of the tongue</p>	<p>Genioglossus: Protrudes apex of tongue through mouth</p> <p>Hyoglossus: depressed tongue.</p> <p>Styloglossus: Draws tongue upward and backward</p> <p>Palatoglossus: Pulls roots of tongue upward and backward, narrows oropharyngeal isthmus</p>
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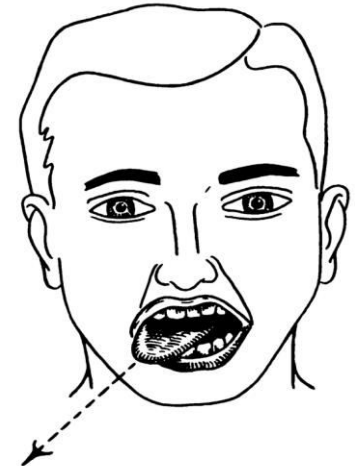


Note: The most important extrinsic muscle clinically is the Genioglossus muscle (Originates from the superior genial tubercle of the mandible and inserts into the base of the tongue). Its function is pulling the base of the

tongue forward thus allowing the tongue to stick out of the oral cavity in a straight direction (protrusion of the tongue)

Clinical application on Genioglossus Muscle:

If a patient presents to you with an injury to the right hypoglossal nerve, you'd examine your patient by asking him to stick out his tongue and Symptoms often show deviation of the tongue towards the paralyzed side when the tongue is stuck out. So your patient's tongue would be deviated to the right side.

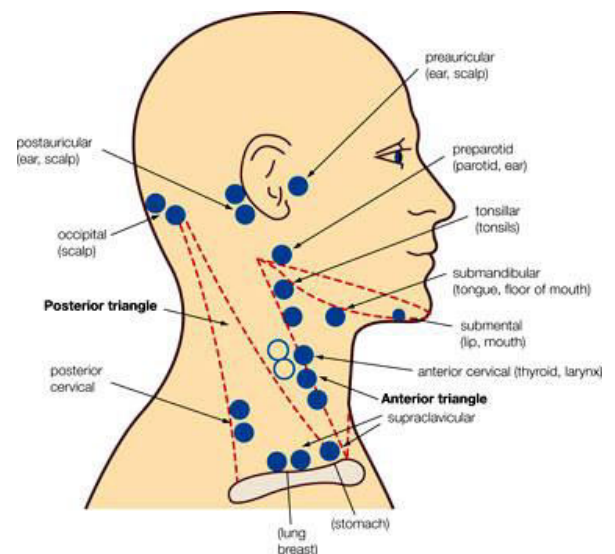


Blood Supply Of the tongue:

The lingual artery, the tonsillar branch of the facial artery, and the ascending pharyngeal artery supply the tongue / Veins drain into the internal jugular vein.

Lymphatic drainage of the tongue:

-Tip of the tongue & mid of the lip:
Submental lymph nodes (at the symphysis menti) / Sides of the anterior two thirds:
Submandibular and deep cervical lymph nodes / Posterior third: Deep cervical lymph node



The Palate:

