

Anatomy

Nerves of the orbit

1. frontal nerve:

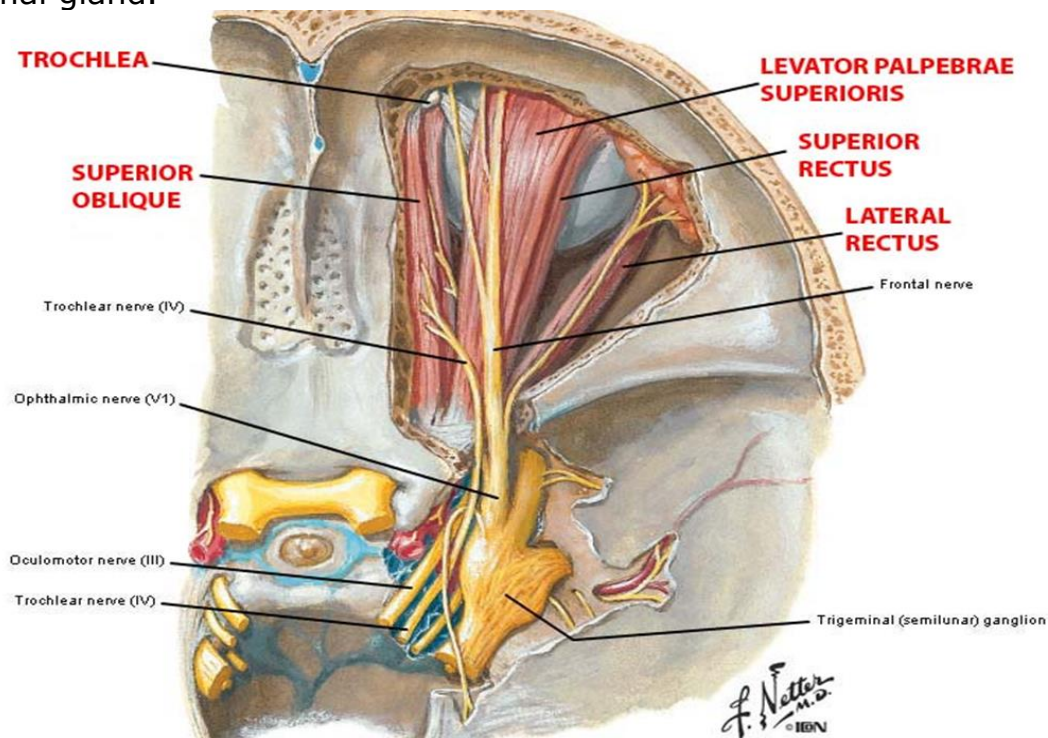
It is a direct continuation of the ophthalmic nerve, enters the orbit through the lateral part of S.O.F. it passes forwards between the roof of the orbit and the levator palpebra superioris and ends by dividing into

- Supra-trochlear nerve: it passes above the trochlea of the superior oblique then wind round the upper margin of the orbit to supply the skin of the forehead, upper eyelid and the conjunctiva.
- Supra-orbital nerve: it is a large nerve passes through the supra-orbital notch to supply the skin of the forehead, frontal sinus, upper eyelid and the conjunctiva.

2. Lacrimal nerve:

It is small nerve arises from the ophthalmic nerve in the lateral wall of the cavernous sinus, and enters the orbit through the lateral part of the S.O.F.

It runs above the lateral rectus to end by supplying the skin of the lateral part of upper eyelid and the conjunctiva. It receives postganglionic parasympathetic fibers from pterygopalatine ganglion via the zygomaticotemporal nerve. These fibers leave the lacrimal nerve to supply the lacrimal gland.



