

وَقُلْ رَبِّ زِدْنِي عِلْمًا



PERIPHERAL NERVOUS SYSTEM



SUBJECT : Anatomy

LEC NO. : 5

DONE BY : Batool Alzubaidi + Hashem Ata

#كَلِينِيكَال_إِلَا_شَحْطَة

(2) The lacrimal canaliculi:

Tears are spread by blinking



- Tear is distributed over the eye from lateral to medial by blinking.
- In the medial angle of the eye, the tear collects in the lacrimal lake.
- In the medial end of the margin of each lid, there is an elevated region called the *lacrimal papilla* on the summit of which the *lacrimal punctum* opens. Through these openings, tear passes into the lacrimal canaliculi.
- The superior and inferior lacrimal canaliculi are two short canals, lined by stratified squamous non-keratinized epithelium that pass medially to open into the lacrimal sac.

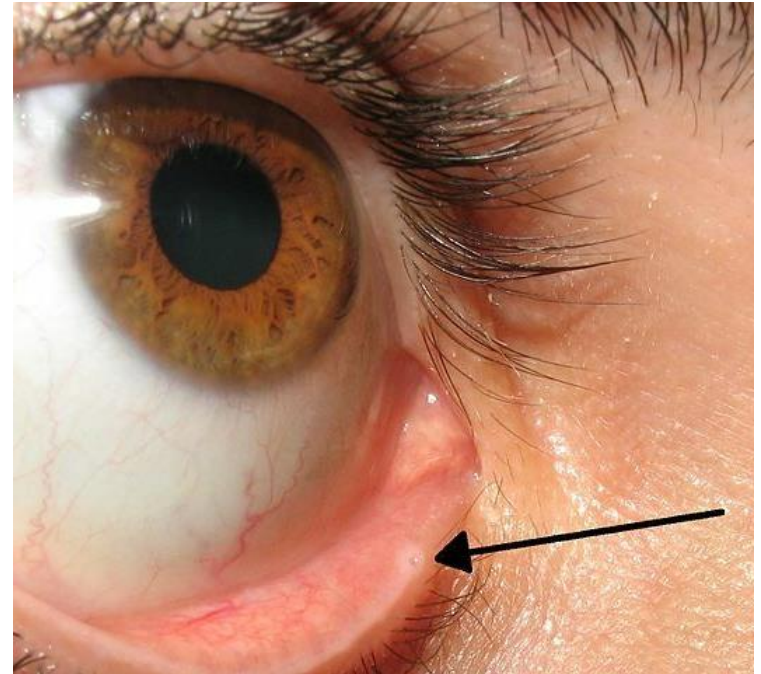
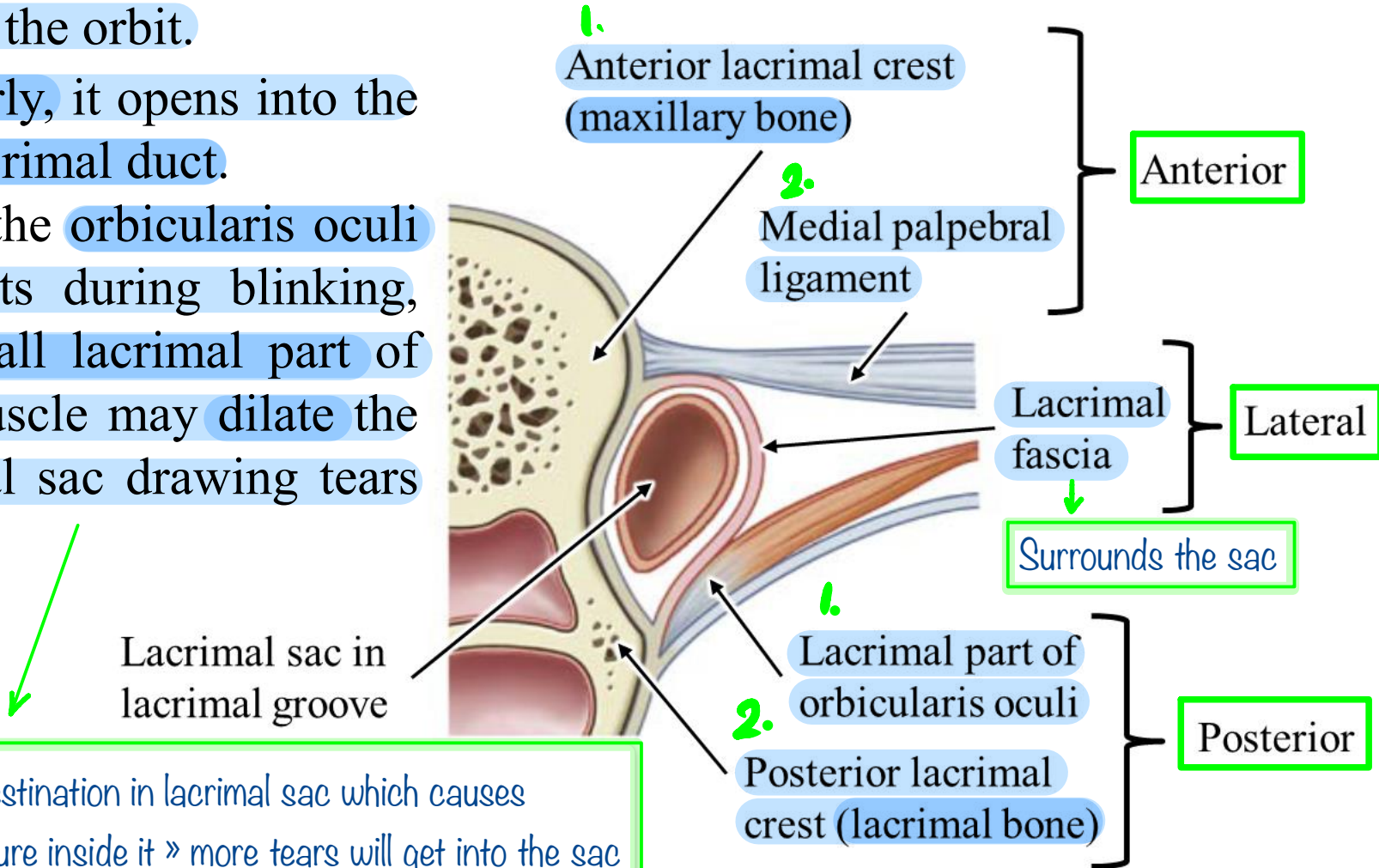


Fig.20: The inferior lacrimal papilla and punctum (arrow).

(3) The lacrimal sac:

- This is a blind pouch located in the lacrimal groove in the medial wall of the orbit.
- Inferiorly, it opens into the nasolacrimal duct.
- When the orbicularis oculi contracts during blinking, the small lacrimal part of this muscle may dilate the lacrimal sac drawing tears into it.



(4) The nasolacrimal duct:

- This passes down from the lacrimal sac through a bony nasolacrimal canal to open in the inferior meatus of the nasal cavity. Act as a valve
- A fold of mucous membrane, the **lacrimal fold**, guards the opening. This prevents air from being forced up the duct into the lacrimal sac when pressure is increased in the nose (as in blowing the nose).
- The nasolacrimal duct and the lacrimal sac are lined by pseudostratified ciliated epithelium.