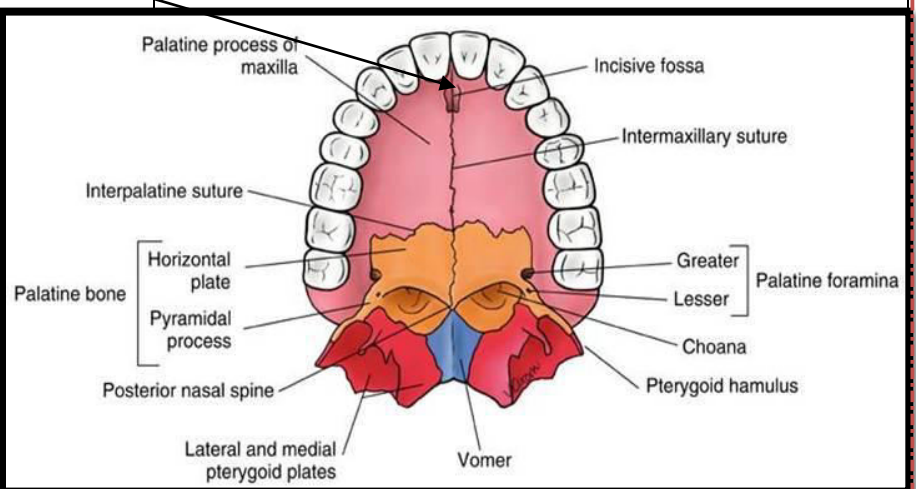
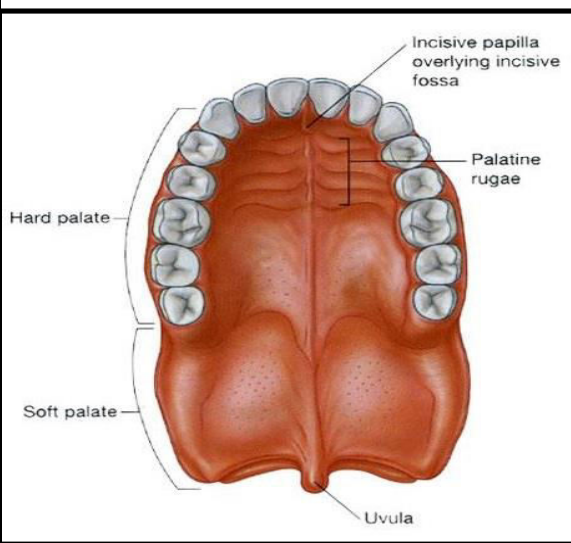
-The palate forms the roof of the mouth and the floor of the nasal cavity. It is also divided into two parts: the hard palate in front and the soft palate behind.

The Hard palate

- related to the upper most teeth
 - Mucosa attaches to the periosteum of the palate by tough connective tissue
 - It has palatine glands (mucus-secreting glands) forming the Palatine Rugae
 - It is continuous behind with the soft palate
 - composed of two bony structures; The first one is the horizontal plate of maxilla which makes the anterior two thirds of the hard palate, and the posterior third is from the palatine bone.
- Incisive foramen: Passage of blood supply and nervy supply to the palate

The soft Palate

- expansion that starts of the posterior part of the hard palate, extended to give plantar aponeurosis (ends by forming the uvula)
- Its free posterior border presents in the midline a conical projection called the uvula
- The soft palate is continuous at the sides with the lateral wall of the pharynx
- The soft palate is composed of mucous membrane, palatine aponeurosis, and muscles

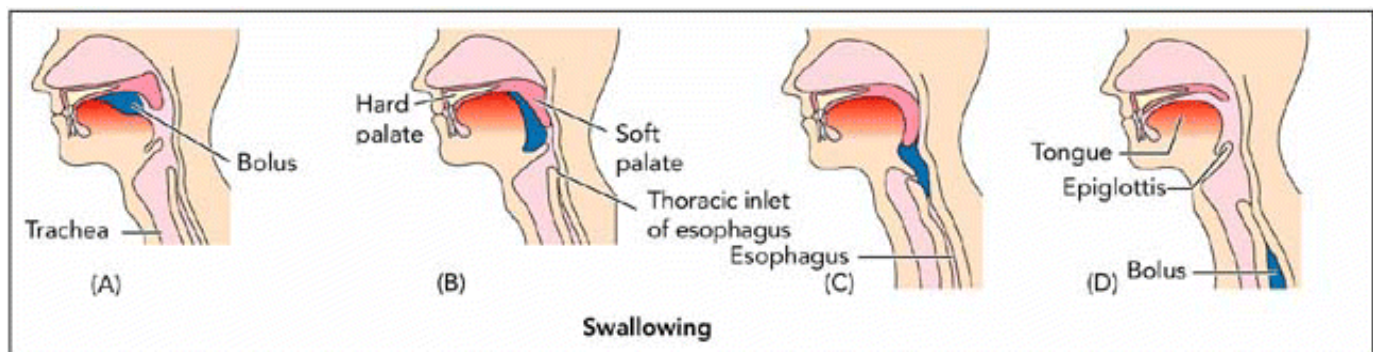


Significance of the soft palate & its movements

It has a major importance since it's the movable palate, therefore It's important in mastication as it helps in closing the Oropharyngeal Isthmus in order to increase intra oral pressure to perform a better mastication.

