

The Orbit and its Contents

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MED II/OP-3 GLP
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Objectives

Students should be able to:

- 1) Identify the bones that form the socket for the eyeball, the foramina that open into the socket and review the contents of the foramina.
- 2) Identify the extraocular muscles, their insertions, innervation, actions and consequences of disrupted function.
- 3) Describe the innervation and functional importance of the intrinsic muscles of the eye.

References:

Blumenfeld H.: 2002. **Neuroanatomy through Clinical Cases**. Sunderland, Sinauer Assoc Inc., pp. 530-544.

Moore KL, Dalley AF.: 2006. **Clinically Oriented Anatomy**., 5th ed., Philadelphia: Lippincott Williams & Wilkins, pp. 957-976.

Using the skulls provided (refer to Netter's Atlas, 4th ed., Plate 2) and identify the different bones (**maxillary, zygomatic, frontal, lacrimal, ethmoid, sphenoid**) that contribute to the formation of the orbit or socket for the eyeball. Also identify the **optic canal, superior and inferior orbital fissures, foramen rotundum**.

What important structures traverse the superior orbital fissure and optic canal?

Examine the pre-dissected specimens of the orbital cavities provided. Several are available (some with different exposures) because no one specimen will reveal equally well all structures to be identified. Be certain to circulate among them as required.

In most cases the orbital plate of the frontal bone will have been removed so that the orbital cavity is approached from above. If this is the case structures located in the superior part of the orbital cavity will be readily identified. With the aid of **Netter's Atlas 4th ed., Plates 83-86** and the models available in lab identify the **levator palpebrae superioris** muscle (the most superior of all muscles). Note this muscle as well as the superior and inferior obliques do not arise from the common tendon (**annulus tendineus**) attached at the apex of the orbit to the body and lesser

wing of sphenoid bone and extending across the optic canal and superior orbital fissure.

Find the **frontal nerve** (largest branch of CN V₁) as it enters the orbit above the annulus from the superior orbital fissure. Note that it divides into the lateral supraorbital and medial supratrochlear branches.

Lateral to the frontal nerve along the upper part of the lateral wall of the orbit find the **lacrimal nerve** (also a branch of CN V₁) on its way to the **lacrimal gland**. This nerve also enters the orbit from the superior orbital fissure above the annulus.

The **trochlear nerve** (outside the annulus) should now be identified on its way to the **superior oblique** (SO) muscle. It enters the orbit with the frontal and lacrimal nerves. Also identify the pulley or **trochlea** of the SO muscle. You should note in a specimen in which the levator palpebrae and superior rectus have been retracted (or on a model) that the SO muscle inserts on the upper lateral quadrant of the posterior eyeball. When it contracts it turns the eyeball downward and outward

Find the **superior rectus** muscle (which underlies the levator palpebrae). The levator palpebrae and superior rectus muscles are innervated by CN III. The superior and inferior recti tend to pull ~ 20° off the long axis of the eye. This medial pull is offset by the pull of the obliques so that an upward/downward movement of the eye can occur.

In a specimen in which the levator palpebrae and superior rectus muscles have been cut and reflected, the **optic nerve** (invested by the 3 meningeal layers) should be identified. Lateral to it about 1 cm from apex of orbit (well back in the orbit) it may be possible to see the small **ciliary ganglion** which is only ~1-2 mm diam. (**Netter's Atlas 4th ed., Plate 121**).

Beneath the superior oblique muscle find the **medial rectus** muscle

Along the lateral wall of the orbit partly concealed by the lacrimal gland find the **lateral rectus** muscle. You should also be able to identify the **abducent nerve** applied to its medial surface.

With the levator palpebrae and superior rectus muscles cut and reflected the **superior division of CN III** may be seen entering the underside of these 2 muscles which it innervates. The **inferior division of CN III** innervates the medial and inferior recti, the inferior oblique and the intrinsic muscles of the eye via the ciliary ganglion. It may be difficult distinguishing the inferior division from the nasociliary nerve and its branches. The nasociliary nerve (the third branch of CN V₁) enters the orbit through the annulus from the superior orbital fissure and conveys sensory information from the eyeball, nose, medial lids, ethmoidal and sphenoid sinuses.

Attempt to identify the **ophthalmic artery** (it may not be present on all projects). The ophthalmic artery enters within the annulus and lies below the optic nerve upon entering the orbit and then lateral to it. It gives off the lacrimal artery and then turns medially to lie above the optic nerve where it gives off a number of branches among which is the **central artery of the retina**. The terminal branches are the supraorbital and ethmoidal. Note that the ophthalmic veins (superior and inferior) which are likely not preserved unite to form a common trunk before

leaving the orbit (above, through or below the annular tendon) to enter the superior orbital fissure.

Recall from NE 9 the innervation (Netter's Atlas, 4th ed., Plate 132) and functions of the intrinsic (sphincter pupillae, ciliary muscle) muscles of the eye. Review the innervation and functions of the extrinsic muscles (levator palpebrae, obliques, recti) of the eye were seen in this lab session.