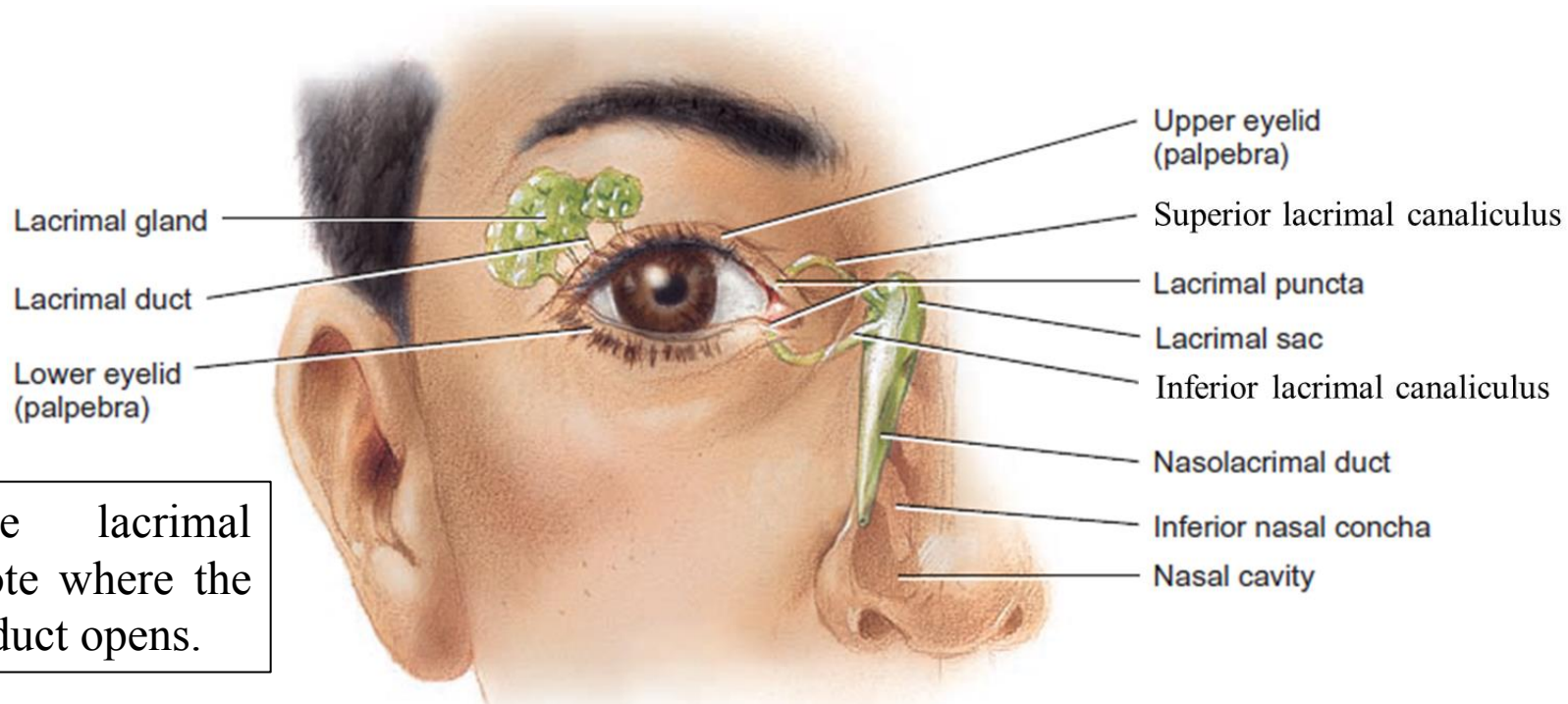


Fig.22: The lacrimal apparatus. Note where the nasolacrimal duct opens.

The Fascia the Eye

1. **The periorbita:** this is the periosteum of the bones of the orbits. At the orbital margins, it's continuous with the orbital septum.
2. **Common tendinous ring:** Posteriorly, the periorbita becomes thickened around the optic canal and part of the SOF where it forms the common tendinous ring, the site of origin of the 4 recti muscles.
3. **The bulbar fascia:** this covers the sclera of the eyeball. It extends from the site of entrance of optic nerve posteriorly to the corneoscleral junction anteriorly.

SOF » superior orbital fissure

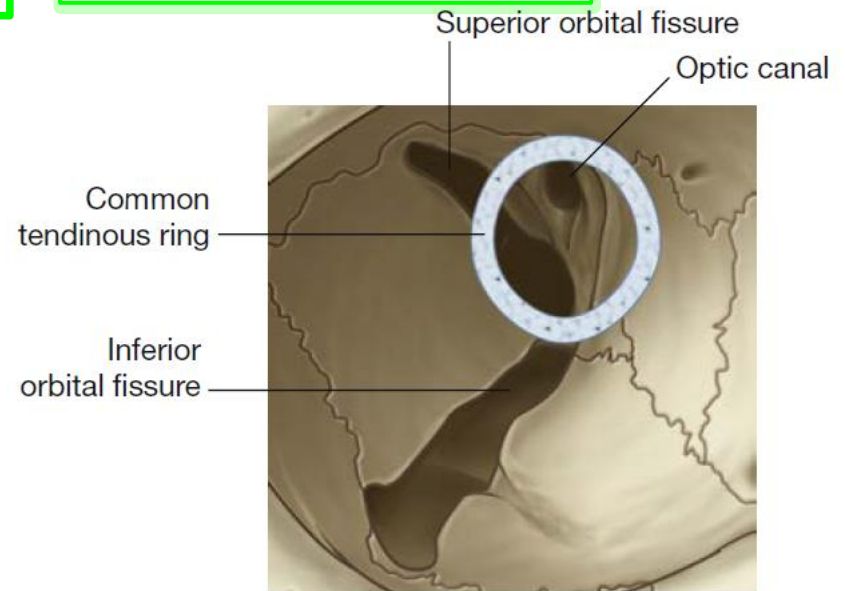


Fig.23: The common tendinous ring.

4. **Medial and lateral check ligaments:** these are extensions from the fascia of the medial and lateral recti which insert into the medial and lateral walls of the orbits.

5. **The suspensory ligament:** this is the thickened inferior part of the bulbar fascia. It forms a 'sling' that is attached to the two check ligaments suspending the eye in its position. **IOF » inferior orbital fissure**

Orbitalis muscle is a smooth muscle that bridges the IOF. It's supplied by sympathetic fibers. Its function is unknown, but it's thought that it keeps the eye facing forwards and may cause protrusion.

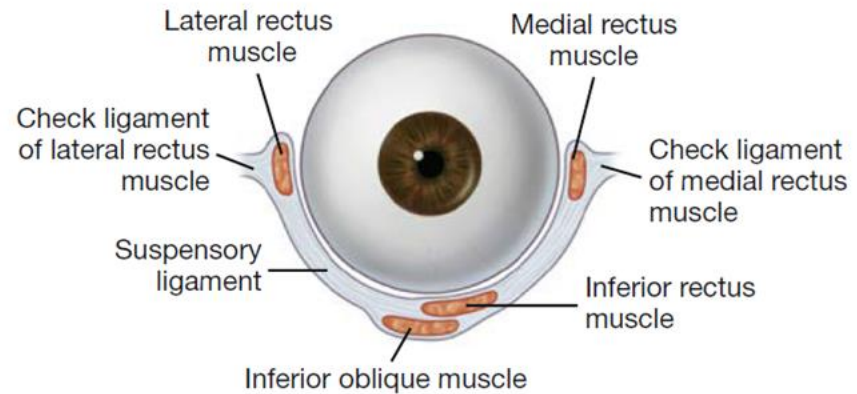
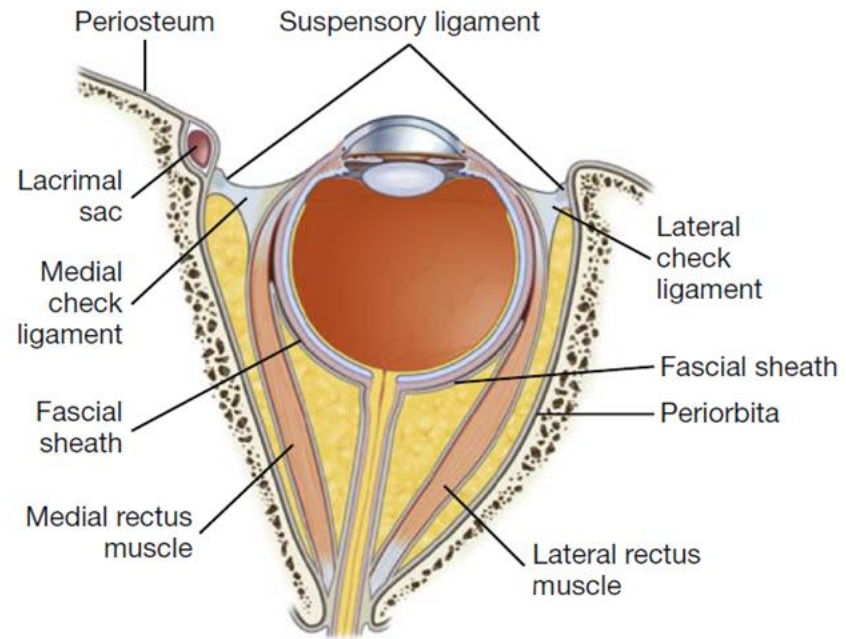


Fig.24: Various fascia of the eye.

Action of orbitalis muscle » when it contracts the eye will push forward and look forward

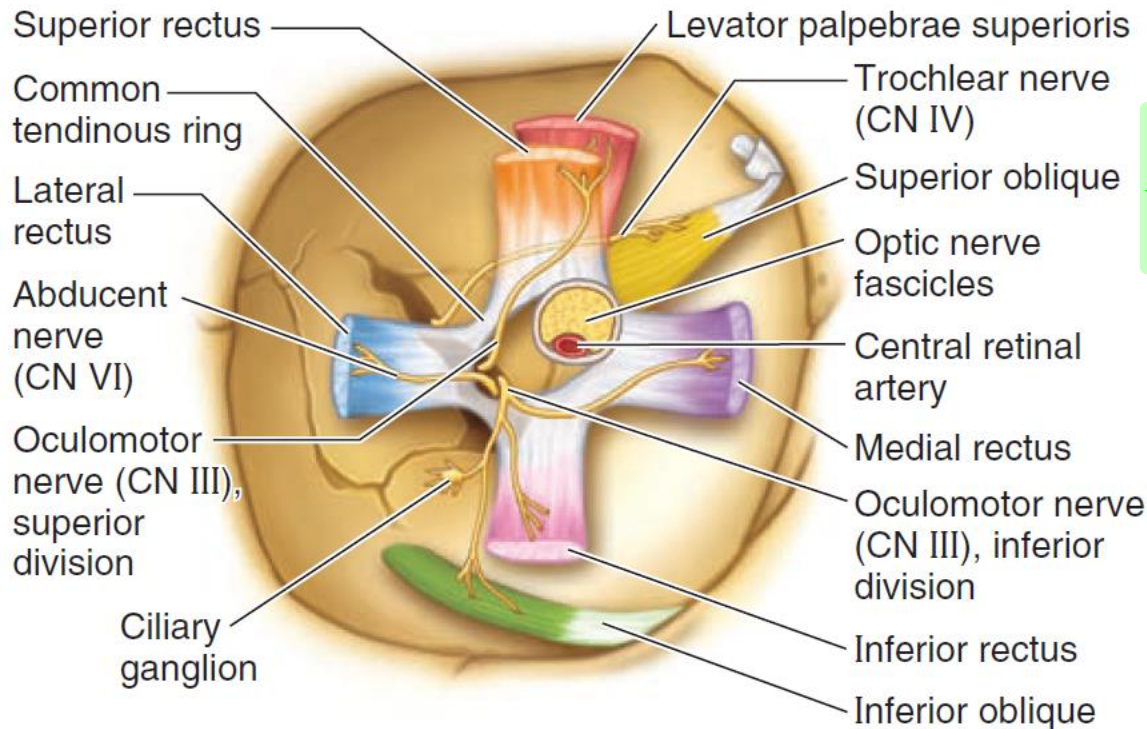
Exophthalmus that is seen in thyroid disease isn't related to this muscle

