RS

ANATOMY

MODIFIED NO. 2

كتابة: دكتور 021

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The Pterygopalatine fossa

Color code

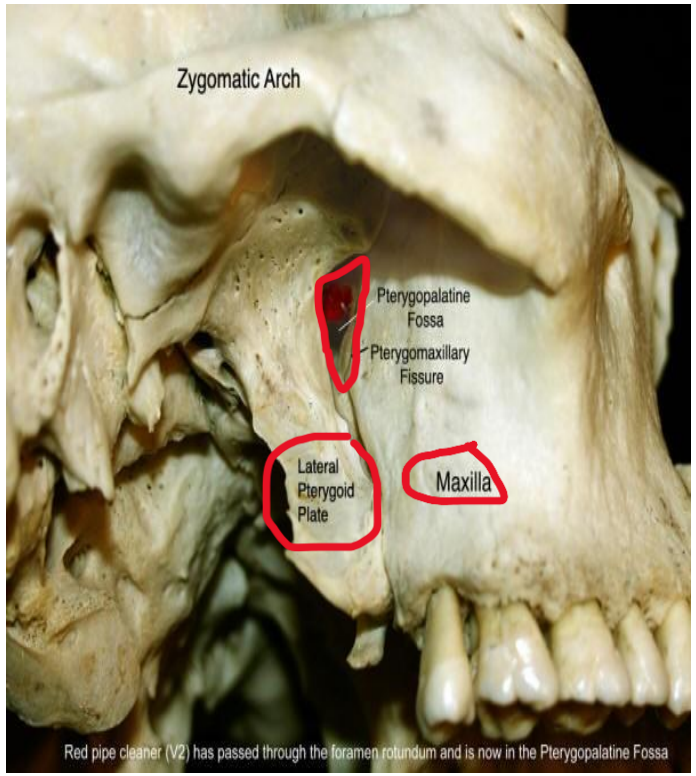
- Slides
- Doctor
- Additional info
- Important

The underlined text = what doctor mentioned from slides

The Pterygopalatine fossa

Pterygopalatine fossa is the red-coloured encircled space in the adjacent picture.

- Inverted **'tear-drop'** shaped space.
- Between bones on the lateral side of the skull.
- Immediately posterior to the maxilla.
- Pterygopalatine fossa between maxilla and sphenoid bone.
- Small in size



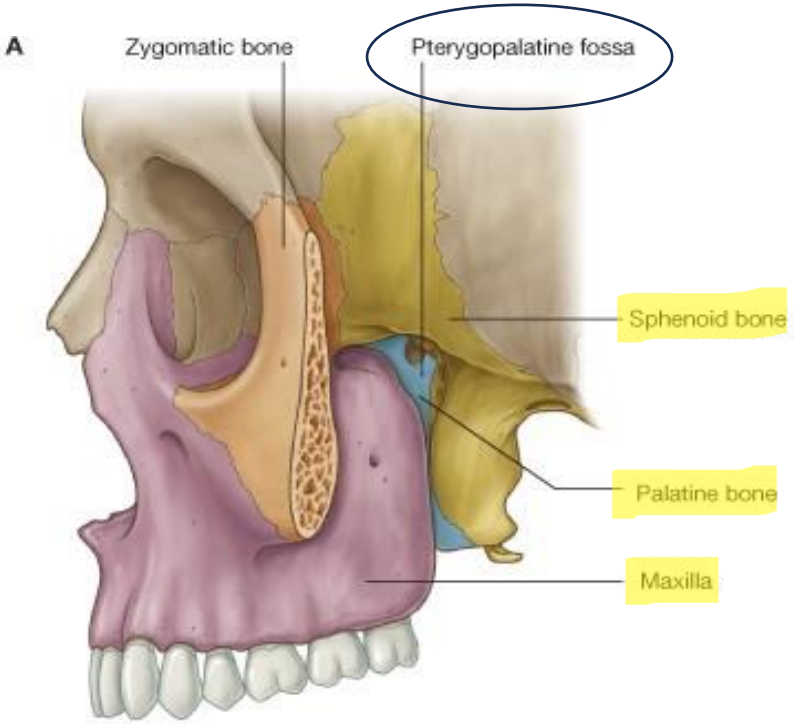
- Pterygopalatine fossa is an important space due to its communications with surrounding organs: orbit, nasopharynx, oral cavity, nose (by spheno-palatine foramen), middle cranial fossa and infra temporal fossa→ so it has 6 communications.

- These communications play a major role in carrying blood supply and innervation to the surrounding organs.

- Our interest today is to know each foramen that connects between pterygopalatine fossa and other organs and the type of supply (nerve, artery or vein) that pass through that foramen, Let's go !!

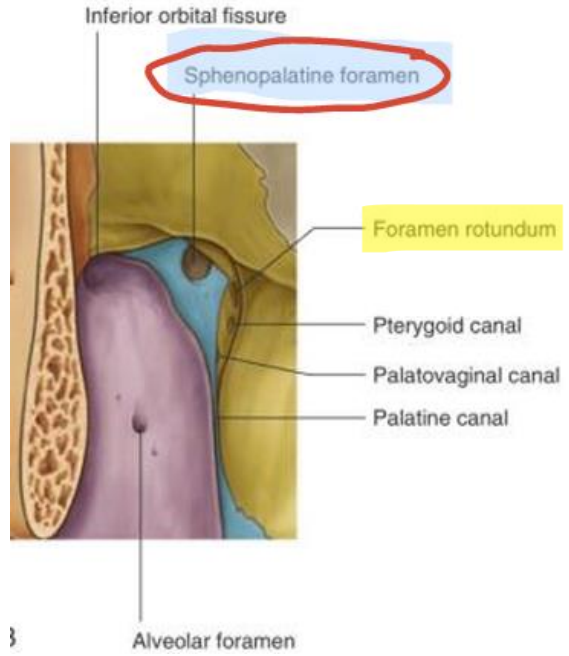
Skeletal framework

- The walls of the pterygopalatine fossa are formed by:
- The anterior wall is formed by the posterior surface of the **maxilla;** [purple area].
- The medial wall is formed by the lateral surface of the **palatine bone** [blue area].
- The posterior wall and roof are formed by parts of the **sphenoid bone.** [yellow area].

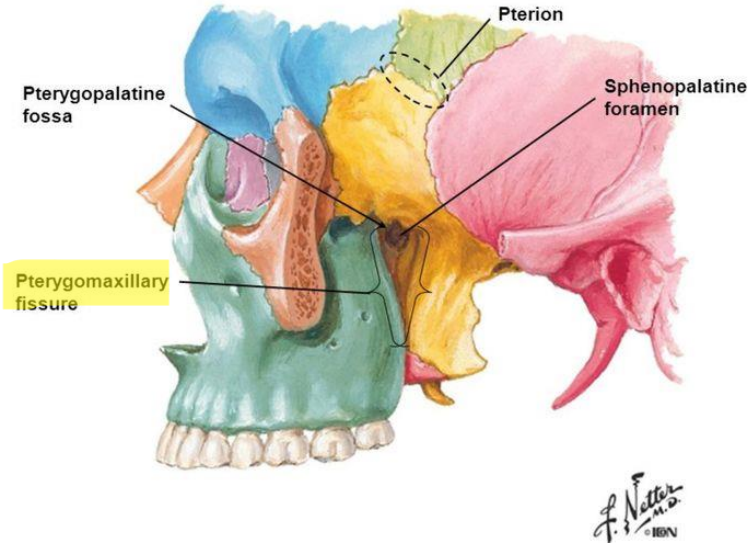


So again, pterygopalatine fossa located between sphenoid bone, maxilla and palatine bone.

• In this picture you can notice a foramen in the palatine bone, **spheno-palatine foramen** that contains sphenopalatine artery and nerve, the nerve divides into long and short branches to supply nasal cavity.

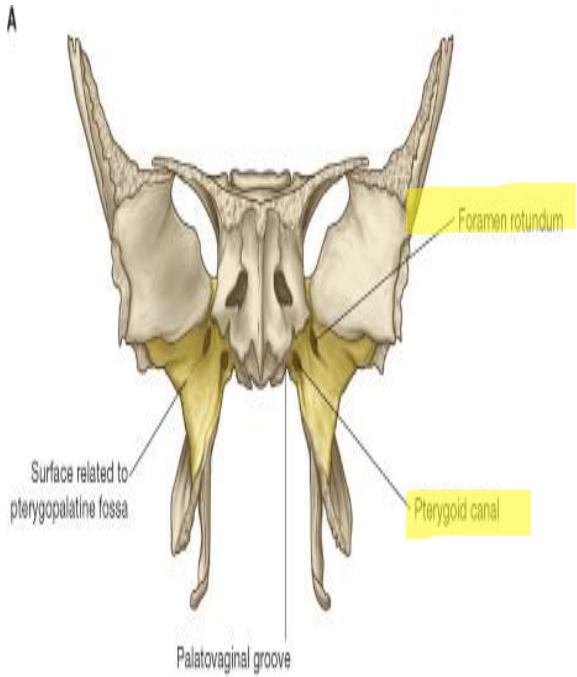


• Laterally there is **pterygomaxillary fissure** which is a **space** that opens into the **infratemporal fossa**. Its primary function is to allow the **maxillary artery** (a branch of the external carotid artery) to pass from the **infratemporal fossa** into the **pterygopalatine fossa**. In contrast, the **maxillary nerve** (a branch of the trigeminal nerve) reaches the **pterygopalatine fossa** through the **foramen rotundum**.



Sphenoid bone

- The part of bone that contributes to the formation of the fossa is the **anterosuperior surface of the pterygoid process**



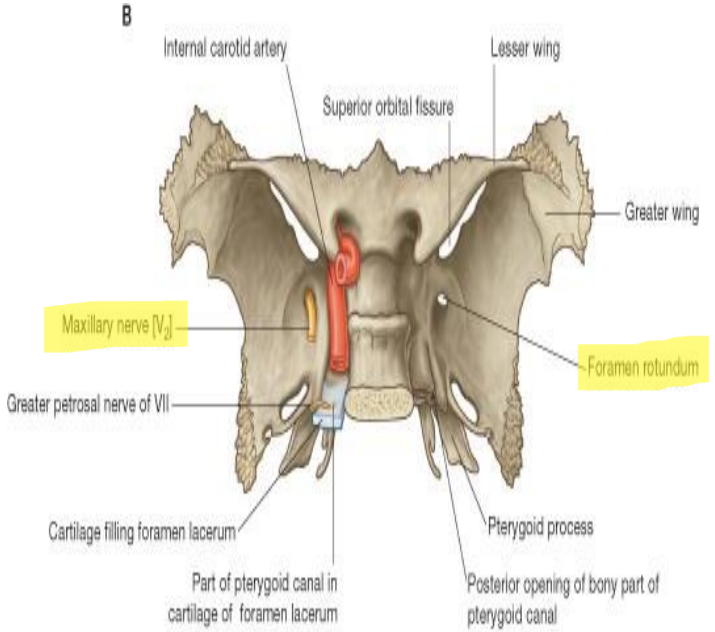
•Opening onto this surface are two large foramina (These two foramina connect the middle cranial fossa and the pterygopalatine fossa).

1.The Foramen rotundum (maxillary nerve passes through it, which is a branch from trigeminal nerve).

2. Pterygoid canal (at the roof of foramen lacerum, it contains the nerve of pterygoid canal (that carries sympathetic and parasympathetic fibers). And the parasympathetic fibers synapse in the pterygopalatine ganglion within the pterygopalatine fossa, while the sympathetic fibers pass through the ganglion without synapsing.