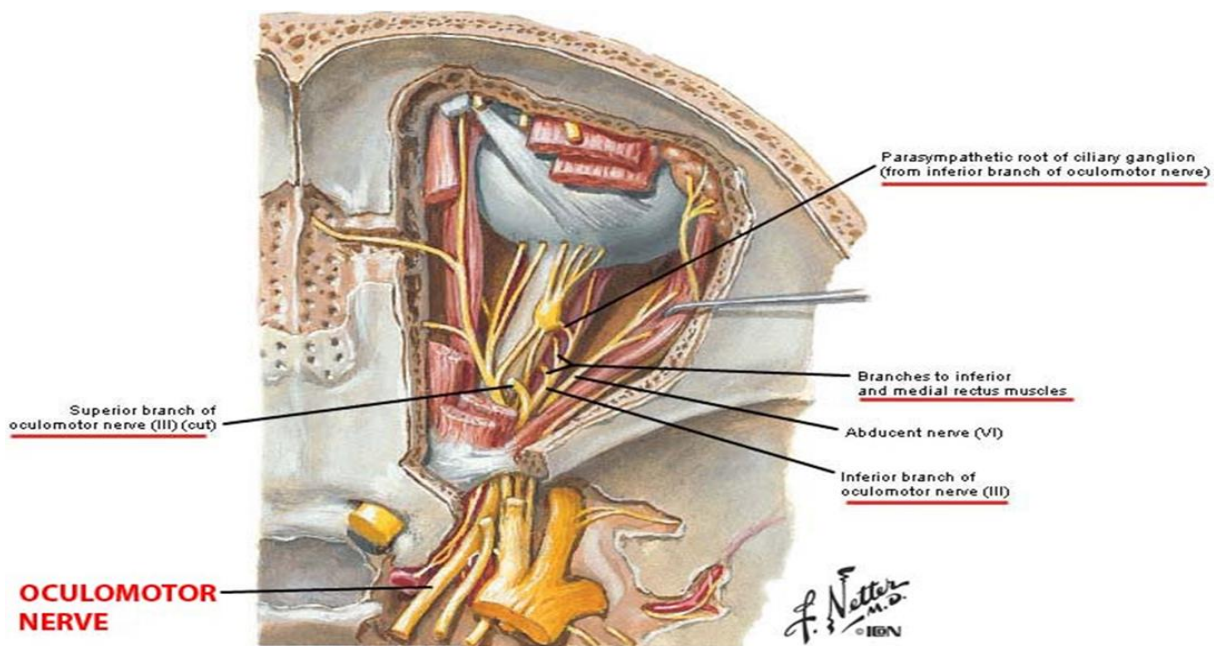
3. nasociliary nerve:

It arises from the ophthalmic nerve in the anterior part of the lateral wall of the cavernous sinus and enters the orbit through the middle part of the S.O.F. is usually the first branch from the ophthalmic nerve and is most deeply placed in the orbit.

In the orbit, it runs forwards and medially, crosses above the optic nerve [with ophthalmic artery] to reach the medial side of the orbit. Then it runs forwards between the superior oblique and the medial rectus to end by dividing into the infratrochlear nerve and anterior ethmoidal nerve.

Branches:

- Communicating branch to the ciliary ganglion: it contains sensory nerve fibers and sympathetic nerve fibers.
- Long ciliary nerves: are 2-3 in number, arise from the nasociliary nerve as it crosses the optic nerve. Then they run along the medial side of the optic nerve and pierce the sclera close to this nerve. It contains sensory fibers to the eyeball except the retina and sympathetic nerve fibers to the dilator pupillae.
- Posterior ethmoidal nerve: it arises at the medial wall of the orbit and passes through the posterior ethmoidal foramen to supply the ethmoid and sphenoid air sinuses.
- Infratrochlear nerve: it is the smaller terminal branch, runs forwards below the trochlea of the superior oblique to appear in the face at the medial angle of the eye. It supplies the medial side of the skin of the upper eyelid and upper half of the external nose.
- Anterior ethmoidal nerve: is the larger terminal branch, leaves the orbit through the anterior ethmoidal foramen, crosses above the ethmoidal air sinus and enters the anterior cranial fossa at the lateral margin of the cribriform plate of the ethmoidal bone. It crosses the cribriform plate and enters the nasal cavity through a slit-like opening alongside the crista galli. It gives internal nasal branch [to the mucous membrane of the anterior part of lateral and medial wall of the nasal cavity] and the external nasal branch [to the skin of lower half of the nose].