The question is, What happens during Mastication? The soft palate moves downwards and the posterior curve of the tongue moves upwards and together they assist in closing the Oropharyngeal Isthmus.

Logically, mastication is followed by swallowing, so how does swallowing occur? The soft palate will move backwards and upwards and the posterior wall of the pharynx moves forwards and these two movements close the Nasopharyngeal Isthmus to prevent the swallowed Bolus from going towards the nasal cavity so the bolus would have no choice but to go downwards to the Pharynx then afterwards to the esophagus.



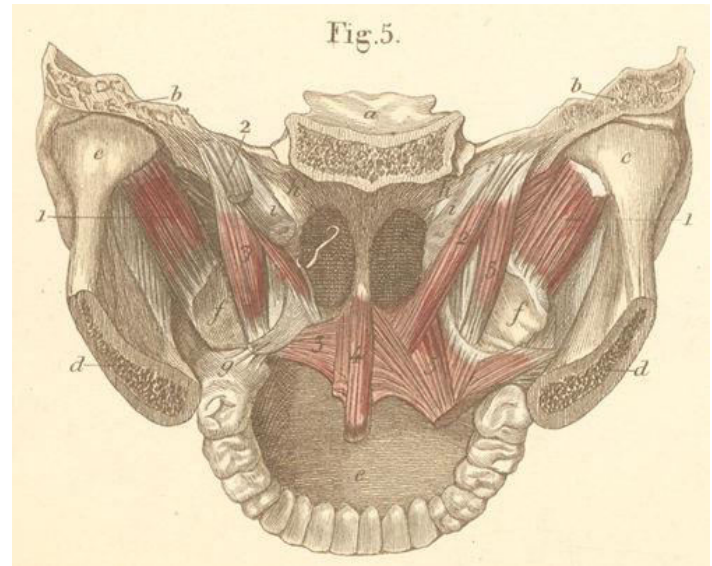
Muscles of the soft palate:

The muscles of the soft palate are the **tensor** veli palatine (for tension), the **levator** veli palatine (for elevation) , the palatoglossus, the palatopharyngeus, and the musculus uvulae.

Nerve supply of the muscles of the soft palate: all of them are innervated by the Pharyngeal plexus except for Tensor Veli Palatini (innervated by the mandibular nerve).

The tendon in the midline that forms the Uvula at the end is called the palatine aponeurosis.

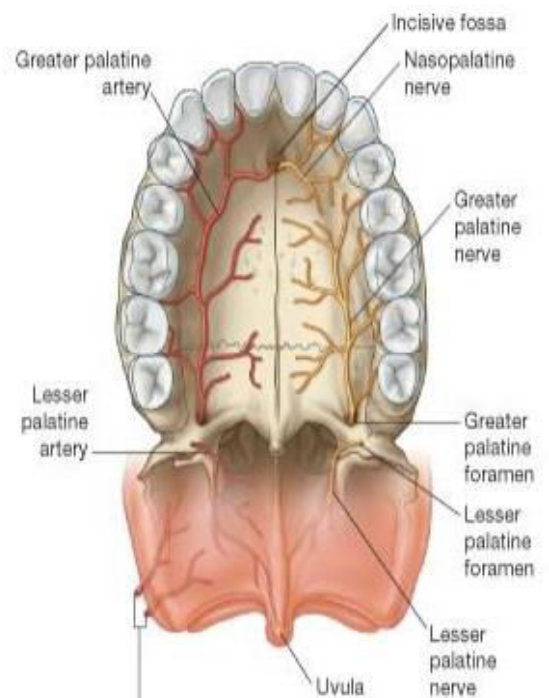
It's interesting enough to mention that the Uvula is actually a muscle called The Musculus Uvulae.



Quick Reminder of the movements of the soft palate: Either downwards during mastication to close the Oropharyngeal Isthmus or upwards during swallowing to close the Nasopharyngeal Isthmus.

Nerve supply of the Palate:

by the greater and lesser palatine nerve from the maxillary division of the trigeminal nerve.