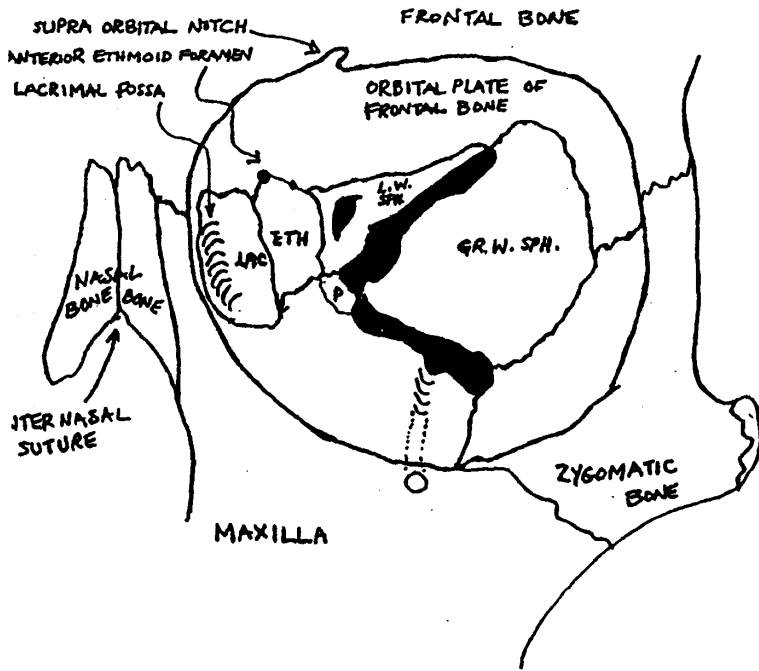
Of what clinical significance is the ophthalmic vein?

Does occlusion of the ophthalmic artery or retinal artery result in blindness of the eye supplied?

With the aid of Netter's Atlas, 4th ed., Plate 104 examine the relationship of CN's III, IV and VI to the cavernous sinus and be aware that lesions of the cavernous sinus can affect these nerves and result in impaired eye movement and a fixed and dilated pupil.

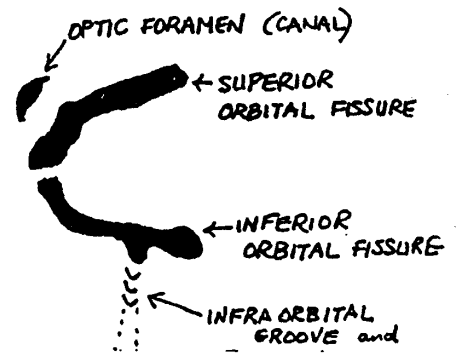
Review and be able to discuss the connections between the facial, ophthalmic veins, and cavernous sinus and between the external and internal carotid arterial circulations via the ophthalmic artery and their possible clinical importance.

BONES FORMING WALL of LEFT ORBIT

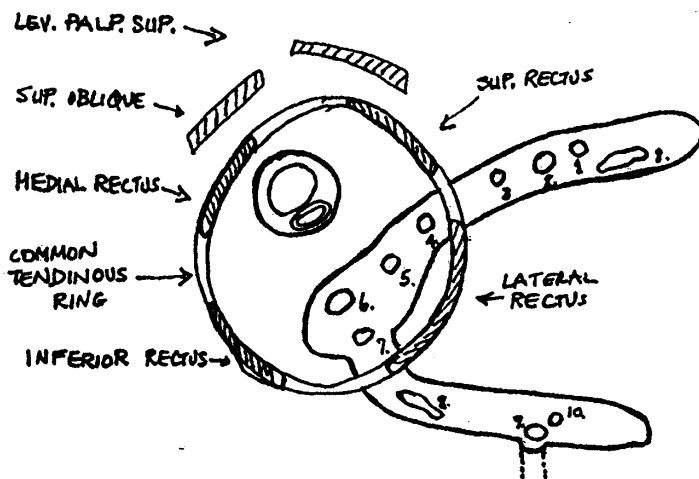


KEY:

- LAC = LACRIMAL BONE
- ETH = ETHMOID BONE
- L.W. SPH. = LESSER WING of SPHENOID
- GR.W. SPH. = GREATER WING of SPHENOID
- P = ORBITAL PROCESS of PALATINE BONE



MAIN STRUCTURES ENTERING ORBIT (LEFT SIDE) and MUSCLE ORIGINS



NOTE
INFERIOR OBLIQUE ORIGINATES FROM ANTERIOR PART OF FLOOR OF ORBIT

THROUGH OPTIC FORAMEN:

- OPTIC NERVE
- OPHTHALMIC ARTERY

THROUGH SUPERIOR ORBITAL FISSURE:

1. LACRIMAL NERVE V¹
2. FRONTAL NERVE V¹
3. TROCHLEAR NERVE IV
4. SUPERIOR DIV., OCULOMOTOR N.
5. NASOCILIARY NERVE V¹
6. INFERIOR DIV., OCULOMOTOR N.
7. ABDUCENS NERVE VI

8. OPHTHALMIC VEINS, BRANCHES LEAVE IN SUPERIOR + INFERIOR ORB. FISS.

THROUGH INFERIOR ORBITAL FISSURE:

9. INFRA ORBITAL NERVE V²
10. ZYGOMATIC NERVE V²