4. Optic nerve:[nerve of sight]

Is a second cranial nerve [4 cm long], enters the orbit from the middle cranial fossa through the optic canal. It is surrounded by 3 sheaths of the meninges [dura, arachnoid and pia matter] and its space and is accompanied by the ophthalmic artery [below the nerve].

In the orbit the nerve runs forwards ,laterally and slightly downwards and pierces the sclera medial to the center of its posterior surface[here the meninges are fused with the sclera].

The nasociliary nerve, the ophthalmic artery and the superior ophthalmic vein cross above it, while the ciliary nerves and vessels surround it near the eyeball.

The nerve is slightly longer than the distance it has to run, so that it does not restrict the movements of the eyeball.

It is a sensory nerve [its fibers originate in the retina].

5. oculomotor nerve:

It is a third cranial nerve, has two divisions [superior and inferior] that enters the orbit through the middle part of the S.O.F.

The superior division supplies the superior rectus and the levator palpebrae superioris.

The inferior division is large branch and divides into three parts:

- Nerve to inferior rectus.
- Nerve to medial rectus.
- Nerve to inferior oblique [this nerve gives preganglionic parasympathetic fibers to the ciliary ganglion.

6. ciliary ganglion:

Is a small collection of parasympathetic nerve cells [pin head-sized], lies between the optic nerve and the lateral rectus near the apex of the orbit.

Roots:

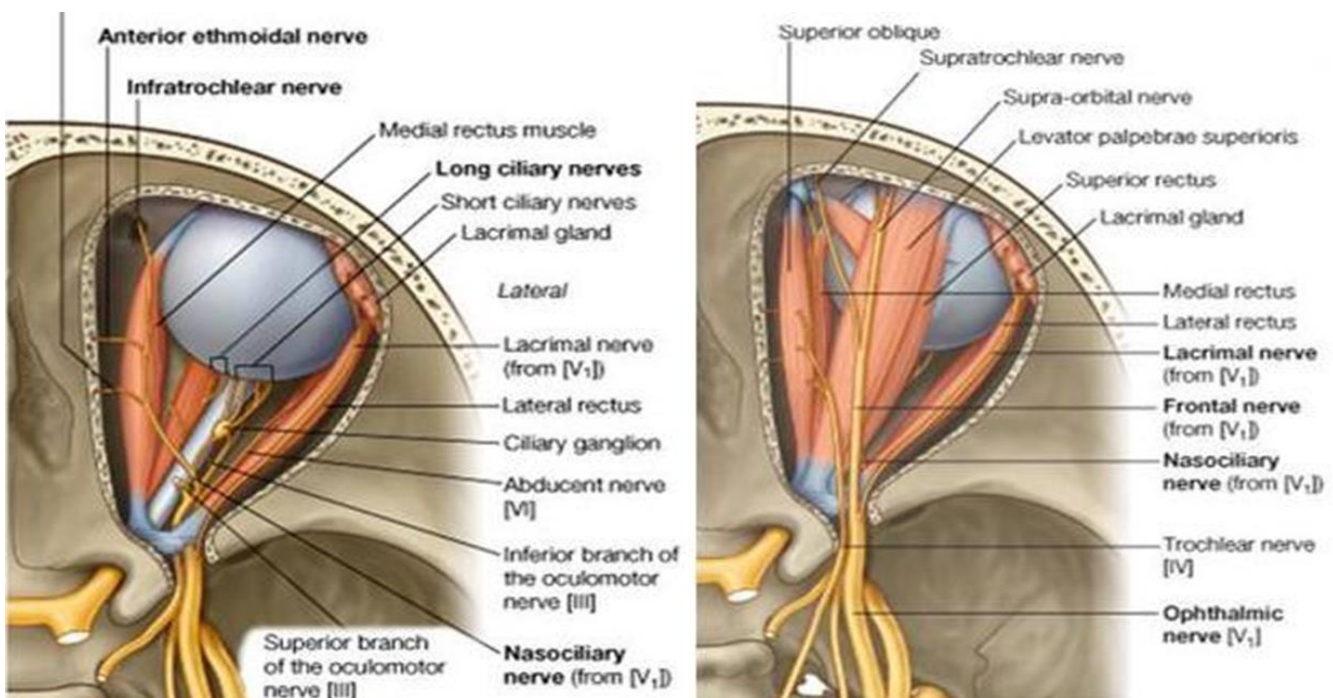
- Parasympathetic root: it receives preganglionic parasympathetic fibers from the oculomotor nerve [via nerve to inferior oblique]. The postganglionic fibers pass through the short ciliary nerves to supply the sphincter pupillae and the ciliary muscles.
- Sensory root: comes from the nasociliary nerve [sensory to the eyeball]
- Sympathetic root: postganglionic sympathetic nerve fibers reach the ganglion from internal carotid plexus through two routes: [A]direct route: the fibers from the internal carotid plexus pass through the S.O.F. to join the ganglion. [B]indirect route: the sympathetic nerve fibers enter the ophthalmic nerve, pass to the nasociliary nerve, then enter the ganglion by the communicating branch of the nasociliary nerve.