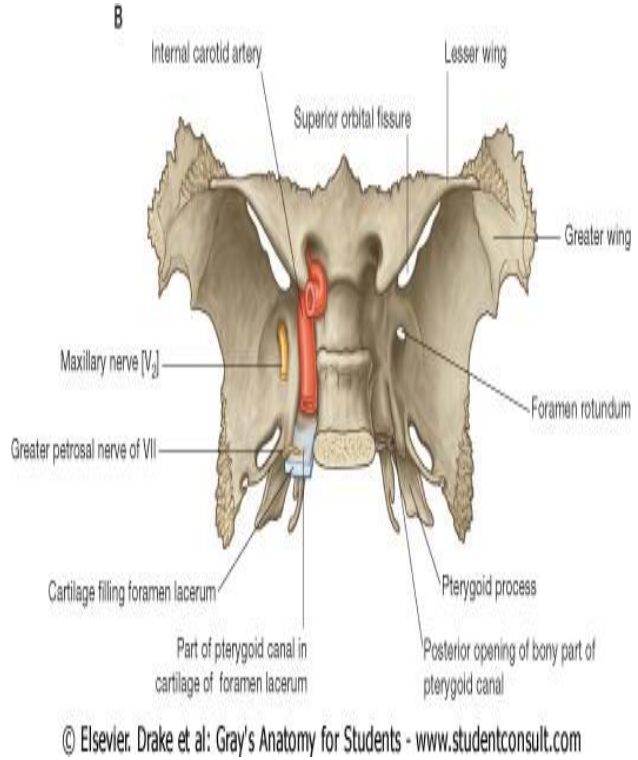
Foramen rotundum

- Lateral and superior foramen
- Communicates posteriorly with the middle cranial fossa
- The **maxillary nerve** [V2] passes through it.



Pterygoid canal

- Medial and inferior foramen
- Bony canal opening onto the posterior surface of the pterygoid process.
- Continuing superomedially for a short distance in the cartilage that fills the **foramen lacerum**.
- Opens into the middle cranial fossa just anteroinferior to the internal carotid artery.
- The greater petrosal and sympathetic fibers from the internal carotid plexus join to form the nerve of the pterygoid canal



• The greater petrosal (which is a branch of facial nerve and carries preganglionic parasympathetic fibers to synapse in the pterygoid ganglion). And sympathetic fibers (called deep petrosal nerve, carries postganglionic sympathetic fibers (it passes through the fossa without synapsing in the ganglia because it is postganglionic).

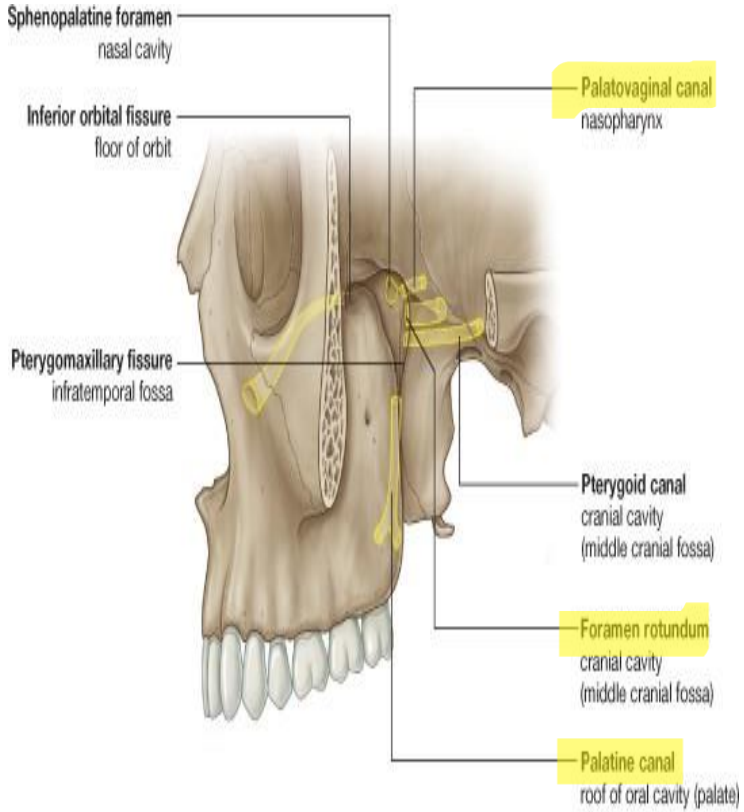
Gateways

- Seven foramina and fissures provide apertures through which structures enter and leave the pterygopalatine fossa

1. **Foramen rotundum** [maxillary nerve passes through it] **and pterygoid canal** communicate with the middle cranial fossa.

2. Palatovaginal canal opens onto the posterior wall and leads to the nasopharynx; and give innervation and blood supply to nasopharynx.

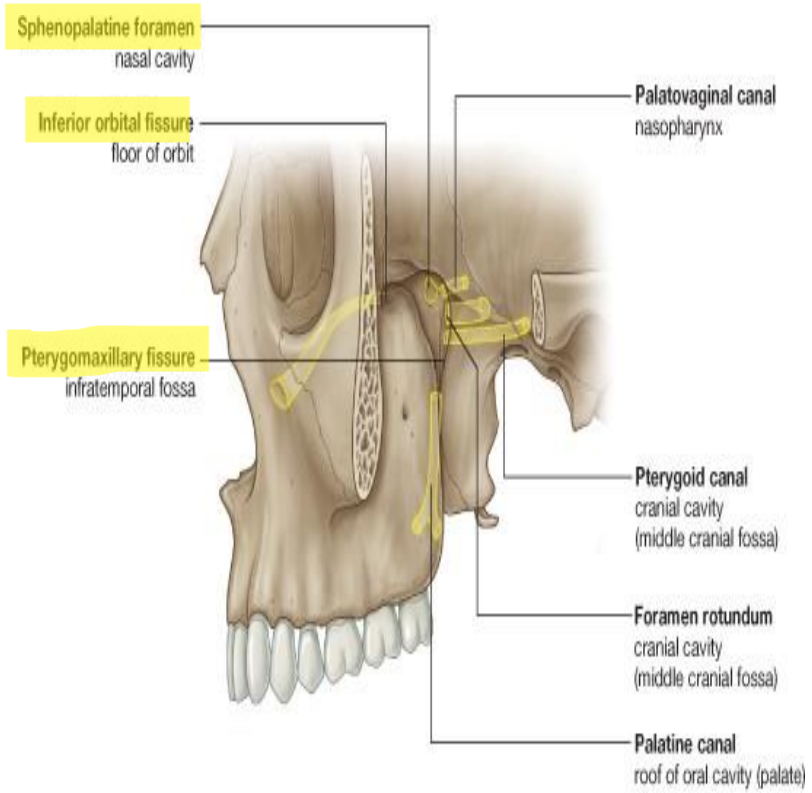
3. **Palatine canal** (palatine artery passes through it) leads to the roof of the oral cavity (hard palate) and opens inferiorly.
- Palatine artery divides into greater and lesser palatine passes. The lesser palatine supplies the soft palate, and the greater palatine supplies the hard palatine.



4. **Sphenopalatine foramen** which is Located on the medial wall of pterygopalatine fossa, and this leads to the nasal cavity (sphenopalatine artery and vein pass though it) opens onto the lateral wall of the nasal cavity and is in the medial wall;

5. **Pterygomaxillary fissure** between lateral aspect of the pterygopalatine fossa and the infratemporal fossa (maxillary artery passes though it to the fossa, maxillary nerve passes though it from the fossa).

6. **Inferior orbital fissure** between the superior aspect of the fossa into the floor of the orbit (terminal parts of maxillary nerve and artery pass through it).



Contents:

1. The maxillary nerve [V2]: through foramen rotundum from middle cranial fossa.

2. Terminal part of the maxillary artery: from infratemporal fossa to pterygoid fossa.

3. Nerve of the pterygoid canal: sympathetic and parasympathetic fibers from middle cranial fossa to the ganglion.

4. The pterygopalatine ganglion, parasympathetic ganglion.

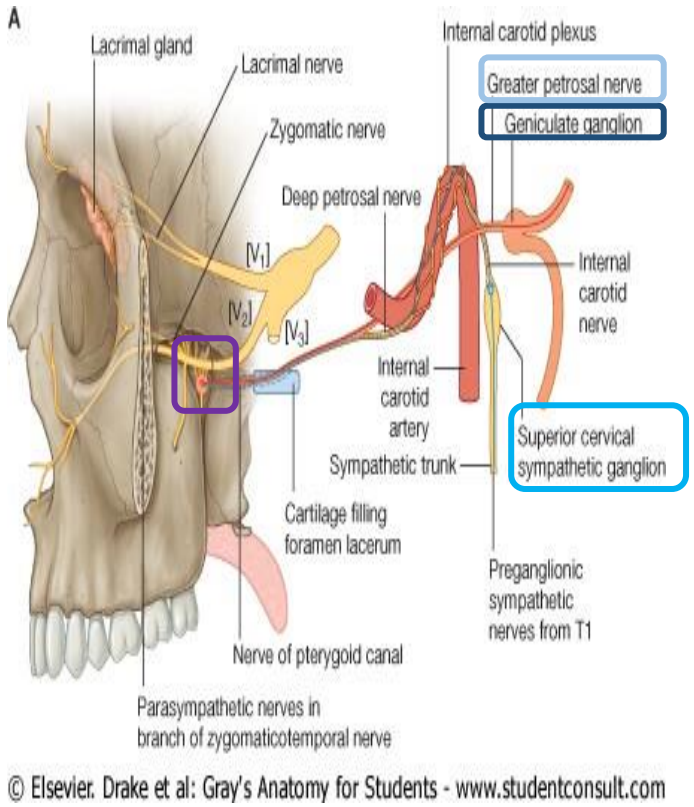
5. Veins and lymphatics also pass through the pterygopalatine fossa.

Pterygopalatine ganglion

• The **pre-ganglionic parasympathetic fiber** is the **greater petrosal nerve** (a branch of the facial nerve) travel to the pterygopalatine ganglion where it synapses with the **post-ganglionic parasympathetic branches** that are **distributed along with branches of the maxillary nerve** and artery to innervate the nose, palate, lacrimal gland, orbits…etc.

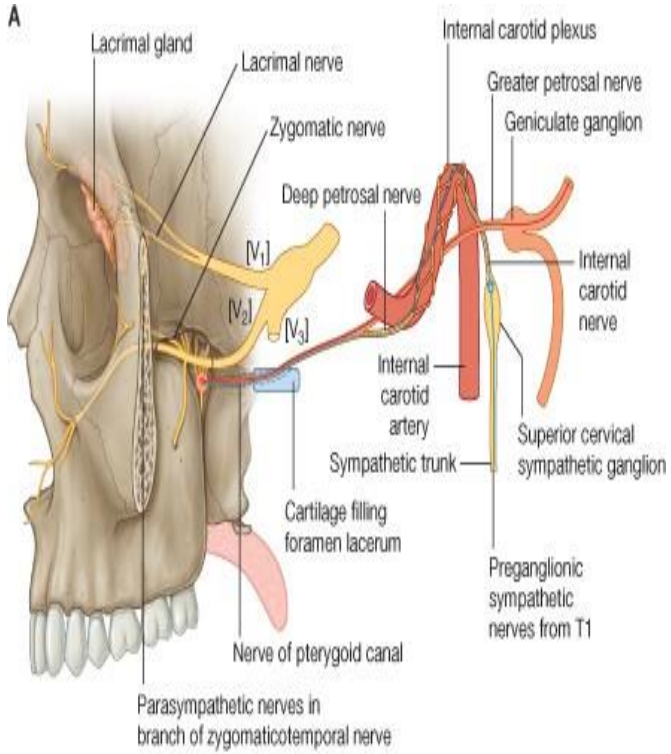
• The **preganglionic sympathetic nerve** originates from the **lateral horn of the thoraco-lumbar** and **synapse in the superior cervical sympathetic ganglion with the post-ganglionic sympathetic fiber which is the deep petrosal nerve.**

Pterygopalatine ganglion



The nerve to pterygoid canal contains mixed sympathetic and parasympathetic fibers

- Formed in the middle cranial fossa by the union of:
- 1. The greater petrosal nerve (a branch of the facial nerve [VII]);
- 2. The deep petrosal nerve (a branch of the internal carotid plexus).
- Joins the pterygopalatine ganglion
- Carries mainly **preganglionic parasympathetic** (great petrosal) and **postganglionic sympathetic** (deep petrosal) fibers.