In Horner syndrome for example this muscle will be paralyzed because it's supplied by sympathetic fibers resulting with enophthalmus (eye will be abnormally deep in the orbit)

The Extrinsic Muscles of the Eye

Extra-ocular muscles

- Seven skeletal muscles are called the extrinsic muscles of the eye:
 - Levator palpebrae superioris – moves the upper eyelid
 - Four recti (superior, inferior, medial, and lateral) } Move eyeball
 - Two obliques (superior and inferior)



حكى ال relations الموجودة بالصورة بده
نرجعلها و ندرسها منيح بعد ما ناخذ ال nerves

Fig.25: The extrinsic muscles of the eye (near their origins). Note the nerve supply.

Trochlea » fibrous ring found in the medial wall of the orbit, made of fibrocartilage

Passes along the medial wall of the orbit then it hooks around the trochlea to pass postero-laterally

Muscle	Origin	Insertion	Nerve Supply
Superior oblique (SO)	Body of sphenoid bone, superomedial to optic canal	Sclera, deep to SR	Trochlear (IV)
Inferior oblique (IO)	Anterior part of orbital floor	Sclera deep to LR	Oculomotor (III)
Superior rectus (SR)	Common tendinous ring	Sclera just posterior to corneoscleral junction, according to their position	
Inferior rectus (IR)			
Medial rectus (MR)			
Lateral rectus (LR)			

Supplied by abducent because it's responsible for abduction of the eye

From the medial side of the floor it passes postero-laterally

(LR₆SO₄)₃

Supplies most of extrinsic muscles of the eye » this is why its named oculomotor the nerve responsible for the movement of the eye

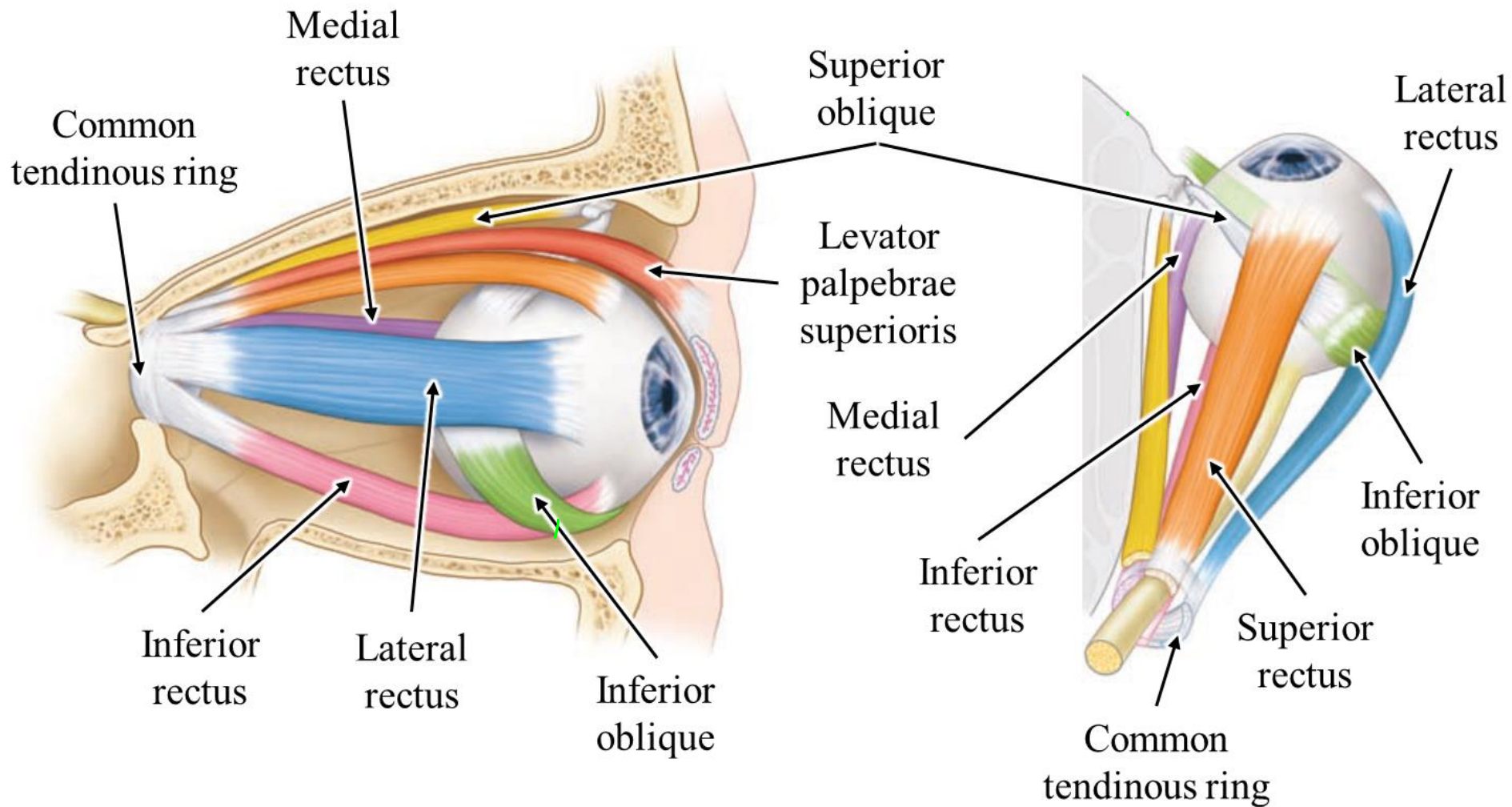
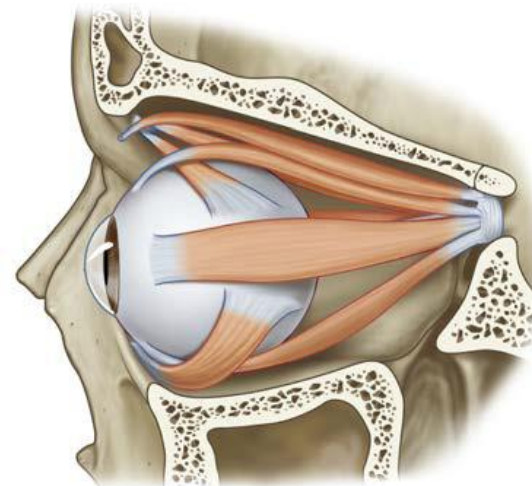


Fig.26: The extrinsic muscles of the eye. Left image, lateral view of the right eye. Right image, superior view of the right eye. Note how the muscles run along the axis of the orbit, which differs from the axis of the eyeball in resting position.

- The tendon of the **SO** muscle passes through the **trochlea** (a **fibrocartilaginous ring attached to the frontal bone**) before **turning posterolaterally** to its insertion.
- The **IO** muscle arises **medially**, just lateral to the **lacrimal groove**. It runs **posterolaterally** to its insertion.
- The **trochlea of the SO** is located **medially**. Both **obliques** are **attached laterally**. This can be used to **identify the left or right eye**.

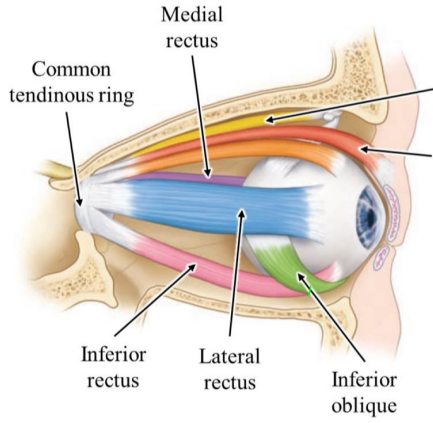
The axis of the muscles is the same as the axis of the orbit but the axis of the muscle is different than the axis of eye ball that's why there's an angle between them .. this means that the movement of the eye doesn't necessarily be at the same direction as the contraction of the muscle

Fig.27: Is this the right or the **left eye**?