7. trochlear nerve:

It is the fourth cranial nerve, enters the orbit through the lateral part of the S.O.F.it runs forwards medially just under the roof of the orbit, it ends by supplying the superior oblique.

8. abducent nerve:

It is the sixth cranial nerve, enters the orbit through the middle part of the S.O.F .it supplies the lateral rectus



Eyelids

Are upper and lower eyelids placed in front of the eye and protect it from the injury and the excessive light by their closure. They meet each other at the medial and lateral angles.

The upper eyelid is larger and more movable due to action of the levator palpebrae superioris.

The space between the two eyelids called the palpebral fissure.

The eyelids consist of four layers:

1. The skin and superficial fascia:

The skin is thin with eyelashes at the free edges of the eyelid.

The ciliary glands [modified sweat gland] between the hair follicles open on to the eyelid margin. Stye is an infection of these glands.

The superficial fascia is thin, loose and devoid of fat.

2. The orbicularis oculi:

3. The tarsi, the palpebral fascia, palpebral ligaments and the tendon of levator palpebrae superioris in the upper eyelid:

Tarsi: are two thin plate of condensed fibrous tissue. The tarsal glands are modified sebaceous glands embedded within the tarsal plate.

- Inferior tarsus: attached to the inferior orbital margin by the palpebral fascia.
- Superior tarsus: is larger and attached to the superior margin of the orbit by the palpebral fascia.

The palpebral fascia: thin fibrous membrane which connects the tarsi to the orbital margins. It is pierced by the nerves and vessels that pass from the orbit to the exterior.

The palpebral ligaments:

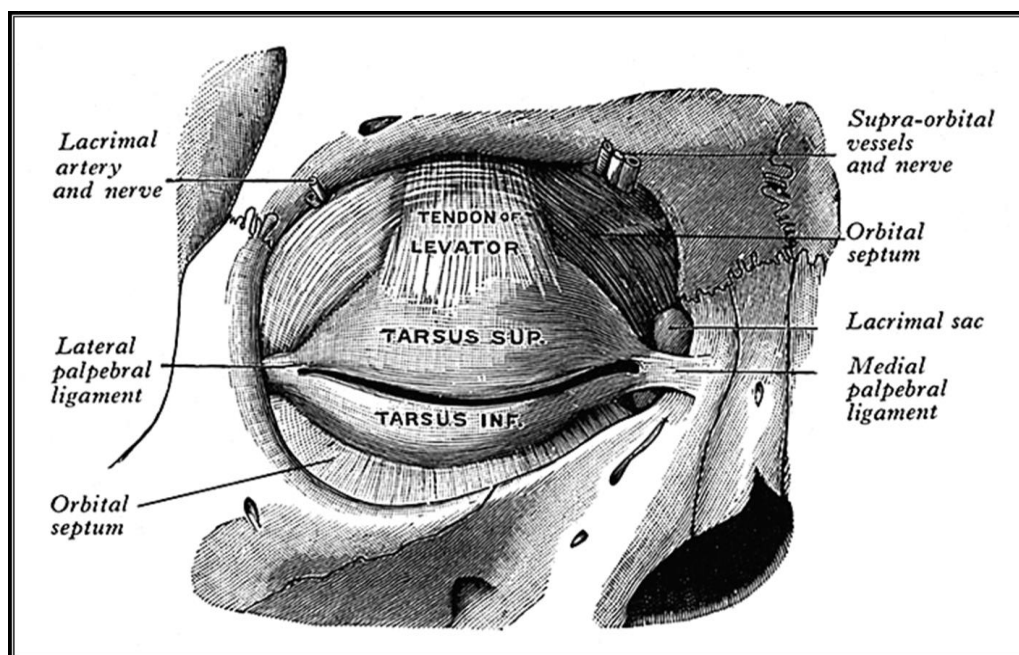
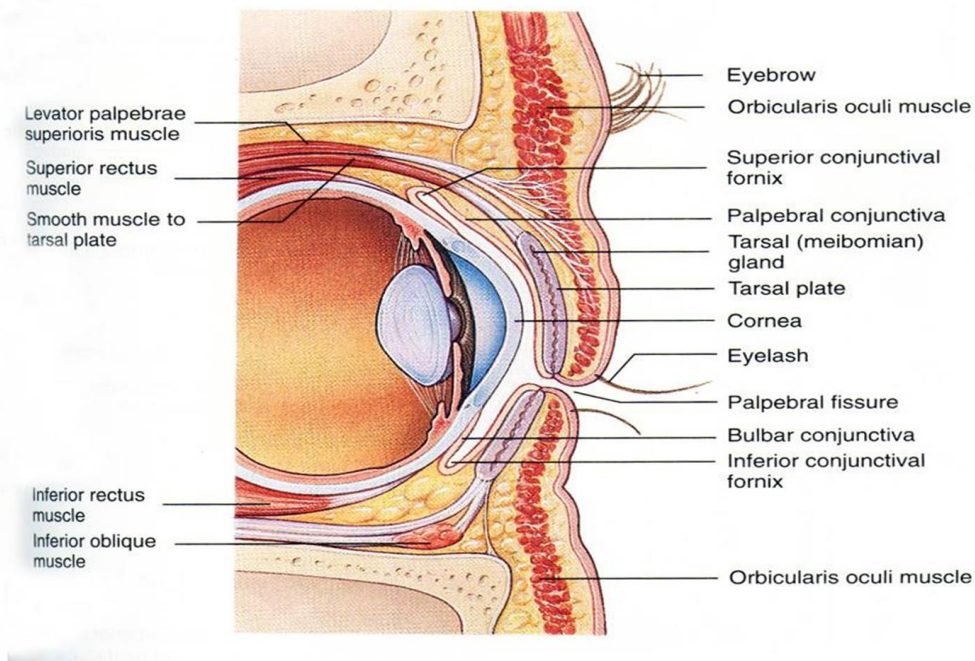
Medial ligament: is strong band that connects the tarsi to medial margin of the orbit. It lies anterior to the lacrimal sac.

Lateral ligament: is a slender band that connects the tarsi to the lateral margin of the orbit.