Pterygopalatine ganglion

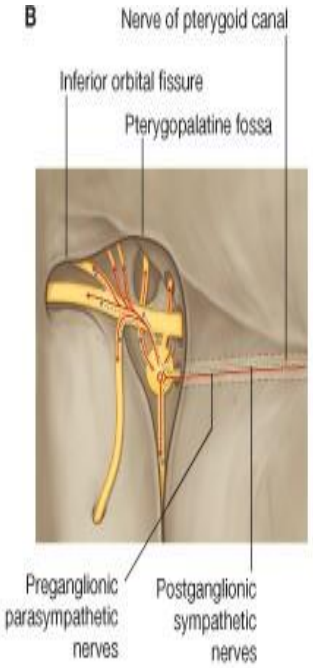
- Largest of the four parasympathetic ganglia in the head

- Formed by the cell bodies neurons associated with:

1. **Preganglionic parasympathetic** fibers of the facial nerve carried by the **greater petrosal nerve** and the **nerve of the pterygoid canal.**

2.Sensory and ganglionic branches of the **maxillary nerve**

3.Postganglionic sympathetic fibers **(deep petrosal)**



• The post-ganglionic sympathetic fiber as we mentioned is the deep petrosal nerve, passing through the pterygopalatine ganglion without synapse, because it has synapsed earlier in the superior cervical ganglion, as we said.

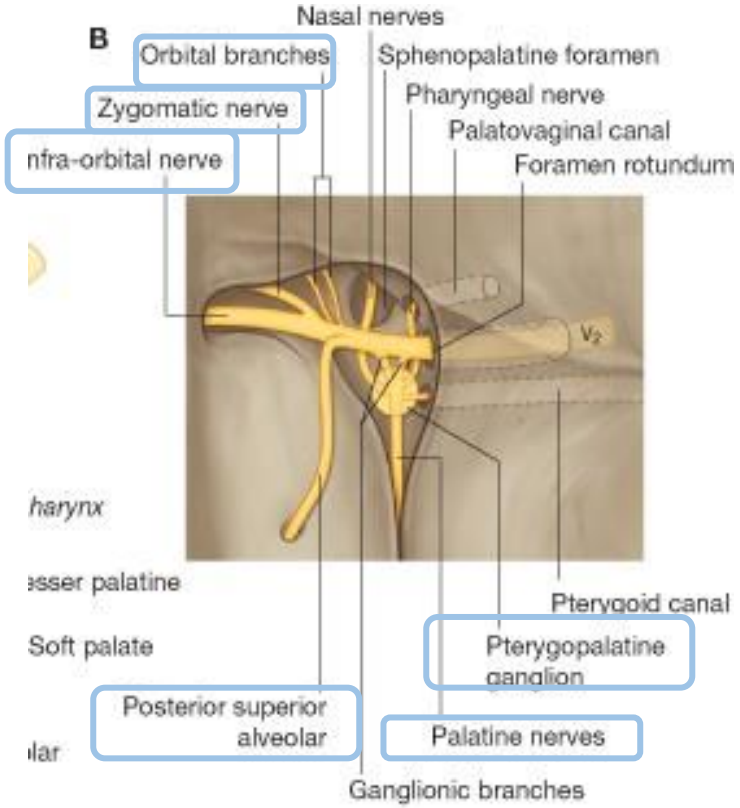
Pterygopalatine ganglion

- The pterygopalatine ganglion gives off **orbital, palatine** which becomes lesser and greater., **nasal** through sphenopalatine (long and short), **and pharyngeal branches**, which leave the ganglion.

- Other fibers pass superiorly through the ganglionic branches of the maxillary nerve to enter the main trunk of the maxillary nerve.

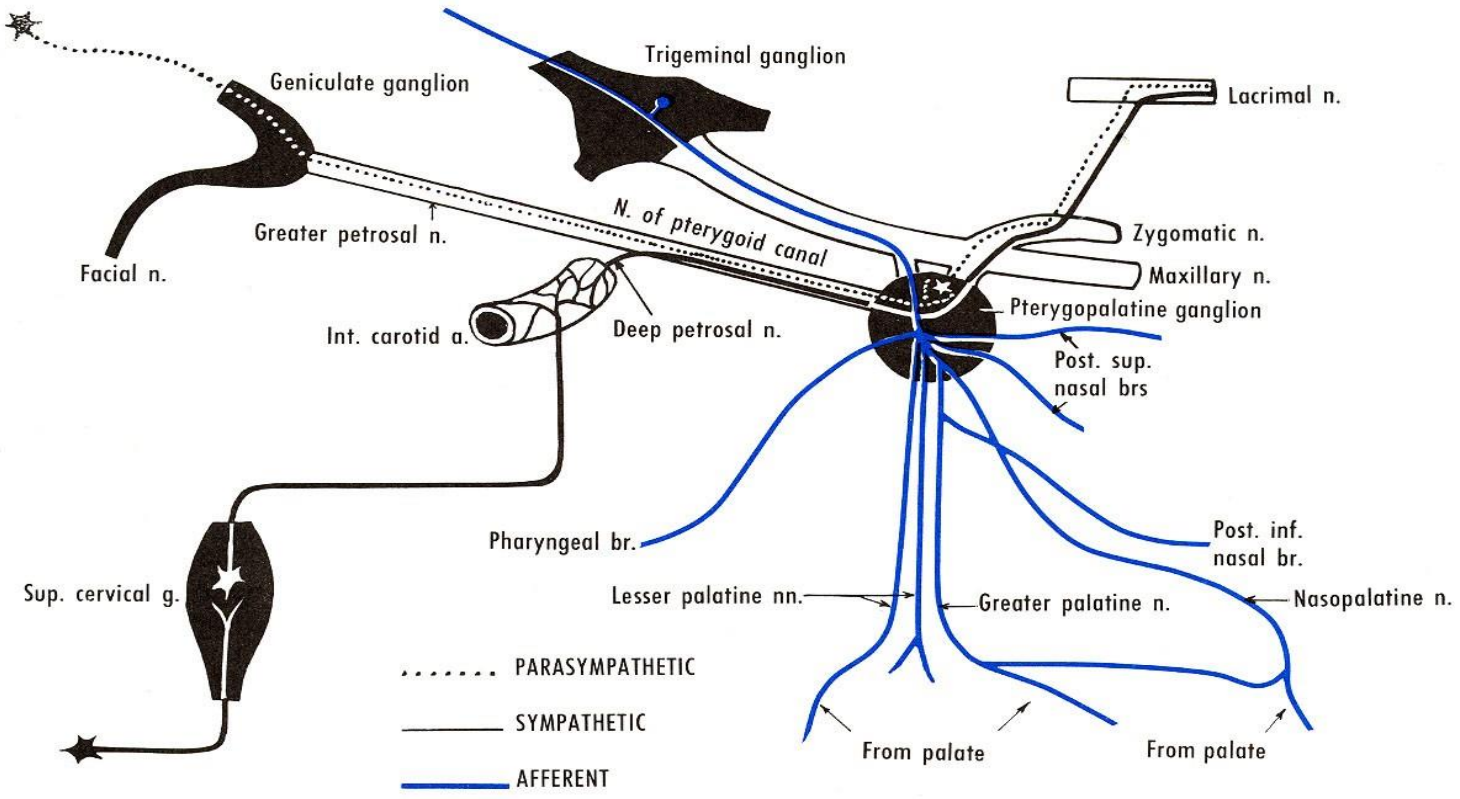
• And then distributed with:

1. Zygomatic: gives which divides into Zygomaticotemporal and Zygomaticofacial.
2. Posterior superior alveolar: sensory for molar teeth.
3. Ends as infraorbital nerve.



Pterygopalatine ganglion

important pic.



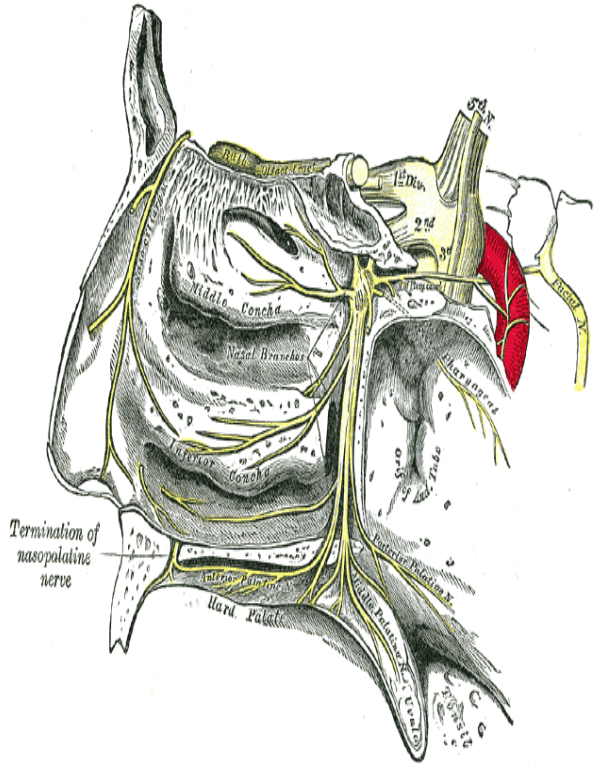
- The lacrimal nerve carries parasympathetic fibers to the lacrimal gland from the zygomaticotemporal branch of the maxillary nerve.

Orbital branches

- Pass through the inferior orbital fissure.
- Supply of the orbital wall (periosteum) and lacrimal gland.
- Supply the sphenoidal and ethmoidal sinuses.

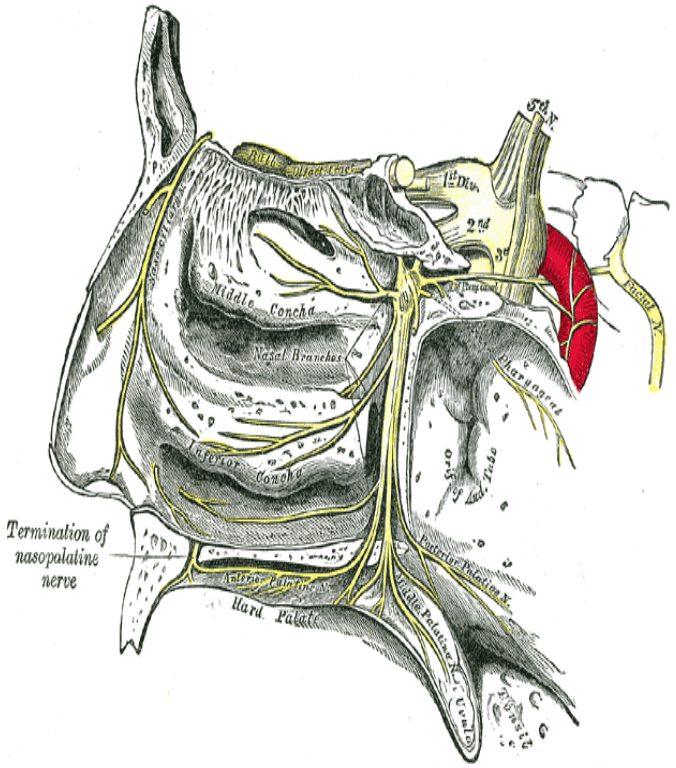
Pharyngeal nerve

- Passes posteriorly from the pterygopalatine ganglion.
- Leaves the fossa through the palatovaginal canal.
- Supply the mucosa and glands of the nasopharynx.