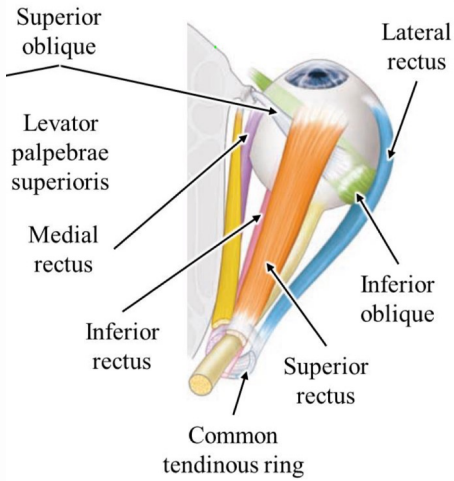


بس حضرت المحاضرة صراحة ما فهمت كيف نميز العين اليمين من الشمال ف حبشتلكم بالموضوع من هنا و هناك و طلعتكم بخلاصة احفظوها و راح تعرفوا تحلوا .. راح اكتب النوتس و اطبقهم بالنوتة الي بعدها على صور السلايدات عشان تفهموا

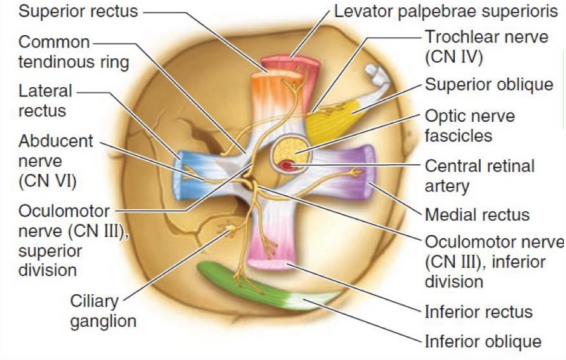
اذا كان ال view من ال anterior or front :
اذا كانت ال trochlea على جهة الشمال medially اذا هاي العين اليمين .. و اذا كانت على جهة اليمين medially فهاي العين الشمال
اذا كان ال view من ال lateral or superior :
اذا كانت ال lateral rectus muscle على اليمين هاي العين اليمين .. اذا كانت على الشمال اذا هاي العين الشمال



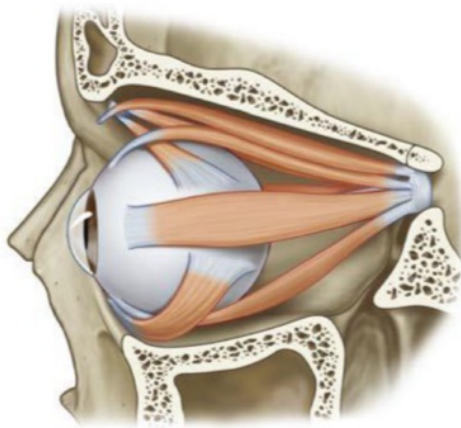
هاي الصورة lateral view
 على شو بدك تدور؟ على ال
 lateral rectus muscle لقينها
 الي لونها ازرق، ضل اعرف
 هي right or left جاية؟ اطلع
 نفس اتجاه العين بالصورة و
 شوف على اي جهة؟ اليمين
 اذا هاي ال right eye



هاد superior view برضه
 بدي ادور على ال lateral
 rectus muscle و اشوفها
 على اي جهة، بهاي الصورة
 جاية على جهة اليمين اذا
 هاي ال right eye




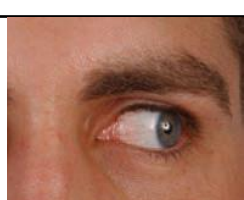


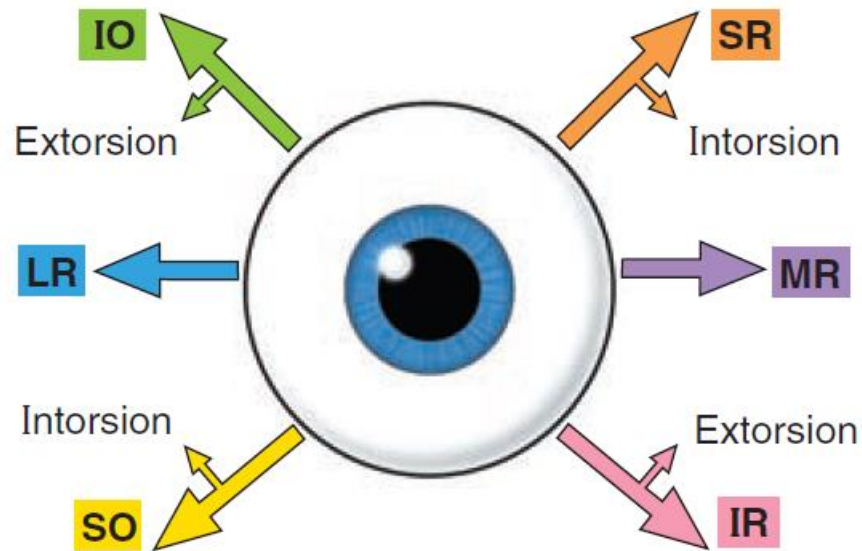
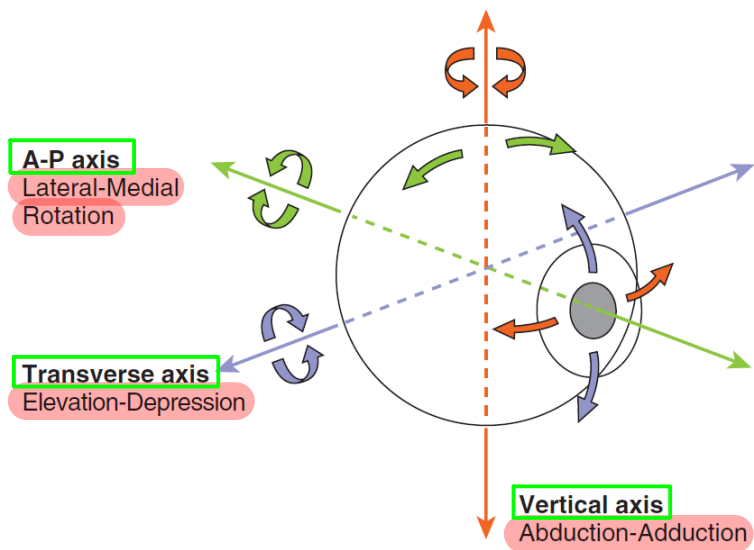
هاي anterior view و لكن
 العين مش موجودة، على شو
 بدي ادور ؟ على ال trochlea
 الي attached medially
 اشوفها على جهة اليمين او
 الشمال بالصورة ال trochlea
 جاي على الشمال اذا هاي ال
 right eye



هون lateral view بدنا ندور
 على ال lateral rectus
 muscle هيها بالوجه ضل
 اعرف هي على اي جهة
 موجودة حرك راسك يكون
 نظرك زي العين بالصورة و
 حدد اي جهة، جاية على
 الشمال اذا هاي ال left eye

Movements of the eye:

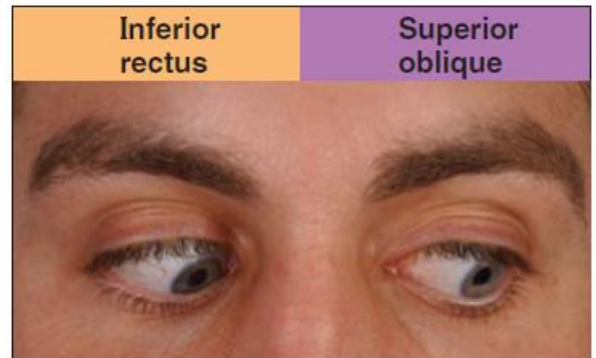
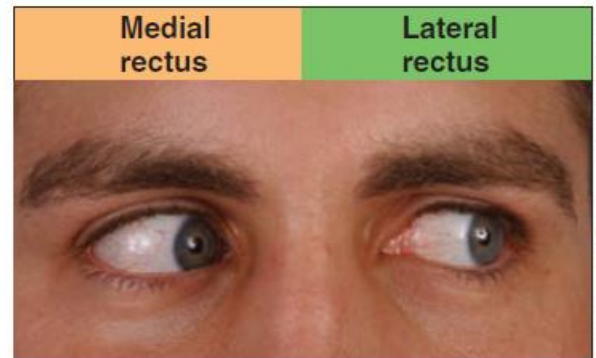
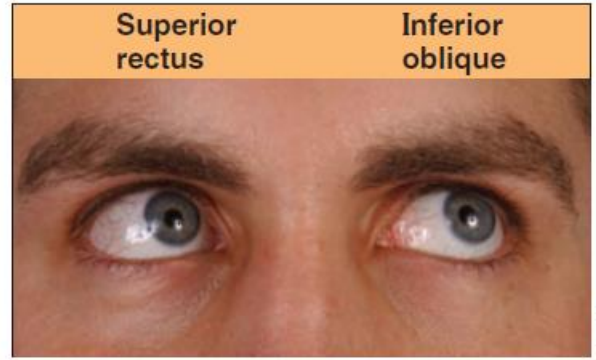
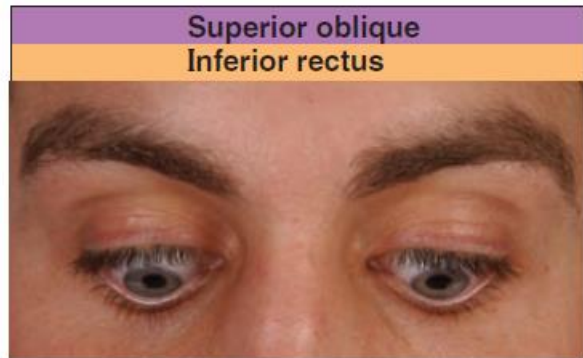
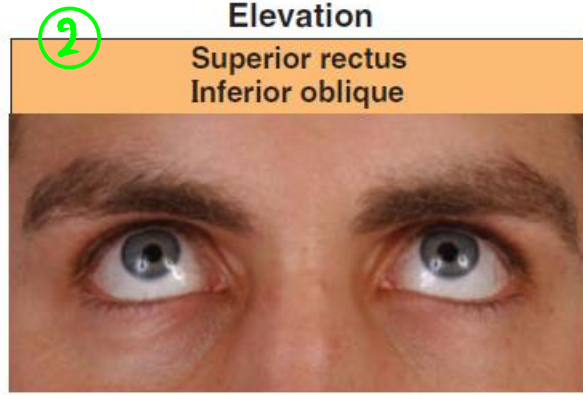
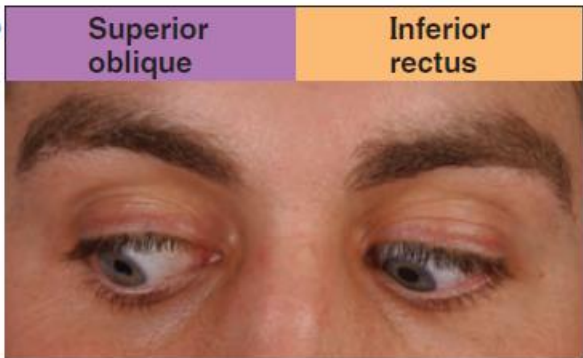
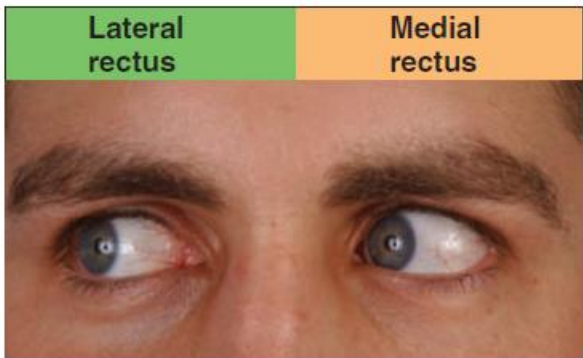
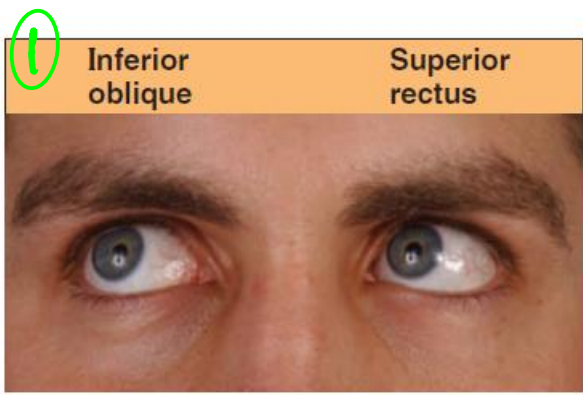
Term	Definition	
Elevation	Moving the pupil superiorly	
Depression	Moving the pupil inferiorly	
Adduction	Moving the pupil medially	
Abduction	Moving the pupil laterally	
Internal rotation (<u>intorsion</u>)	Rotating the upper part of the pupil medially (or toward the nose)	
External rotation (<u>extorsion</u>)	Rotating the upper part of the pupil laterally (or toward the temple)	آخر تتنن صعب نشوفهم و نفحصهم راح نركز على اوله



Muscle	Action
Superior oblique (SO)	Depression, abduction, intorsion
Inferior oblique (IO)	Elevation, abduction, extorsion
Superior rectus (SR)	Elevation, adduction, intorsion
Inferior rectus (IR)	Depression, adduction, extorsion
Medial rectus (MR)	Adduction
Lateral rectus (LR)	Abduction

Fig.28: Movements of the eye. Top left, the axes around which movements occur. Top right and table, movements produced by the individual muscle.

Right Abduction - Left Adduction



Left Abduction - Right Adduction

Depression

Oculomotor nerve (CN III)
 Trochlear nerve (CN IV)
 Abducent nerve (CN VI)

Fig.29: Binocular eye movements.

بالواقع ما في individual muscle contraction العضلات دائما
بتتحرك ب coordination مع بعض سواء عدة عضلات بنفس العين او
عضلات بالعينتين التنتين

صورة ١ لو بديك تتطلع على اشى and to left ال up ال up يعني
elevation لما بدي اطلع بالعين الشمال بدي اعمل elevation and
abduction فبحرك ال inferior oblique و لما بدي اطلع بالعين اليمين
بدي elevation and adduction فبحرك ال superior rectus

صورة ٢ لو بدي اطلع على اشى straight up لا يمين ولا شمال
بدي احرك ال superior rectus and inferior oblique ب both
eyes ليش ؟ لانه التنتين بعملوا elevation و راح يلغوا تاثير بعض
من حيث ال adduction and abduction فلما اطلع لفوق بكون
بالمنتصف مو رايح يمين ولا شمال النظر

و على هاد الاساس قيسوا على باقي الحركات بالصور و
اسماء العضلات اصلا مكتوبين فسهلين

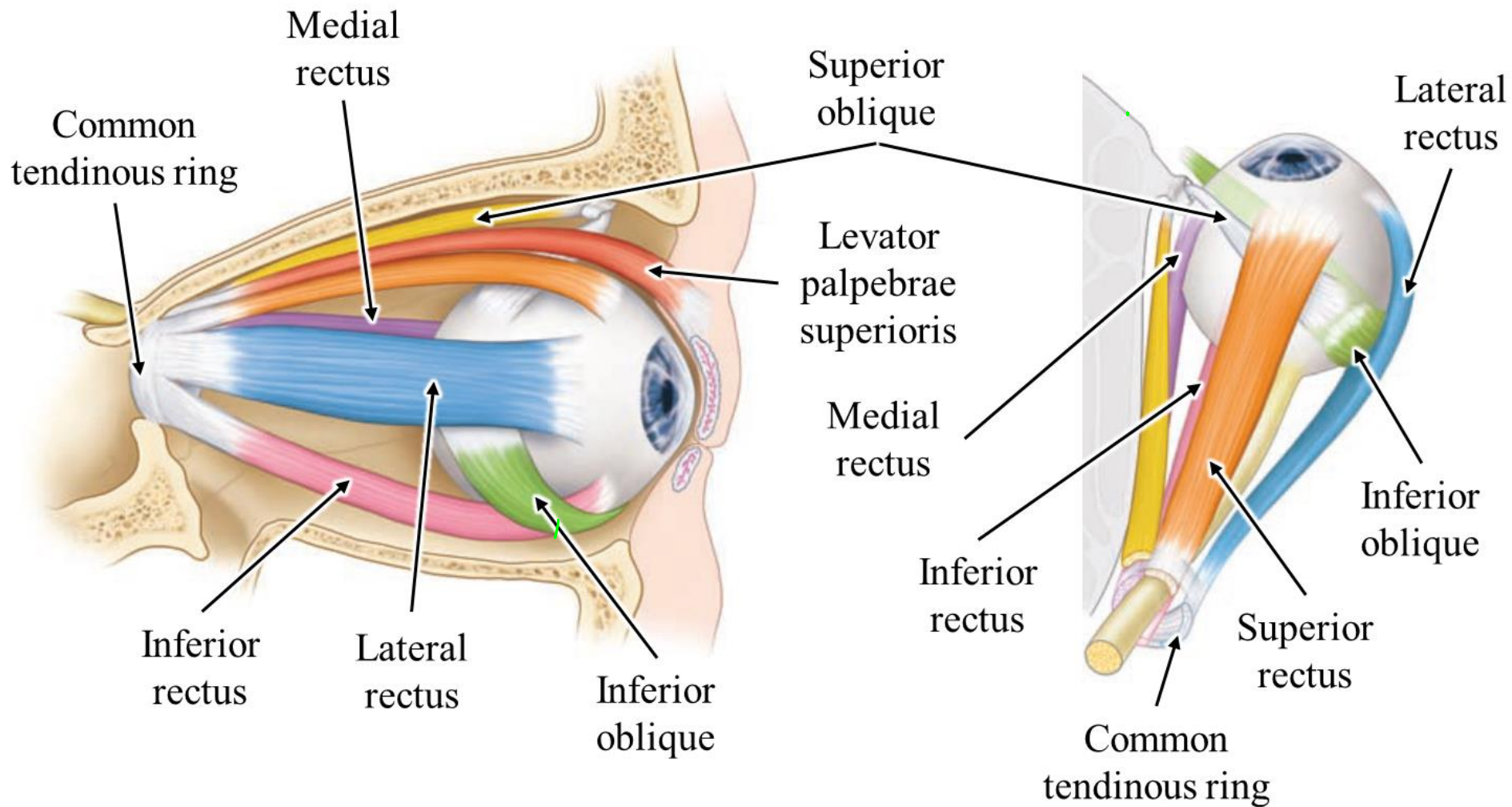


Fig.26: The extrinsic muscles of the eye. Left image, lateral view of the right eye. Right image, superior view of the right eye. Note how the muscles run along the axis of the orbit, which differs from the axis of the eyeball in resting position.