Branches from ascending palatine artery of facial artery and palatine branch of ascending pharyngeal artery

the greater palatine nerve emerging from the greater palatine foramina to innervate the hard palate.

lesser palatine nerves emerging through the lesser palatine foramina to innervate the soft palate .

Blood Supply of the Palate:

The greater and lesser palatine arteries which are branches of the maxillary artery, the ascending palatine branch of the facial artery, and the ascending pharyngeal artery branch of the external carotid artery.

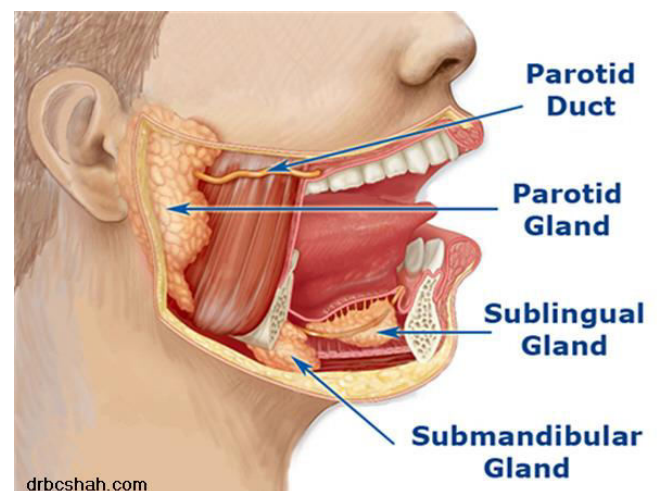
Lymphatic Drainage of the palate: Deep Cervical Lymph Nodes

The Salivary Glands

1) The Parotid Gland:

It's the largest salivary gland.

Anatomical position: it lies behind the ramus of the mandible and in front of the external acoustic meatus, then it descends downwards behind the angle of mandible. It overlies two muscles, the Sternocleidomastoid muscle and the Masseter muscle.



- Its duct, the parotid duct, crosses the Masseter muscle and it pierces the Buccinator muscle and opens into the vestibule of the oral cavity at the level of upper second molar tooth. The length of the duct is about 5 cm.

-The surface anatomy of the parotid duct: one finger below The Zygomatic Arch.

-Contents of parotid gland:

1) *Facial nerve (7th cranial nerve):*

it lies in the substance of the parotid gland and divides it into superficial lobe and deep lobe.

The facial nerve gives 5 branches in the substance of parotid gland and it's also the most superficial content in the parotid gland

2) *Retromandibular nerve*

3) *External carotid artery* (The deepest structure) and its two terminal branches, the maxillary artery and the Superficial temporal artery.

-The parotid gland is surrounded by two capsules:

1) A capsule from the cervical deep fascia

2) A connective tissue capsule that divides the gland into lobes and lobules

Clinical significance of the parotid gland:

1) Parotitis: An inflammation of the parotid gland, the most common cause is Mumps (caused by mumps virus). The parotid gland will get inflamed and swell and it will cause severe pain since it's surrounded by two capsules which means there isn't enough space to allow for the normal enlargement of the inflammatory process.

2) Salivary Stones: They may block the parotid duct causing it to swell and enlarge, it's painful (Pain can be severe when squirting lemon juice in the mouth due to excess secretions but we use it in the clinic because it promotes spontaneous expulsion of the stone), This condition needs a surgical operation as well!

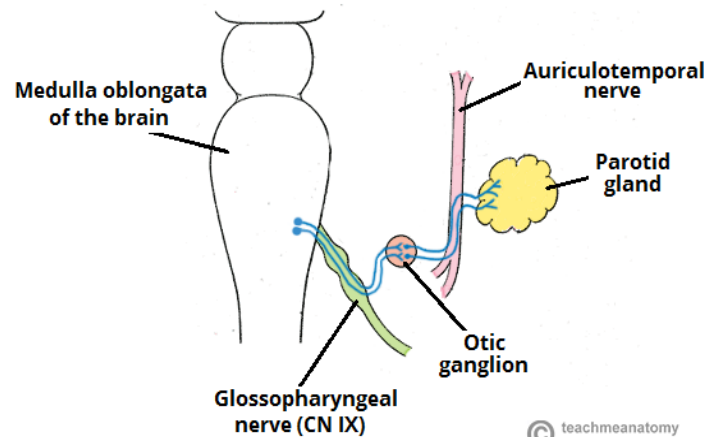
Anatomical relations of the parotid gland:

1) Superficial relation: Skin, superficial fascia, some nerves and lymph nodes.