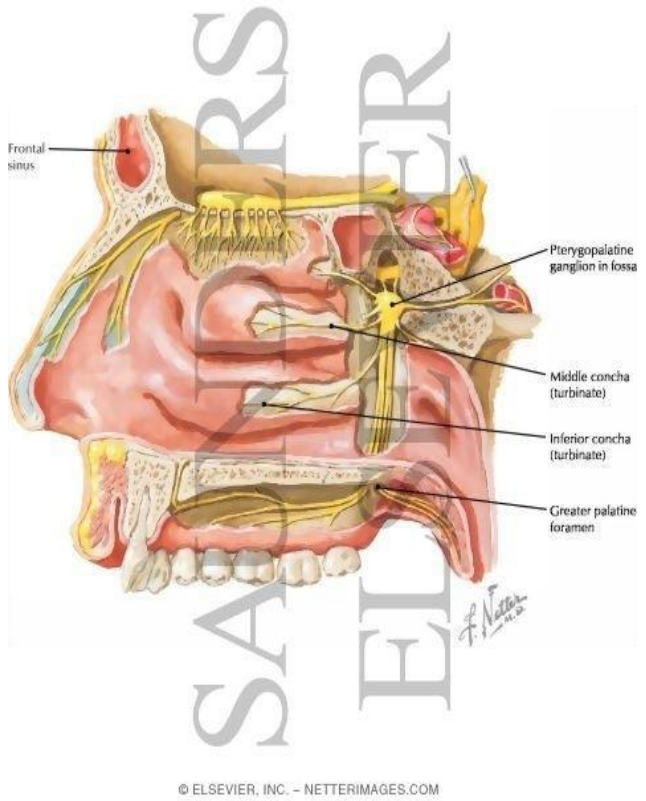
Greater and lesser palatine nerves

- Pass through the palatine canal
- Enter the oral surface of the palate through the greater and lesser palatine foramina.
- **Lesser palatine (Middle, Post, palatine)** nerve passes posteriorly to supply the soft palate.
  - Lesser palatine for soft palate.
  - Greater palatine for hard palate and nose: It enters incisive foramen to go to nasal cavity.



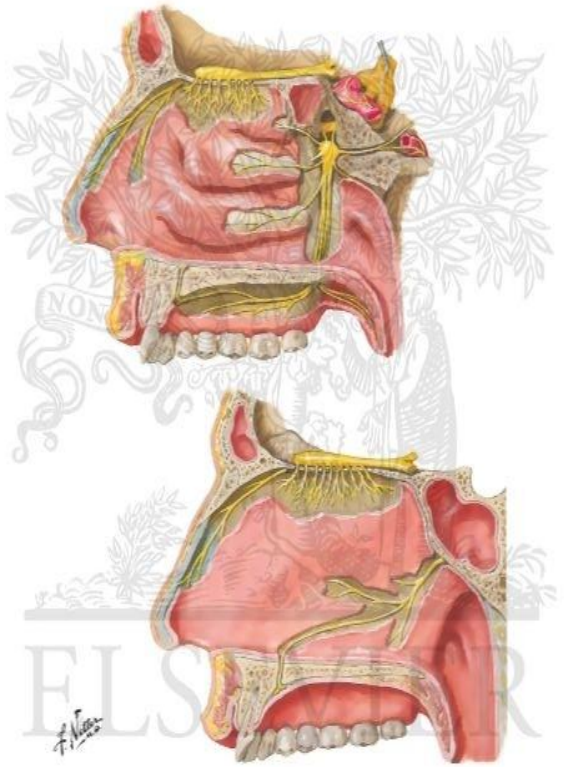
Greater and lesser palatine nerves

- **The Greater palatine (Ant.palatine)** nerve passes forward on the roof of the oral cavity
- Innervate mucosa and glands of the hard palate and the adjacent gingiva, almost as far forward as the incisor teeth
- Also supply the mucosa over the middle and lower part of the lateral wall of the nasal cavity
- Joins the long sphenopalatine nerve



Nasal nerves

- Seven in number
- Pass medially through the sphenopalatine foramen to enter the nasal cavity
- **Short spheno-palatine** (Post.Sup. Lateral nasal) supply the mucosa of the Post,Sup. quadrant of the nasal cavity.
- The **Nasopalatine nerve (long Spheno- palatine)** is the largest of the nasal nerves ,Passes anteriorly grooving down the nasal septum through the incisive canal and fossa in the hard palate. Supply mucosa, gingiva, and glands adjacent to the incisor teeth. Join the greater palatine nerve.



Maxillary nerve [V2]

1. Purely sensory (Ophthalmic nerve is purely sensory too, but the mandibular is mixed (sensory & motor).

- Originates from the trigeminal ganglion in the cranial cavity.

- Exits the middle cranial fossa, and enters the pterygopalatine fossa through the foramen rotundum.

- It terminates as the infra-orbital nerve through the inferior orbital fissure.

- The maxillary nerve (V2) exits the skull through the infraorbital foramen and terminates as infraorbital nerve which gives three main branches:

1. Palpebral Branches: to the lower eyelid.
2. Nasal Branches: to the external nose.
3. Labial Branches: to the skin of the upper lip.

Maxillary nerve

- Branches in pterygopalatine fossa:

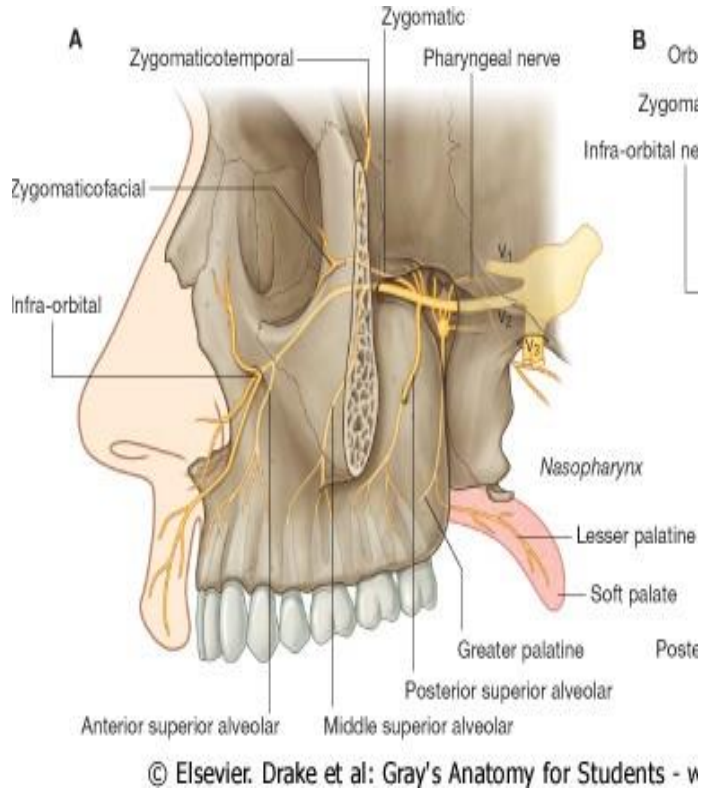
1. Meningeal (before it enters the Fossa)

2. Two ganglionic branches (twigs) pass through the pterygopalatine ganglion (Postganglionic parasympathetic fibers and sensory).

3. Zygomatic nerve (which divides into zygomaticotemporal and zygomaticofacial) (sensory).

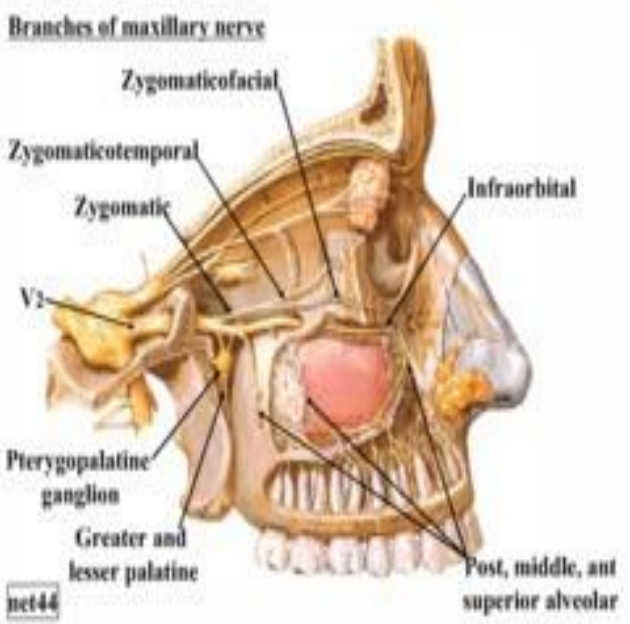
4. Posterior superior alveolar nerve (for upper 3 molars)

5. Infra-orbital



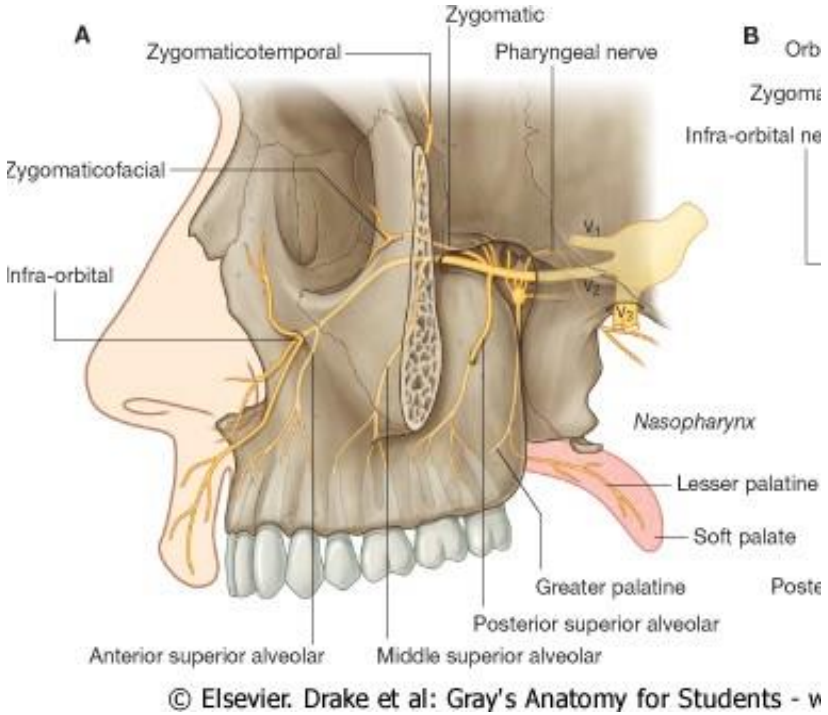
Zygomatic nerve

- Originates directly from the maxillary nerve in the pterygopalatine fossa.
- Enter the orbit through the inferior orbital fissure.
- Divides into zygomaticotemporal and zygomaticofacial branches.
- **Zygomaticotemporal branch** enter the temporal fossa and passes superficially to supply skin over the temple. Carries postganglionic parasympathetic and sympathetic fibers and form a special autonomic nerve to join the lacrimal nerve.
- The **Zygomaticofacial branch** opens on the anterolateral surface of the zygomatic bone, and supply the adjacent skin.