رجع لهاي الصورة حكي بده يفهمنا الحركات راح يشرح ال superior oblique و احنا نحاول نفهم الباقي و راح يعلمنا طريقة تانية .. ال SO بترتبط بال eye ball من الخلف posteriolateral لما تتقلص اتجاه التقصص عبارة عن قوة و لانه عنا زاوية حكيينا عنها فوق تذكروا هاي القوة بدها نحللها و حسب التحليل بعرف شو الحركة و فلو ال posterior aspect تحرك ال eye راح medially تتحرك laterally و بهاي الحالة يكون صار abduction

طريقة تانية في عضلة اسمها ال medial rectus هاي شو بتعمل adduction و بنفس اتجاهها ال superior and inferior rectus جايين على ال medial side of the eye و عشان هيك راح يتحركوا زيها و يعملوا adduction ال lateral rectus بتعمل abduction ال superior and inferior oblique نفس اتجاهها ف يعملوا زيها abduction ال superior rectus من اسمها بتعمل elevation و ال inferior rectus بتعمل depression اما ال obliques بعلموا عكس اسمهم

Vessels of the Orbit

Blood Supply

- This is mainly through the *ophthalmic artery*, a branch of the internal carotid artery after leaving the cavernous sinus.
- The ophthalmic artery passes into the orbit through the optic canal with the optic nerve. Initially, it lies inferior and lateral to the optic nerve. It, then, crosses superior to the optic nerve to run along the medial side of the orbit. It gives off various branches in the orbit.
- The *infraorbital artery*, a branch of the maxillary artery, supplies structures in the floor of the orbit.

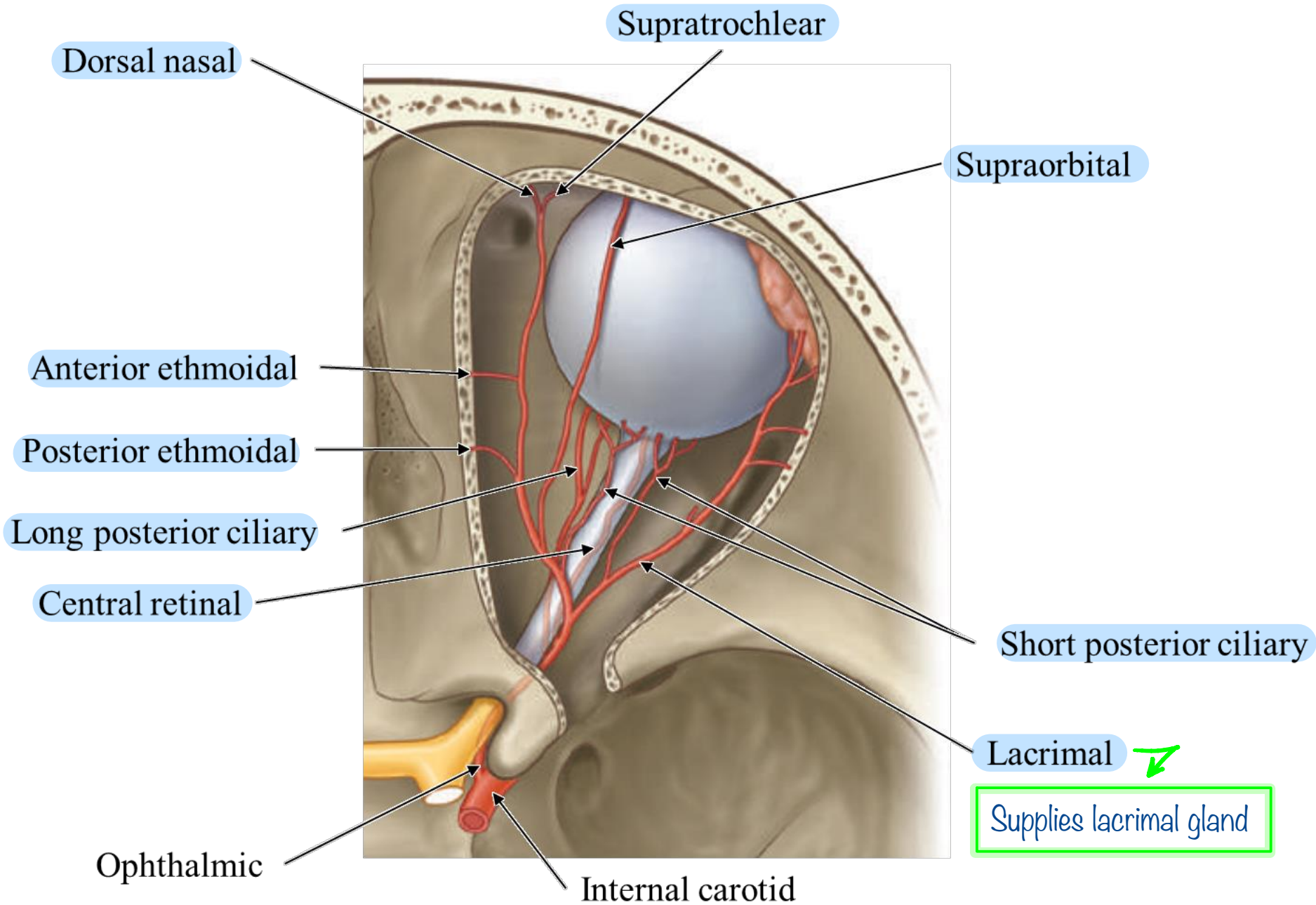


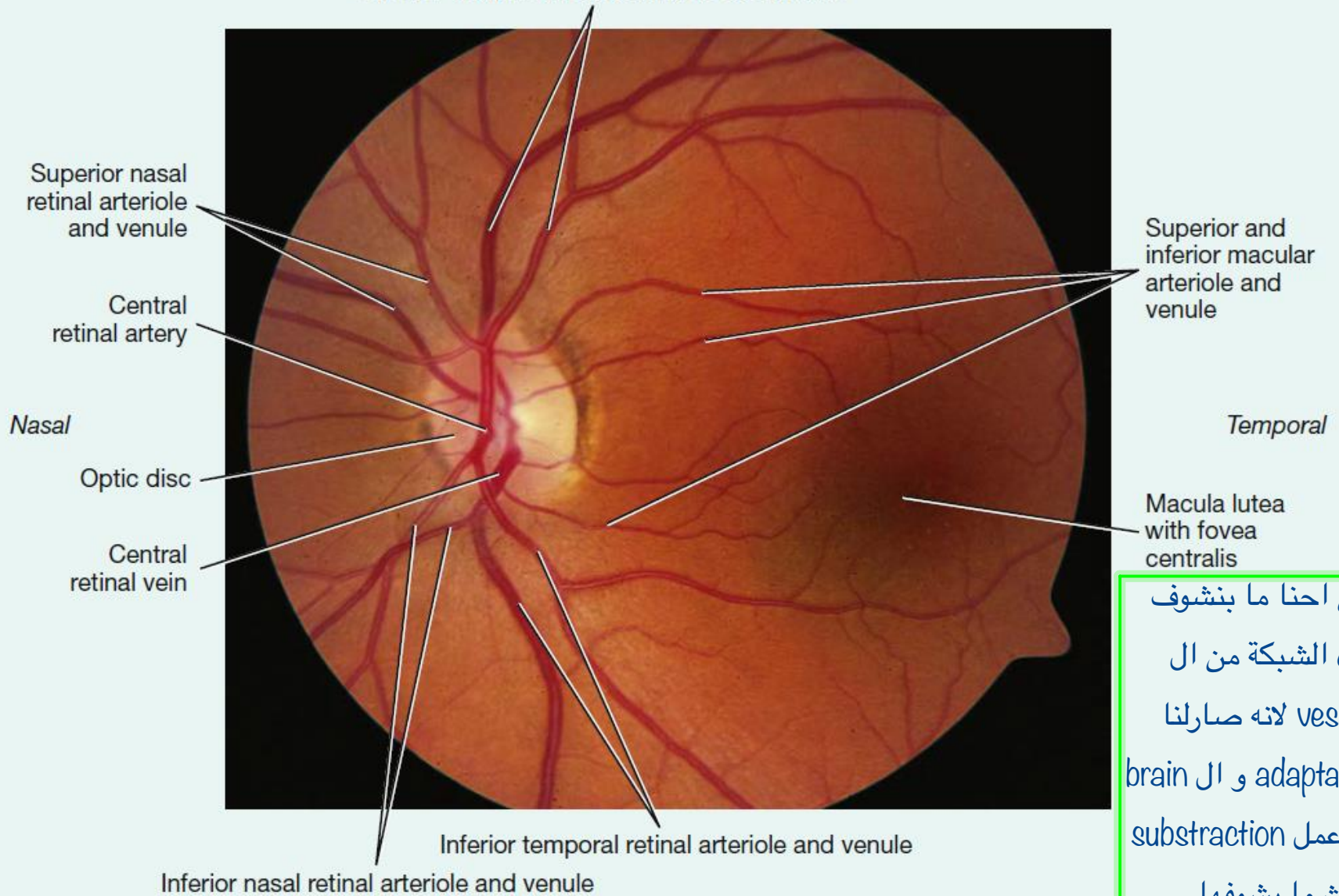
Fig.30: Ophthalmic artery and its branches.