2) Deep relation: The parotid gland rests over a parotid bed, what forms the parotid bed? Posterior belly of digastric muscle/ Stylohyoid muscle /Last 4 cranial nerves /External carotid artery /Internal carotid artery/ Internal jugular vein.

Parasympathetic Secretomotor Innervation of the Parotid gland (VERY IMPORTANT).

Preganglionic parasympathetic fibers leave the brain stem from inferior salivatory nucleus in the glossopharyngeal nerve and then through its tympanic and then the lesser petrosal branch pass into the Otic ganglion (located under the foramen ovalie of the skull).



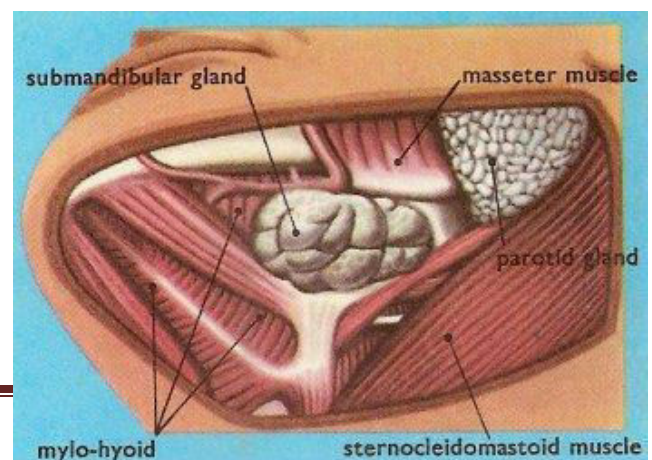
There, they synapse with postganglionic fibers which reach the gland by hitch-hiking via the auriculotemporal nerve.

In one line: The preganglionic nerve is the lesser Petrosal nerve, the post ganglionic nerve is the Auriculotemporal nerve.

Note: Auriculotemporal nerve isn't only responsible for parasympathetic innervations of the parotid gland, it's also sensory to the gland as well (If there's swelling and pain, sensation is transmitted by it).

2)The Submandibular gland:

- It lies in the submandibular fossa of the mandible (Mylohyoid line separates



between the sublingual fossa and the submandibular fossa).

-divided into superficial and deep parts by the mylohyoid muscle.

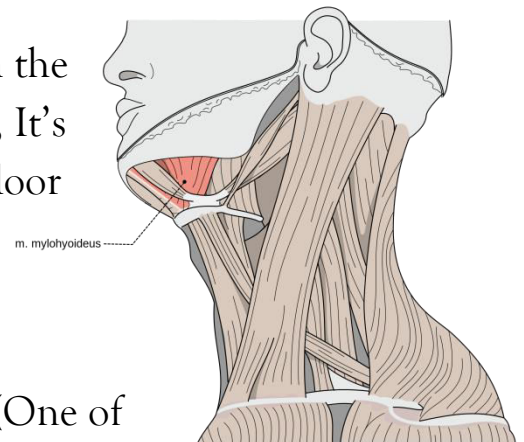
-The submandibular gland consists of a mixture of serous and mucous acini

-Submandibular duct, starts from the anterior end of the deep part of the gland and runs most medially to the sublingual gland and opens into the submandibular papilla under the tongue.

Anatomical relations of the submandibular gland:

We have two muscles that are important in location in relation to the submandibular gland:

1)the first is the Mylohyoid muscle (Starts from the mylohyoid line of the mandible to the midline), It's also called the Diaphragma Oris. (it closes the floor of the oral cavity)



2) The second muscle is the Hyoglossus muscle(One of the extrinsic muscles of the tongue)

IMPORATNT NOTE: There are 5 structures between these two muscles

1) Deep part of the submandibular gland / 2)submandibular ganglia
3)Submandibular duct / 4)lingual nerve / 5)Hypoglossal nerve

So, Deep part of the submandibular gland lies between The Mylohyoid muscle and the Hyoglossus muscle and the superficial part of the gland lies between the Mandible and The Mylohyoid muscle.