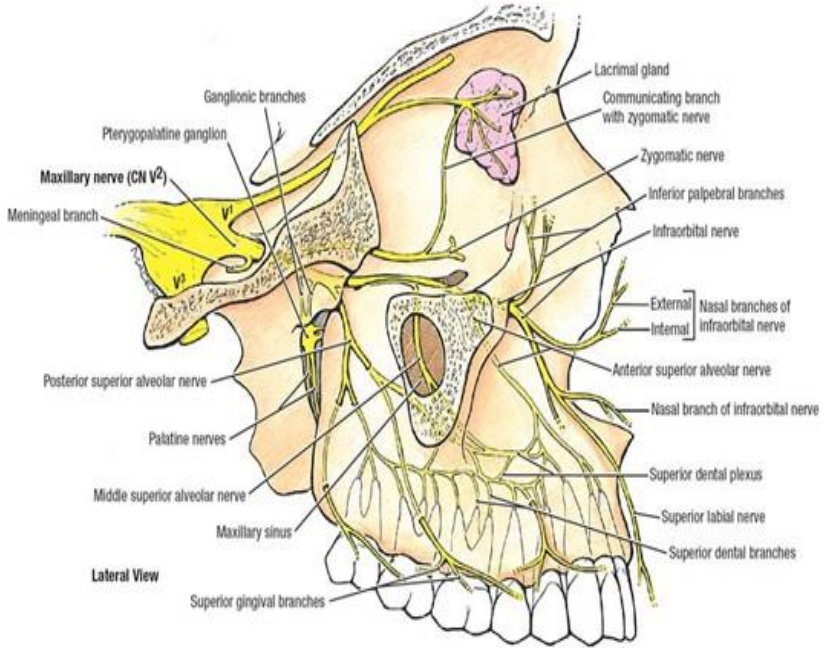
Posterior superior alveolar nerve

- Passes laterally out of the fossa through the pterygomaxillary fissure.
- Enter the posterior surface of the maxilla approximately midway between the last molar tooth and the inferior orbital fissure.
- Supplies the molar teeth and adjacent buccal gingivae.
- contributes to the supply of the maxillary sinus.



Infra-orbital nerve

- Anterior continuation of the maxillary nerve.
- Leaves the pterygopalatine fossa through the inferior orbital fissure.
- First in the **infra-orbital groove** in the floor of the orbit and then continues forward in the **infra-orbital canal.**
- While in the infra-orbital groove and canal, the infra-orbital nerve gives origin to **middle** and **anterior superior alveolar nerves:** They Join the **superior alveolar plexus** to supply the upper teeth
- Middle superior alveolar nerve also supplies the maxillary sinus
- Anterior superior alveolar nerve also gives origin to a small nasal branch.



Infra-orbital nerve

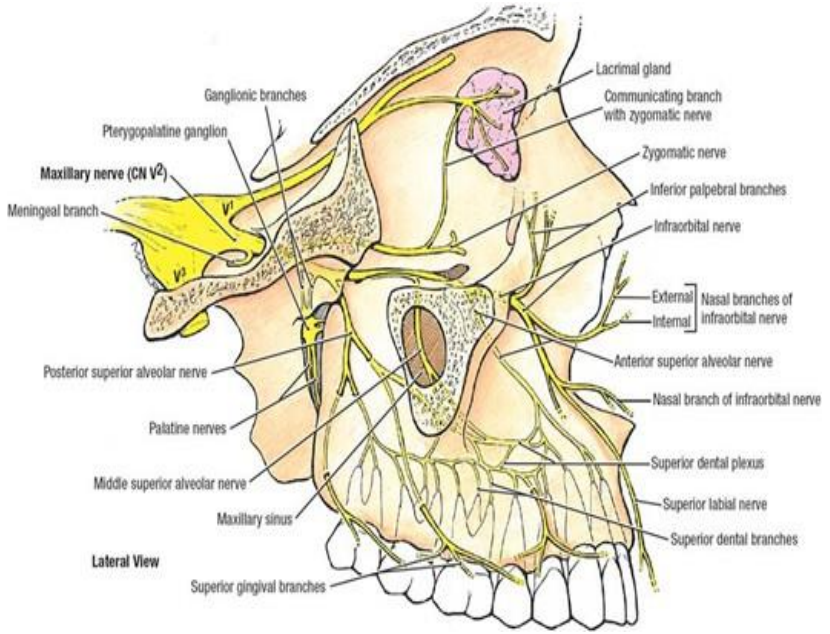
- The infra-orbital nerve exits the infra- orbital canal through the **infra-orbital foramen**.

- Divides into nasal, palpebral, and superior labial branches.

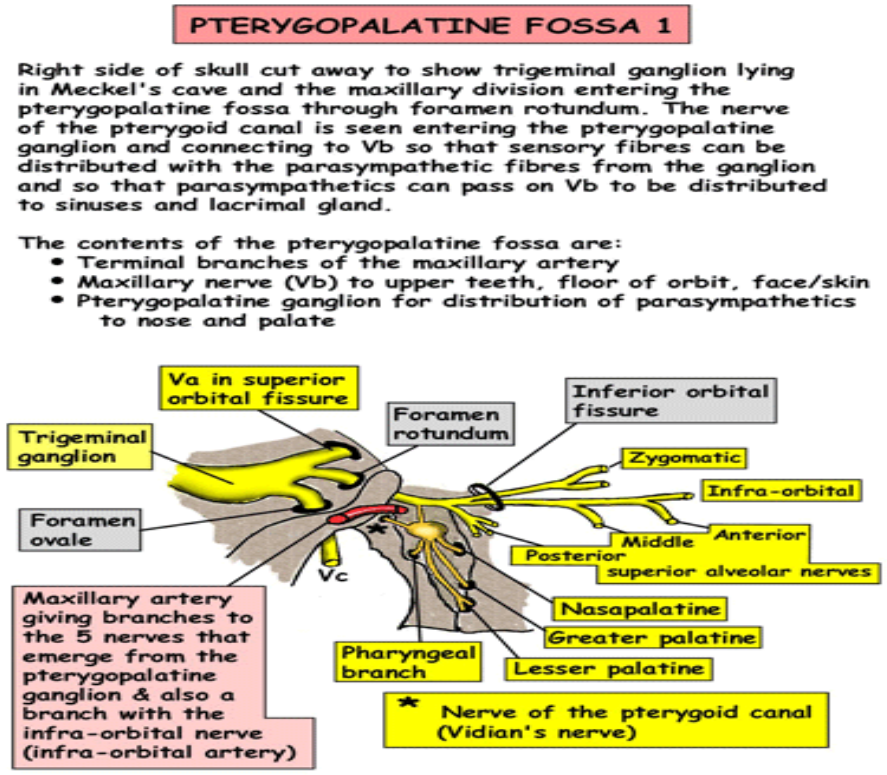
1. Nasal branches supply skin over the lateral aspect of the external nose and part of the nasal septum.

2. Palpebral branches supply skin of the lower eyelid.

3. Superior labial branches supply skin over the cheek and upper lip, and the related oral mucosa.



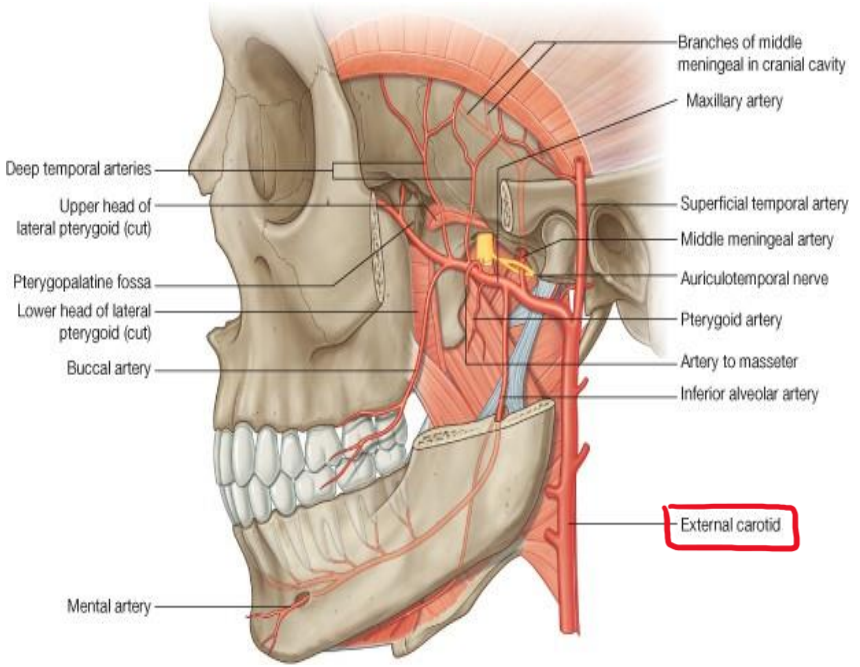
Maxillary Nerve and Pterygopalatine ganglion

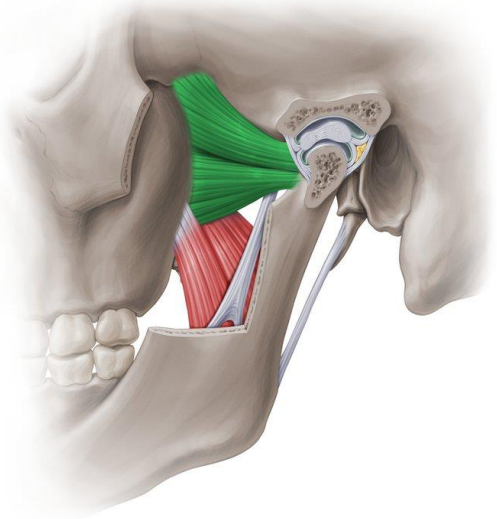


Maxillary Artery

- Look at the upper picture :
- First, we have the **external carotid artery** (the red box in the pic) which is divided within the **substance of the parotid gland** into :

- 1.**superficial temporal artery** (to supply different parts of the skull.)
- 2.**maxillary artery**
- The maxillary artery can be divided into 3 distinct segments by the **lateral pterygoid muscle** (this muscle is usually located posteriorly to the artery but in some cases, it becomes anterior to the artery).





lateral pterygoid muscle

- Maxillary Artery segments :

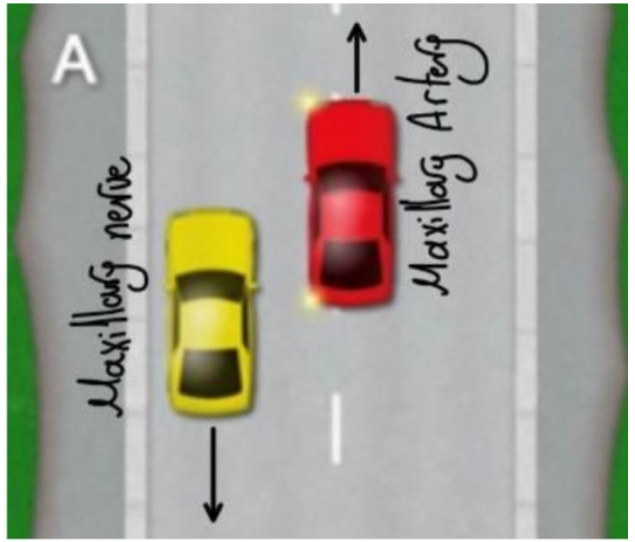
1. First segment of the maxillary artery is located **just before the muscle.**
2. Second segment is related to the muscle (whether it is related posteriorly or anteriorly as we mentioned).
3. Third segment is located **after the muscle** (it leaves the infra- temporal fossa passing through the **pterygomaxillary fissure reaching the pterygopalatine fossa).**