Artery	Notes
<i>Muscular arteries</i>	Supply muscles of the eye
<i>Anterior ciliary arteries</i>	Branches of the muscular arteries. Pierce sclera anteriorly to form the ciliary plexus in iris and ciliary body
<i>Long posterior ciliary arteries</i>	Pierce sclera posteriorly. Join the anterior ciliary arteries to form the ciliary plexus in iris and ciliary body
<i>Short posterior ciliary arteries</i>	Pierce sclera posteriorly to supply the choroid
<i>Central artery of the retina</i>	Pierces the optic nerve and runs in its middle. Branches at the optic disc and can be seen through the ophthalmoscope. Supplies retina.

كلمة
للوقت

لو حدا منكم حابب يشوفهم اطلع على شاشة لونها ازرق او على السما لما تكون صافية راح تشوف
white blood cells moving inside these vessels
black lines with movement inside them

Superior temporal retinal arteriole and venule



ليش احنا ما بنشوف
هاي الشبكة من ال
vessels لانه صارلنا
adaptation و ال brain
عمل subtraction
بحيث ما يشوفها

Fig.31: Central artery of the retina and its branches seen through an ophthalmoscope. *Why don't they obscure vision?*

Venous Drainage

- This is through the superior and inferior ophthalmic veins, which ultimately drain into the cavernous sinus.
- The superior ophthalmic vein is formed as the supraorbital and angular veins join. It runs posteriorly through the superior part of the orbit and passes through the SOF to drain into the cavernous sinus.
- The inferior ophthalmic vein is formed anteriorly. It runs posteriorly through the inferior part of the orbit and passes through the SOF, separately or by joining the superior vein. It drains into the cavernous sinus and communicates with the pterygoid plexus of veins.
- Vorticose veins carry venous blood from the eyeball to drain into the superior or inferior ophthalmic veins. Central retinal vein pass with the artery.

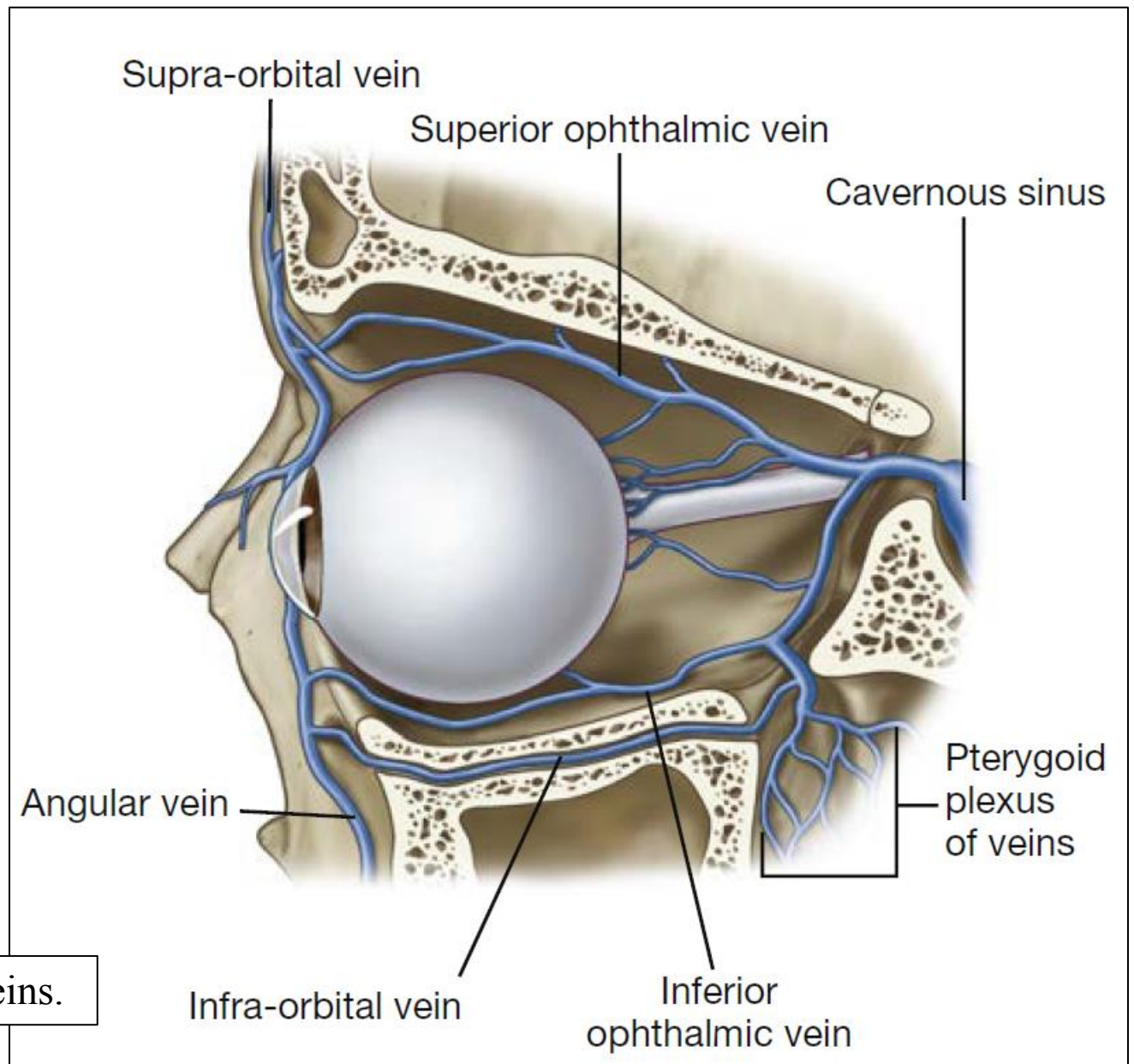


Fig.32: Ophthalmic veins.

Central artery of the retina

- This is an **end artery**. Occlusion of this artery will lead to **blindness**.

Danger triangle of the face

- A **triangular area** between the **bridge of the nose and the corners of the mouth**.
- **Infection** in this area **may spread to the cavernous sinus** due to the **connection between the veins of the face and this sinus through the ophthalmic veins**.



وصول ال infection لل cavernous sinus خطير جدا
لانه ممكن يعمل meningitis او يسبب thrombosis و
تنتقل لمكان تاني او يصير encephalitis

Nerves of the Orbit

The Optic nerve (II) - Sensory

- Although classified as a peripheral cranial nerve, the optic nerve is an extension of the forebrain that carry sensory fibers from the retina.
- It is ensheathed by the cranial meninges: dura, arachnoid, and pia. Therefore, the optic nerve is surrounded by cerebrospinal fluid in the subarachnoid space.
- It passes through the cone of the recti muscles to exit the orbit through the optic canal. Here, it's accompanied by the ophthalmic artery.

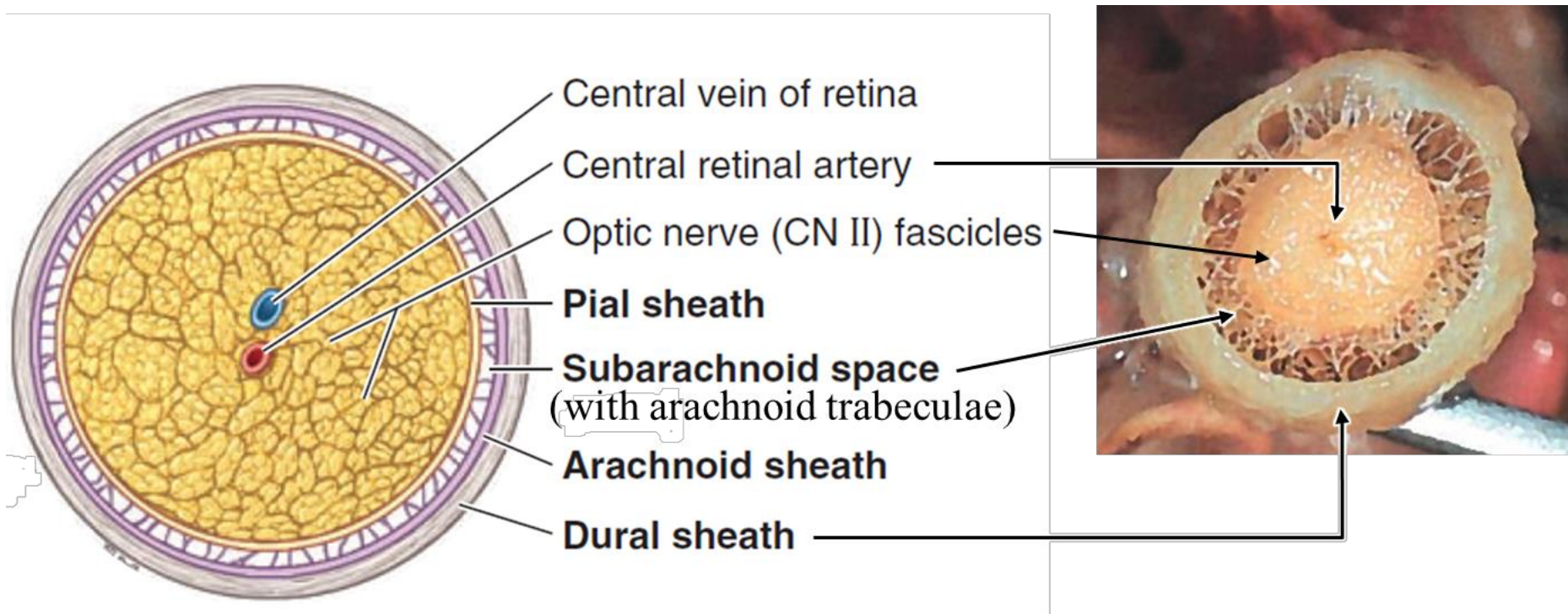


Fig.33: Cross section through the optic nerve. Left, diagram. Right, gross appearance.