4. The conjunctiva:

It is a thin mucous membrane that is covered by the stratified squamous epithelium. It lines the deep surface of the eyelids [palpebral conjunctiva] and covers the front of the eyeball [bulbar conjunctiva]. The area of the reflection between the two parts called the superior fornix and inferior fornix. The upper lateral part of the superior fornix is pierced by the ducts of the lacrimal gland.

The conjunctival sac is a potential space between the palpebral and the bulbar conjunctiva.



Lacrimal apparatus

Are the structures that concerned with the secretion and drainage of lacrimal fluid. It is made up of the following parts:

1. Lacrimal gland and its duct:

It is lobulated, serous gland, situated above the eyeball. It has two parts:

Orbital part: lies in groove called lacrimal fossa on the medial side of zygomatic process of the frontal bone at superolateral angle of orbit.

Palpebral part: project downward into upper eyelid between the palpebral fascia and the conjunctiva.

Both parts are continuous with each other around the lateral edge of the aponeurosis of the levator palpebrae superioris. About 12 ducts open into the lateral part of superior fornix of the conjunctiva.

Nerve supply: parasympathetic and sympathetic nerve fibers from the greater and lesser petrosal nerve via the pterygopalatine ganglion [from this ganglion to the maxillary nerve, to zygomatic nerve, to zygomatico-temporal nerve then to lacrimal nerve].

2. Conjunctival sac:

3. Lacrimal puncta and lacrimal canaliculi:

Lacrimal canaliculi are two slender tubes [1 cm long]; each begins as tiny hole called the lacrimal punctum and then runs medially in the margin of eyelid to open into the lacrimal sac.

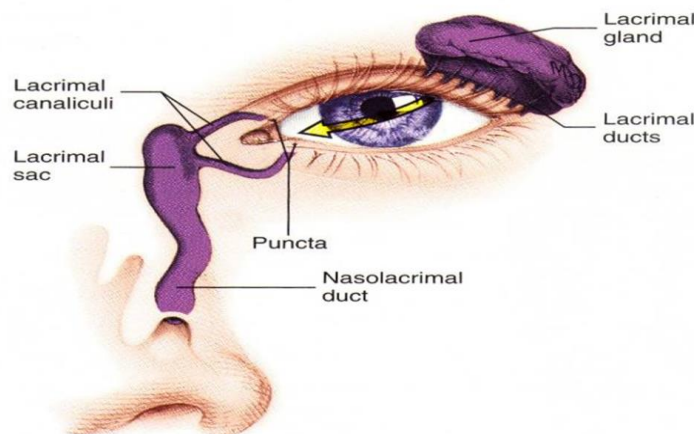
4. Lacrimal sac:

It is a membranous sac lies in the lacrimal groove of lacrimal bone, behind the medial palpebral ligament. About 1 cm long and 0.5 cm wide and continuous inferiorly with the nasolacrimal duct.

5. Nasolacrimal duct:

It is a tube [1.5 cm long and 0.5 cm wide] begins at the anteromedial corner of the floor of orbit and runs downward, backward and laterally to open into the inferior meatus of the nose. The mucous membrane at the medial side of its opening is raised up as lacrimal fold. This act as valve to prevent air and secretion being enter the nasolacrimal duct.

Lacrimal fluid produced by the lacrimal gland → passing through the lacrimal ducts into upper lateral part of the conjunctival fornix → to conjunctival sac → then pass to medial angle of the eye by contraction of the orbicularis oculi → enters the lacrimal canaliculi through the lacrimal puncta → to the lacrimal sac → to the nasolacrimal duct → nose [inferior meatus of the lateral wall].



The eyeball [organ of sight]

It lies in the anterior part of the orbit, encloses in its facial sheath which separates it from the orbital muscles and fat. It is about 2.5 cm in diameter and is spherical in shape.

The eyeball consists of three coats:

1. outer fibrous coat

- Anterior 1/6 is transparent and highly curved called the cornea.
- Posterior 5/6 is opaque called the sclera.

2. the middle coat : it is vascular and muscular layer consists of

- the iris [anteriorly]
- the choroids [posteriorly]
- the ciliary body [which is intermediate in position].