The maxillary **artery's** pathway is the **opposite** of the maxillary **nerve**, that originates in the **middle cranial fossa**, penetrates the **foramen rotundum,** arriving to the **pterygopalatine fossa**, passing through the **pterygomaxillary fissure** to reach the **infra-temporalfossa**, so the **maxillary artery and nerve meet each other in the pterygomaxillary fissure.**

- The question is : Why would the maxillary nerve go to the infra- temporal fossa?

to give a branch called the **posterior superior alveolar nerve that innervate the last 3 molars.**

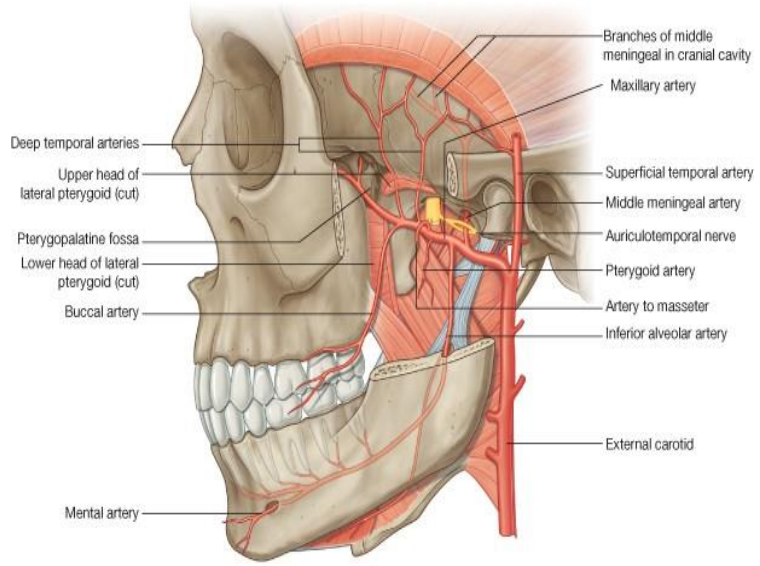
On the other hand , The artery supplies the posterior superior alveolar at the infratemporal fossa, then proceeds to the pterygopalatine fossa, where it gives rise to five branches along with the nerve and branches of the ganglia.



What is mentioned by the doctor from the slide is underlined

Maxillary artery

- Major **branch of the external carotid** artery in the neck
- Originates adjacent to the neck of mandible
- Originates within the substance of the parotid gland
- Passes forward through the infratemporal fossa
- Enters the pterygopalatine fossa through the pterygomaxillary fissure (the third part)

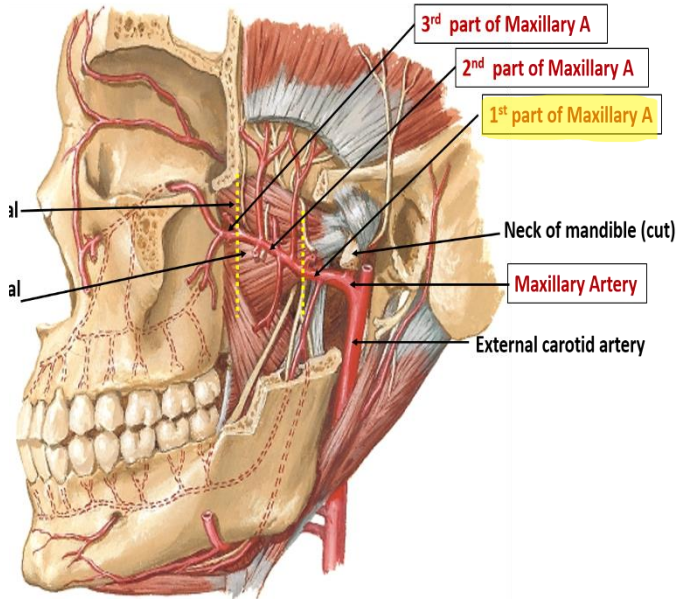


First part of maxillary Art

Note : The lateral pterygoid muscle is inserted into the neck of the mandible.

The **first part** of the maxillary artery gives off **5 branches** all of them pass through **foramina** (openings) for example:

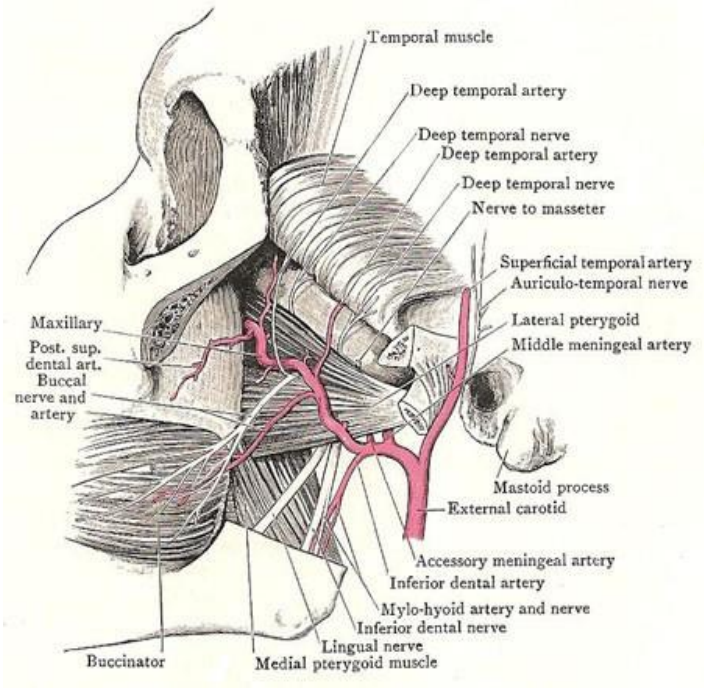
The inferior alveolar artery passes through the **mandibular foramen** to enter the mandible to supply all lower teeth in the lower jaw along with the inferior alveolar nerve (a branch of mandibular nerve).
Middle meningeal artery passes through the **foramen spinosum** to enter the middle cranial fossa.(intracrainally)
Accessory middle meningeal artery passes through the **foramen ovale** then goes intracranially.
Deep auricular & anterior tympanic arteries enter the **auricle**.



- It is very important to notice these two pieces of info :
- The inferior alveolar artery is a branch of **Maxillary Artery**
- The inferior alveolar nerve is a branch of **mandibular nerve**
- In general , the nerves that supply the lower jaw are branches of mandibular nerve , while the ones that supply the upper jaw are branches of maxillary nerve

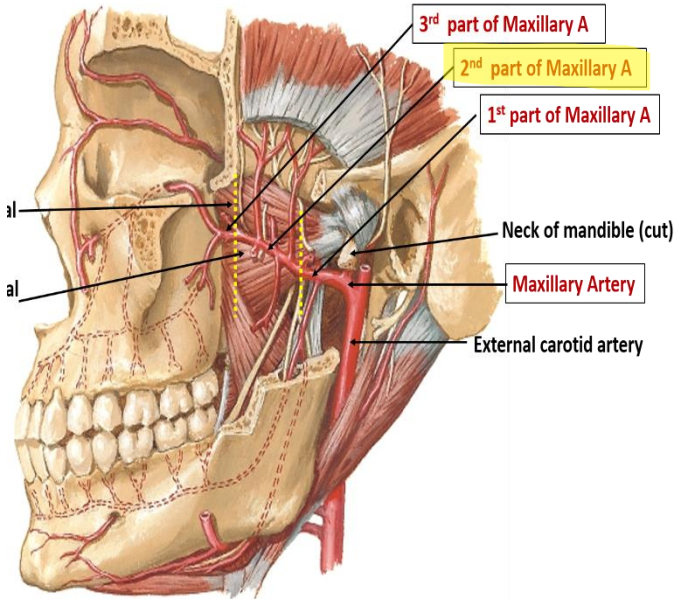
First part

- The first part of the maxillary artery is the part between the neck of mandible (Lat.) and the sphenomandibular ligament (Med.)
- Also related to the auriculo.temporal nerve (above) and the maxillary vein (below).
- Gives origin to two major branches (the middle meningeal and inferior alveolar arteries)
- Smaller branches (deep auricular, anterior tympanic, and accessory meningeal);



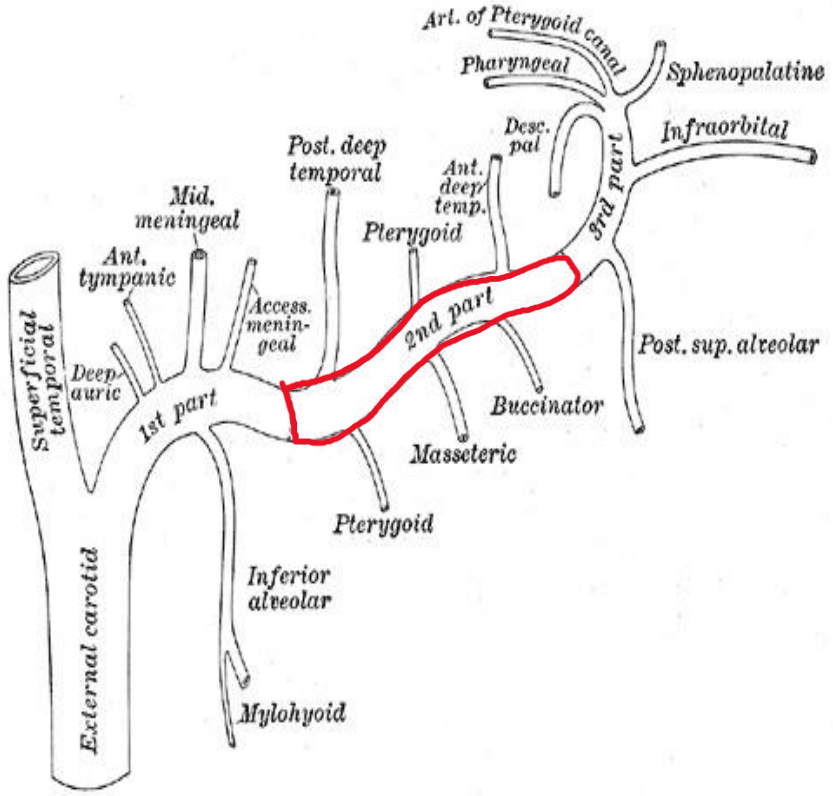
Second part of maxillary Art

- The second part of the maxillary artery gives off **5 muscular branches for the muscles of mastication:**
- **Deep temporal branch** for temporalis muscle.
- **Masseteric branch** for masseter muscle.
- **Pterygoid branches** for medial pterygoid & lateral pterygoid muscle.
- **Buccal branch** to supply the buccinator muscle.