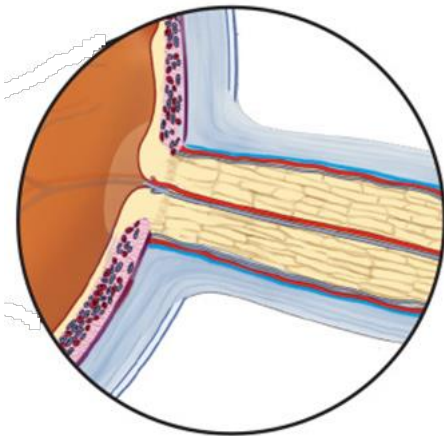
Unique features of the optic nerve

- Extension of the central nervous system
- Surrounded by meninges
- The myelin sheath of its fibers is formed by oligodendrocytes
- The central artery and vein of the retina run in its middle

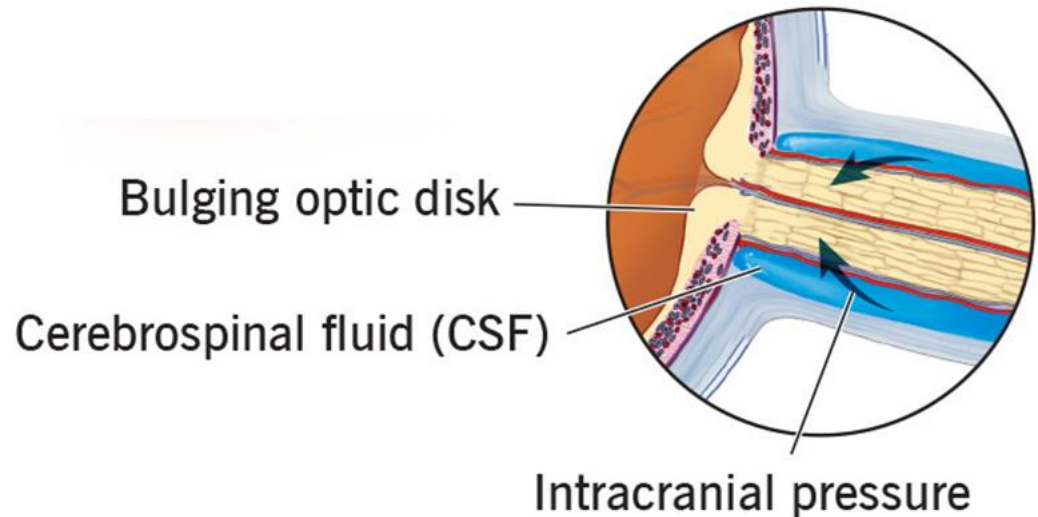
Papilledema

- Swelling of the optic disc due to increased intracranial pressure.
- The high pressure of the cerebrospinal fluid will compress the optic nerve leading to bulging of the disc.
- If untreated, can lead to blindness.

Normal anatomy



Papilledema



The Oculomotor nerve (III) - Motor

- Leaves the anterior surface of the brainstem between the midbrain and the pons.
- Passes forward in the lateral wall of the cavernous sinus.
- Before entering the orbit, it divides into superior and inferior divisions that enter the orbit through the SOF within the common tendinous ring.

- The superior division supplies the superior rectus and the LPS.
- The inferior division supplies the medial and inferior recti and the inferior oblique muscles.
- The branch to the inferior oblique gives off the parasympathetic root of the ciliary ganglion which supplies the sphincter pupillae and ciliary muscles.

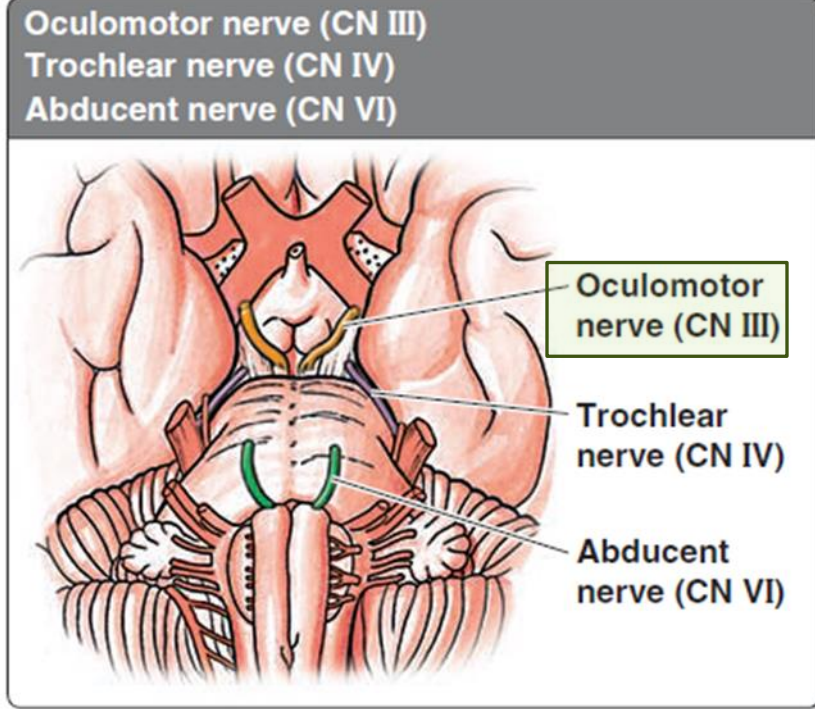


Fig.34: The brainstem. Origin of the oculomotor nerve.

- Because the LPS and the elevators of the eyeball are supplied by the oculomotor nerve, the upper eyelid is elevated when the eye is elevated. This keeps our view-field uncovered.

Oculomotor (III) nerve palsy

- Affects most of the extraocular muscles, the LPS, the sphincter pupillae, and the ciliary muscle of the eye on the same side.
- Main features include:
 - The pupil is directed down and out (depressed and abducted), due to unopposed action of SO and LR
 - Diplopia (double vision)
 - Dilated, unresponsive pupil
 - Loss of accommodation
 - Complete ptosis



The Trochlear nerve (IV) - Motor

- Arises from the posterior surface of the midbrain (the only cranial nerve to do so) and passes around the midbrain.
- Passes through the lateral wall of the cavernous sinus just below the oculomotor nerve.
- Enters the orbit through the SOF outside the common tendinous ring.
- In the orbit, it turns medially, crossing above the LPS, to supply the superior oblique muscle.

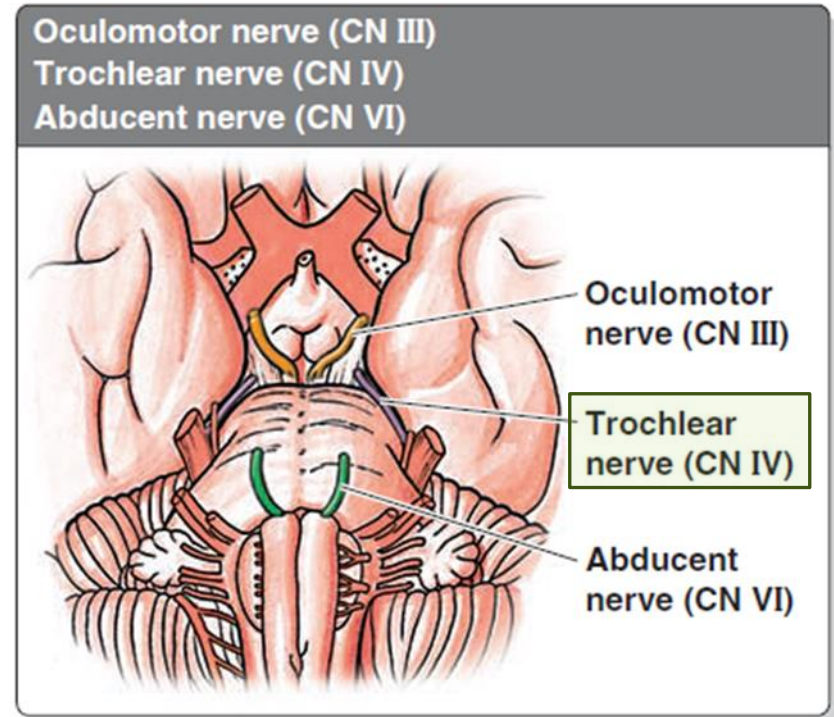


Fig.35: The brainstem. Origin of the trochlear nerve.

Thank You