3. The inner nervous coat: consists of the retina which contains light sensitive elements.

Sclera: is composed of dense fibrous tissue. Posteriorly, it is pierced by the optic nerve and is fused with dural sheath that nerve. It is also pierced by the ciliary arteries and nerves.

The iris

It is colored part of the eyeball and is thin and contractile part with central aperture called the pupil.

It lies between the cornea and the lens, and has two sets of the involuntary muscles which control the diameter of the pupil:

1. **The sphincter pupillae:** circular fibers lie around the margin of the pupil. It decreases the size of the pupil.

Nerve supply: preganglionic parasympathetic fibers from the oculomotor nerve to the ciliary ganglion then to this muscle by short ciliary nerves [postganglionic nerve fibers].

2. **The dilator pupillae:** radial fibers which pass toward the periphery of the iris. It increases the size of the pupil.

Nerve supply: it is supplied by postganglionic sympathetic nerve fibers which come from the internal carotid plexus. These nerve fibers pass to the ophthalmic nerve then to the nasociliary nerve then to the dilator pupillae via long ciliary nerves.

The ciliary body: it consists of two parts:

1. external part called the ciliary muscle:

It is involuntary muscle fibers that are arranged in two groups; radial and circular. It is innervated by postganglionic parasympathetic fibers from the ciliary ganglion via the short ciliary nerves.

Contraction of this muscle pulls the ciliary processes forward, relaxes the suspensory ligament and allows the elastic lens to round up [focusing on near objects, called the accommodation].

2. the internal part called the ciliary processes:

It is 70 radial folds that extend toward the margin of the lens [to which it is attached by the suspensory ligament].

Fractures of Orbit

Because of the thinness of the medial and inferior walls of the orbit, a blow to the eye may fracture the orbital walls while the margin remains intact. Indirect traumatic injury that displaces the orbital walls is called a "blowout" fracture. Fractures of the medial wall may involve the ethmoidal and sphenoidal sinuses, whereas fractures of the inferior wall (orbital floor) may involve the maxillary sinus. Although the superior wall is stronger than the medial and inferior walls, it is thin enough to be translucent and may be readily penetrated. Thus a sharp object may pass through it and enter the frontal lobe of the brain.

Orbital fractures often result in intra-orbital bleeding, which exerts pressure on the eyeball, causing exophthalmos (pro-trusion of the eyeball). Any trauma to the eye may affect adjacent structures—for example, bleeding into the maxillary sinus, displacement of maxillary teeth, and fracture of nasal bones resulting in hemorrhage, airway obstruction, and infection that could spread to the cavernous sinus through the ophthalmic vein.

OCULOMOTOR NERVE PALSY

Complete oculomotor nerve palsy affects most of the ocular muscles, the levator palpebrae superioris, and the sphincter pupillae. The superior eyelid droops and cannot be raised voluntarily because of the unopposed activity of the orbicularis oculi (supplied by the facial nerve). The pupil is also fully dilated and non-reactive because of the unopposed dilator pupillae. The pupil is fully abducted and depressed ("down and out") because of the unopposed activity of the lateral rectus and superior oblique, respectively.



note: Loss of innervation of the levator palpebrae superioris by the oculomotor nerve causes an inability to open the superior eyelid voluntarily, producing a complete ptosis.

Loss of innervation of the superior tarsal muscle by sympathetic fibers causes a constant partial ptosis.

ABDUCCENT NERVE PALSY

When the abducent nerve (CN VI) supplying only the lateral rectus is paralyzed, the individual cannot abduct the pupil on the affected side (abducent nerve palsy or paralysis). The pupil is fully adducted by the unopposed pull of the medial rectus



Trochlear Nerve lesion

- Lesion results in **diplopia &**
- Inability to rotate the eye **infero-laterally**.
- So, the eye **deviates; upward and slightly inward**.
- This person has difficulty in walking downstairs