Second part

- The second part of the maxillary artery the part related to the lateral pterygoid muscle
- Gives origin to deep temporal, masseteric, buccal, and pterygoid branches (muscles of mastication)
- Course with branches of the mandibular nerve

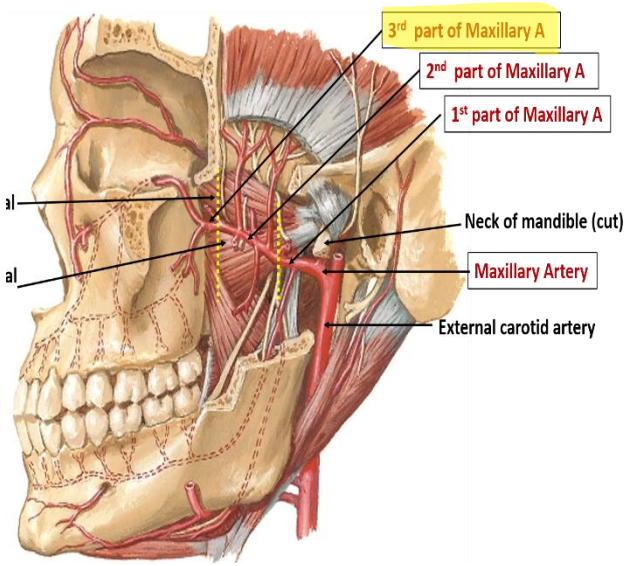


Branches of the maxillary artery

Gray's Anatomy 1918

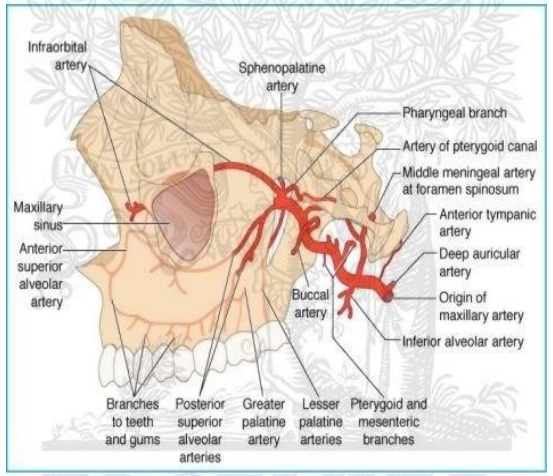
Terminal (3rd) part of maxillary Art

- The third part (terminal part) enters the **pterygopalatine fossa and gives origins to 6 branches (as in slides)** distributed along with the branches of the pterygopalatine ganglion and the maxillary nerve.
- These 6 branches are as follows :
- **Sphenoplatine artery** which divides into **long** and **short** branches. **Palatine artery** which gives **greater palatine and lesser palatine.**
  Infra-orbital artery (represents the end of the maxillary artery) which is also divides into 3 smaller branches: palpebral, nasal, labial arteries.



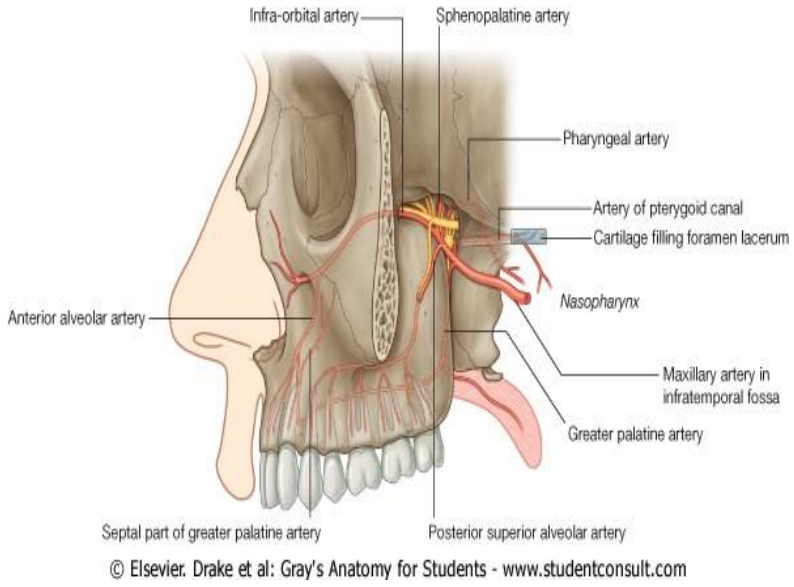
Terminal (3rd) part

- In the pterygopalatine fossa
- Anterior to the pterygopalatine ganglion
- Gives origin to branches that accompany branches of the maxillary nerve [V2] and the pterygopalatine ganglion.
- **These branches supply much of the nasal cavity, the roof of the oral cavity, and all upper teeth.**
- In addition, they contribute to the blood supply of the **sinuses, oropharynx, and floor of the orbit.**



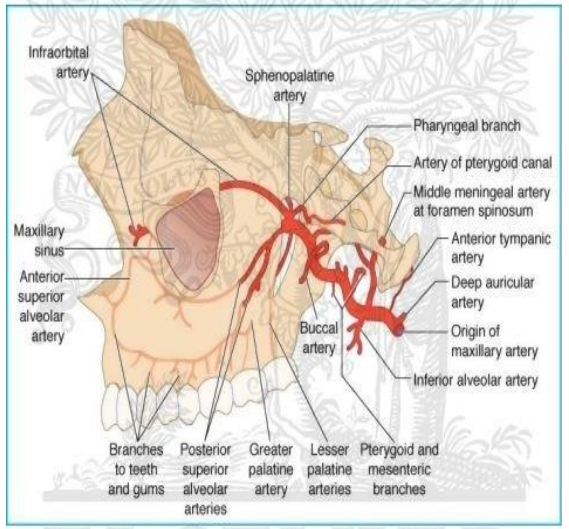
Branches of the 3rd part maxillary artery

- 1. The posterior superior alveolar, **for the last molar teeth**.
- 2. Infra-orbital,
- 3. Greater and **lesser** palatine,
- 4. Pharyngeal, through palatovaginal foramen to nasopharynx .
- 5. Sphenopalatine arteries, long and short
- 6.The artery of the pterygoid canal



Posterior superior alveolar artery

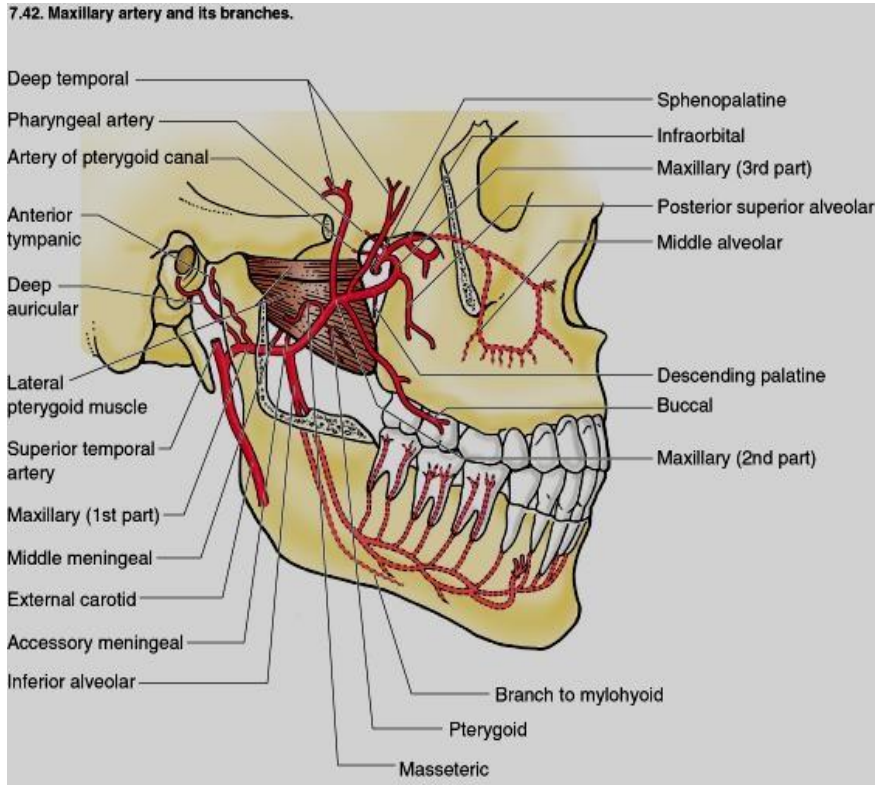
- Originates from the maxillary artery as it passes through the pterygomaxillary fissure
- Meets the posterior superior alveolar nerve,
- Accompanies it through the alveolar foramen on the infratemporal surface of the maxilla
- **Supplies the molar and premolar teeth, adjacent gingiva, and the maxillary sinus.**



- The orbit has **orbital canal, orbital groove and orbital foramen.** The **infra-orbital artery** passes initially **through the canal** then through the **groove** after that through the **foramen** to give origins for the **anterior superior and middle superior arteries (within the orbit)** , but **before the orbit** within the **infra-temporal** fossa it gives origin for the **posterior superior alveolar artery.** All these 3 alveolar arteries **supply the upper jaw.**
- **The posterior alveolar artery** supplies the molars,
- **middle alveolar artery** supplies the premolars
- **anterior alveolar artery** supplies the canines and incisors.

Infra-orbital artery

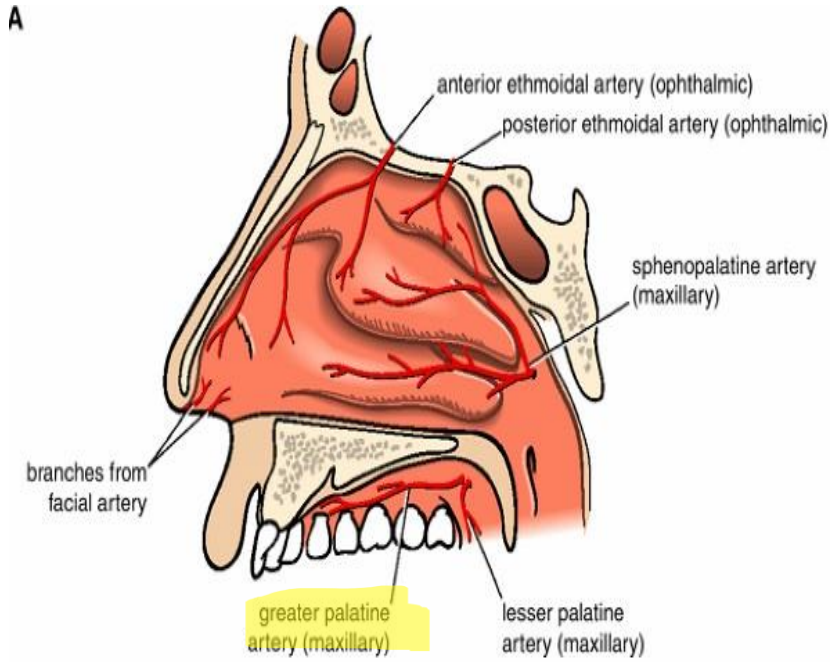
- Passes forward with the infra-orbital nerve and leaves the pterygopalatine fossa through the inferior orbital fissure
- With the infra-orbital nerve, it lies in the infra-orbital groove and infra-orbital canal
- Emerges through the infra-orbital foramen to supply parts of the face.
- In the orbital canal gives :
- 1. Branches that contribute to the blood supply of structures near the floor of the orbit-the inferior rectus and inferior oblique muscles, and the lacrimal sac;
- **2. Anterior superior alveolar arteries**, which supply the incisor and canine teeth and the maxillary sinus.