3) Sublingual gland

-Lies Deep to the tongue in the floor of the oral cavity

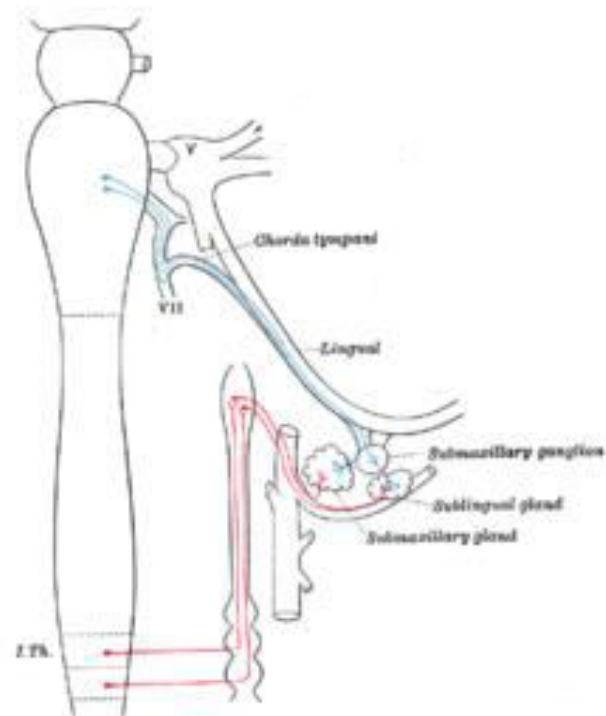
-it has 8 to 20 small ducts that open either separately or in the submandibular gland

- It has both serous (very little) and mucous acini (predominantly)

-Parasympathetic Innervation of the Sublingual gland and the Submandibular gland(Very important):

-Innervation of the the submandibular gland and the sublingual gland is the same from the Superior Salivary nucleus of the **facial** nerve (found dorsal pons, which are located within the brainstem).

-from The superior Salivary nucleus of the facial nerve by Corda Tympani and lingual nerve to the submandibular ganglia, which is a parasympathetic ganglia (located between the Mylohyoid muscle and the Hyoglossus muscle)



-So, Preganglionic nerve is the Corda Tympani nerve through the lingual nerve whereas the postganglionic fibers pass through the lingual nerve OR directly to the gland (Whether it's the submandibular gland or the sublingual gland).

Anatomical relations of the sublingual gland:

It lies in the submandibular fossa, lateral relation is the Mandible and medial relation is the submandibular duct and Lingual nerve, lingual vessels (artery and vein) (Located under the tongue where the lingual vein is the most lateral one).

Note: There's a triple relation between the lingual nerve and the Submandibular duct, it starts lateral to the gland, then below the gland, after that it becomes medial to it.

CONCLUSION: The most medial structure on the medial side of the sublingual gland is the lingual nerve then comes the sublingual duct.

End of the Sheet.

References for this sheet:

1)Snell's clinical Anatomy by systems

- 2) Clinical Methods (3rd edition): The History, Physical, and Laboratory Examinations./ Chapter 93: Inspection, Auscultation, Palpation, and Percussion of the Abdomen
- 3) First aid for the USMLE step 1(2014 edition)
- 4) Doctor's slides and at last, the record.

Shout out to the best friend I've met in med school so far, Mo'nes Al-Badayneh, You rock.☺

Also, shout out to Abu yamen, Abu alia <3, Farah Fram, Dina Murad, Ali khresat <3, Hala Al mahameed, Rand Khawaldeh, Mohammad Darwesh, Elaf batayneh 3shan emt7an el biostatics 8rb, Sura abu Saleem, Mohnd hadadden, Tamer Shalhab, Noor Yousef, yazan halaseh, 3laa Sha3ban, Marah Atare, Ola Zaqeeba, Ali Halabe o 5l9 bkfe.

And I truly apologize for the long sheet but don't blame me, blame the doctor. :p