- **The Greater palatine** is one of the two branches of the **palatine artery** that travels **within the palatine canal to reach the oral cavity supplying the hard palate**, then it passes through the incisive foramen to return backward to the nose, supplying the **posterior inferior quadrant of the lateral wall of the nose.**

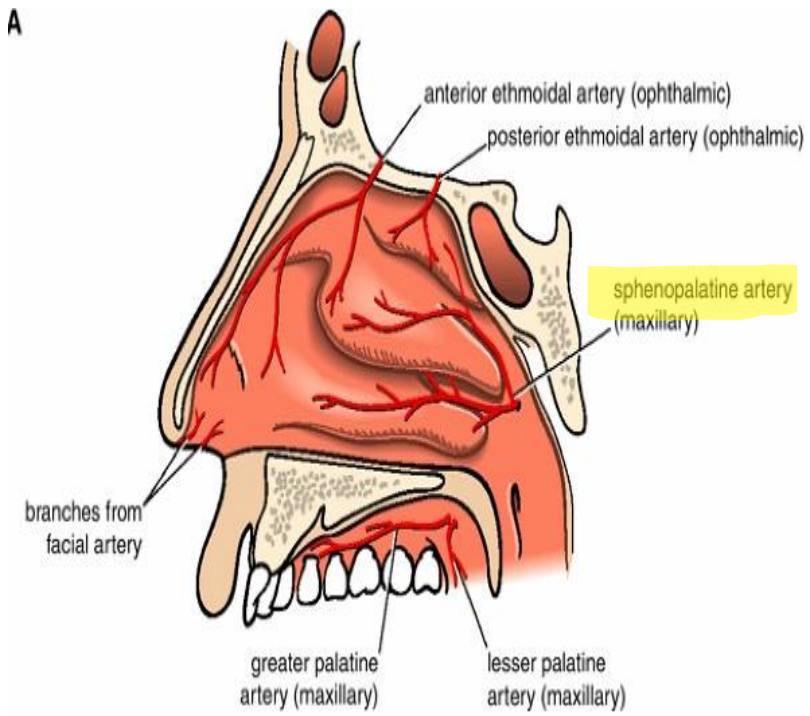
Greater palatine artery

- Supplies the posterior aspect of the roof of the nasal cavity, the sphenoidal sinus, and the pharyngotympanic tube.



Sphenopalatine artery

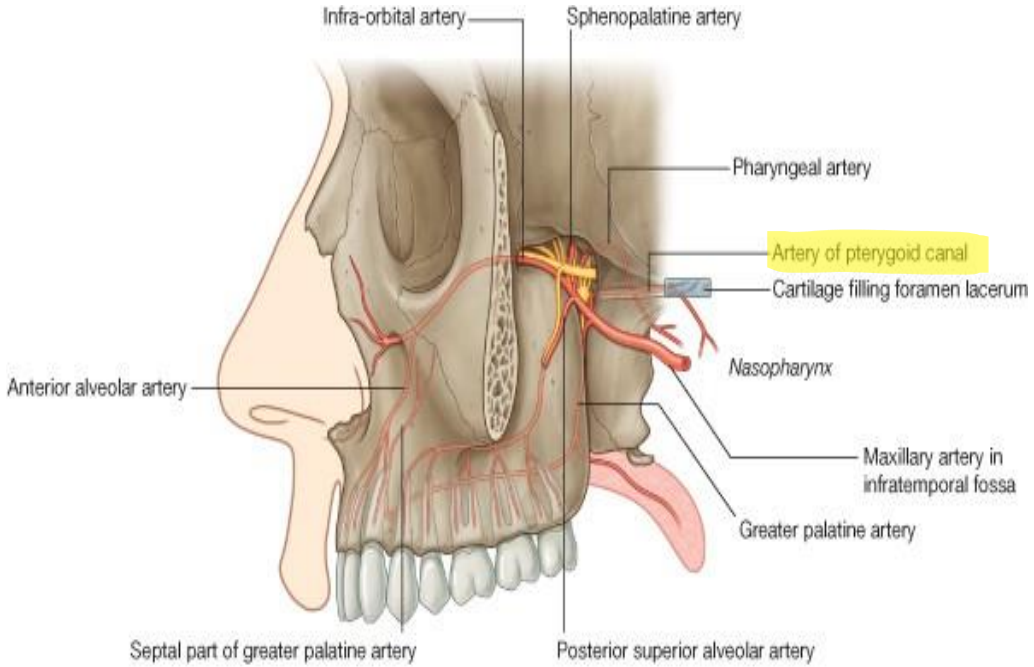
- The terminal branch of the maxillary artery
- Leaves the pterygopalatine fossa medially through the sphenopalatine foramen
- Accompanies the nasal nerves, giving off:
- 1. Posterior lateral nasal arteries, which supply the lateral wall of the nasal cavity and contribute to supply of the paranasal sinuses;
- 2. Posterior septal branches, which supply the nasal septum-the largest of these branches passes anteriorly down the septum to anastomose with the end of the greater palatine artery.



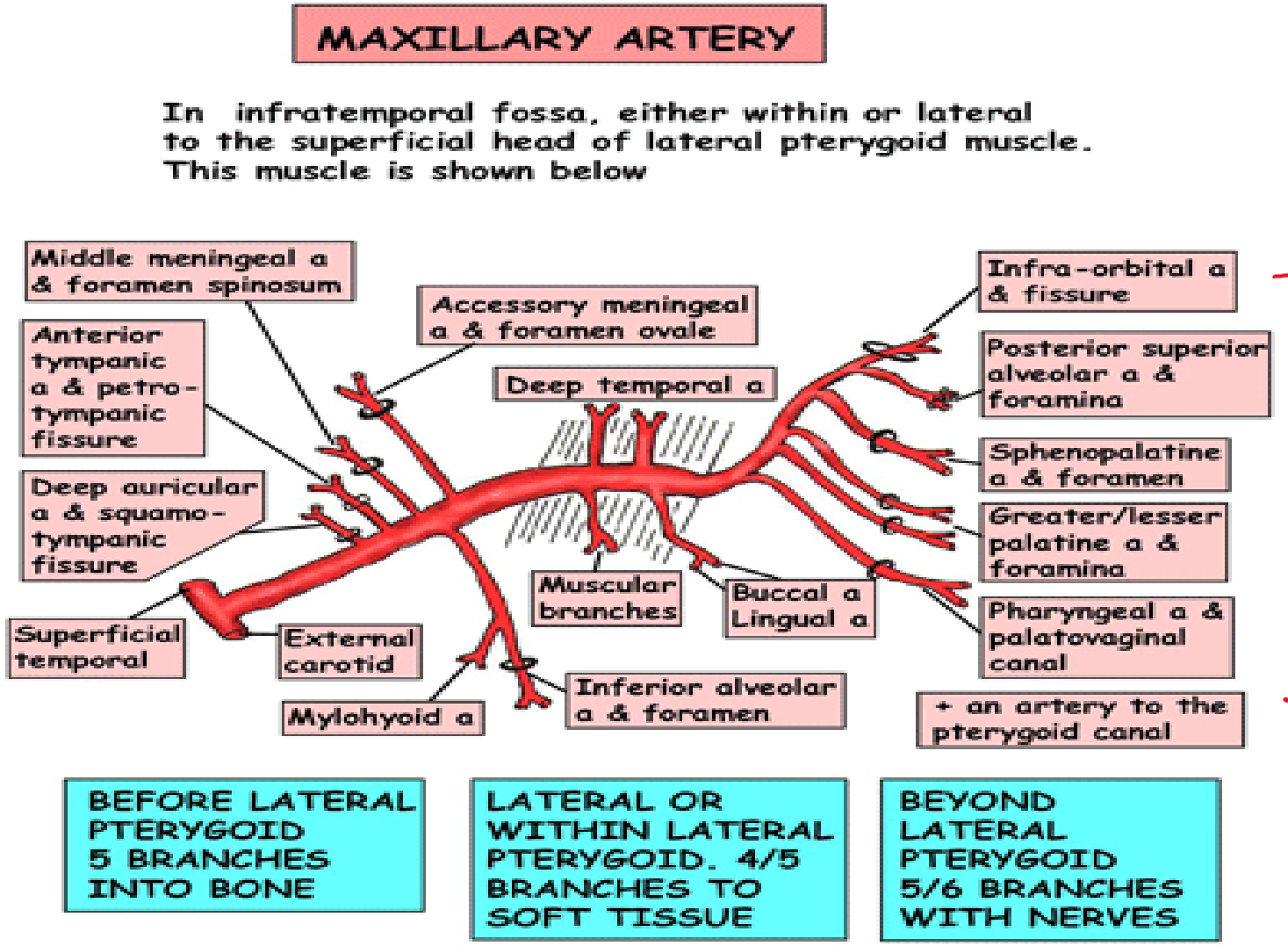
- According to its name, it supplies the pterygoid canal and its structures.

Artery of pterygoid canal

- Passes posteriorly into the pterygoid canal and supplies surrounding tissues
- Passing inferiorly through cartilage filling the foramen lacerum,
- **Terminates in the mucosa of the nasopharynx.**



Maxillary artery



- Branches of the 3rd part

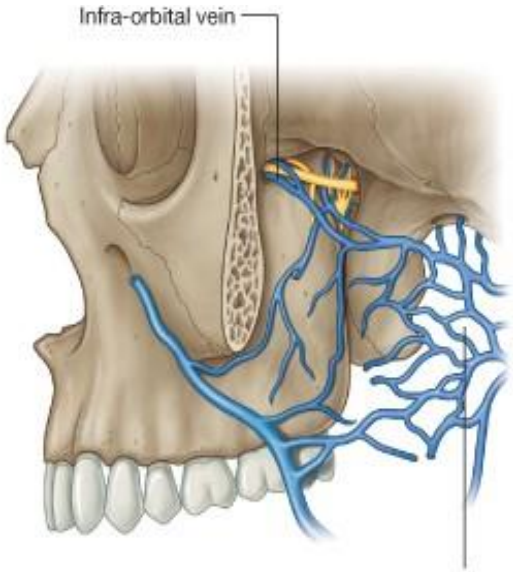
Veins

- The **pterygoid plexus** of veins forms the **maxillary vein** that join the **superficial temporal vein** in the substance of the **parotid gland** forming the **retro-mandibular** vein.

- Keep in mind that the pterygoid plexus also has a connection with the **cavernous sinus** by emissary veins through the **foramen spinosum and ovale.**

Veins

- Drain areas supplied by branches of the terminal part of the maxillary artery
- Generally travel with these branches back into the pterygopalatine fossa.
- The veins coalesce in the **pterygopalatine** fossa and then pass laterally through the pterygomaxillary fissure to join the **pterygoid plexus** of veins in the **infratemporal fossa**
- The infra-orbital vein, drains the inferior aspect of the orbit,
- May pass directly into the infratemporal fossa, so bypassing the pterygopalatine fossa



Pterygoid plexus in infratemporal fossa

E learning quiz

- Which of the following arteries crossing the sphenopalatine foramen to supply the lateral wall of the nose?

A. Greater palatine A

B. Long sphenopalatine A.

C. Short sphenopalatine A.

D. Lesser palatine A.

E. Superior labial A.

Answer: C

- Which of the following paranasal sinuses causing oral fistula as a complication of infection?

A. Sphenoid

B. Anterior ethmoidal

C. Frontal

D. Maxillary

C. Posterior Ethmoidal

Answer:D

VERSIONS	SLIDE #	BEFORE CORRECTION	AFTER CORRECTION
V1→ V2	11 23 37	Nerve Infratemboral 5	Vein Infraorbital 6
V2→V3	16 41 44	Branches of maxillary trunk and pterygopalatine ganglion Intra-temporal fossa Greater palatine artery travels posteriorly and leaves pterygopalatine fossa through the palatovaginal canal with the pharyngeal nerve	corrected Infra- temporal fossa This paragraph is deleted from slides by the doctor

امسح الرمز و شاركنا بأفكارك لتحسين أدائنا !!