The Orbit and Extraocular muscles

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The orbit is the cavity of the skull in which the eye and its appendages are situated. It is composed of seven bones and has a pyramidal shape, with its apex pointed posteromedially. The orbital contents comprise the eye; orbital and retrobulbar fascia; extraocular muscles; cranial nerves II, III, IV, V, and VI; blood vessels; fat; lacrimal gland with its sac and nasolacrimal duct; eyelids; palpebral and suspensory ligaments; ciliary ganglion; and short ciliary nerves.

Bones and Structure of the orbit

- Shaped like a quadrangular pyramidal cavern in the upper face, with a superficial base (orbital margin) and a deep, posteromedial apex.
  - **Orbital margin:**
    - Superior margin: frontal bone
    - Medial margin: frontal process of the maxilla
    - Inferior margin: zygomatic process of the maxilla and zygomatic bone
    - Lateral margin: zygomatic process of the frontal bone and frontal process of the zygomatic bone
  - **Apex:** optic foramen

- **Walls:** covered with periosteum (periorbita)
  - Superior (roof): orbital part of the frontal and lesser wing of the orbit
sphenoid
- Medial: orbital plate of ethmoid bone, body of sphenoid bone, frontal bone, lacrimal bone, and maxilla
- Inferior (floor): orbital surface of the maxilla, zygomatic bone, and palatine bone
- Lateral: greater wing of sphenoid, orbital plate of frontal bone, and frontal process of zygomatic bone

**Important openings:**
- Optic foramen or canal
- Anterior and posterior ethmoidal foramina
- Superior and inferior orbital fissures
- Infraorbital groove
- Supraorbital notch

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**Mnemonic**

To help memorize the bones that make up the orbit, remember:

**Many Friendly Zebras Enjoy Lazy Summer Picnics**
- Many: Maxilla
- Friendly: Frontal bone
- Zebras: Zygomatic bone
- Enjoy: Ethmoid bone
- Lazy: Lacrimal bone
- Summer: Sphenoid bone
- Picnics: Palatine bone

**Image:** The right orbit and the seven bones that comprise its walls: frontal (red), maxilla (orange), lacrimal (green), ethmoid (purple), sphenoid (yellow), palatine (dark orange), and zygomatic (blue) bones. By OpenStax College. License: CC BY 3.0

**Image:** The left orbit, featuring its many openings: optic foramen, ethmoidal foramina, superior and inferior orbital fissures, infraorbital groove, and supraorbital notch. By Dr. Johannes Sobotta. License: Public Domain

### Extraocular muscles

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<td>Anterior, superior surface of the eye</td>
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**Inferior oblique**
- Lateral to the lacrimal groove (maxilla)
- Posterior, inferior, lateral surface of the eye
- Inferior branch of the ophthalmic artery and infraorbital artery
- Inferior branch of oculomotor nerve (CN III)
- Extorsion, elevation and abduction

**Levator palpebrae superioris**
- Lesser wing of the sphenoid, above the optic canal
- Tarsal plate of upper eyelid
- Supraorbital branch of the ophthalmic artery
- Superior branch of oculomotor nerve (CN III)
- Sympathetic fibers innervate the smooth muscle fibers on the inferior surface of this muscle
- Retracting and elevating the eyelid

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Image: “Extraocular muscles” by OpenStax, License: [CC BY 3.0](https://creativecommons.org/licenses/by/3.0)

Image: Eye movements for each extraocular muscle. By Lecturio.

Image: Eye movements for each extraocular muscle. Note the synergistic movements of the superior rectus and oblique, as well as the inferior rectus and oblique muscles. By OpenStax. License: [CC BY 4.0](https://creativecommons.org/licenses/by/4.0) Edited by Lecturio.
Oculomotor (CN III)
- Infarction of midbrain
- Berry aneurysm at junction of posterior communicating and internal carotid arteries
- Lesions of cavernous sinuses (neoplasm, vascular, or inflammatory)
- Horizontal temporal deviation
- Down and out gaze
- Ptosis
- Pupillary dilation

Trochlear (CN IV)
- Head trauma
- Tumor at base of skull
- Microvasculopathy
- Idiopathic
- Eye is up and in

Abducens (CN VI)
- Postviral syndrome
- Ischemic mononeuropathy
- Eye directed medially

Mnemonic
To help memorize the innervation of the extraocular muscles, remember:

**LR6, SO4, 3**

Lateral rectus innervated by the abducens nerve (CN VI)

Superior oblique innervated by the trochlear nerve (CN IV)

The remaining extraocular muscles are innervated by the oculomotor nerve (CN III)

Video Gallery

Overview of the 7 Extraocular Muscles – Orbital Muscles and Innervation by Craig Canby, PhD

Functions of the Extraocular Muscles – Orbital Muscles and Innervation by Craig Canby, PhD

Innervation of Extraocular Muscles – Orbital Muscles and Innervation by Craig Canby, PhD

Lacrimal apparatus

- **Lacrimal gland:**
  - Serous, releases aqueous layer of tear fluid directly onto the eyeball
  - Minimizes friction, protects, and cleans the eye (“tear film”)
  - Located on upper lateral aspect of orbit, drains via lacrimal ducts to the superior conjunctival fornix
  - Innervated by parasympathetic fibers of the facial nerve (VII) via the pterygopalatine ganglion

- **Tears:**
  - Isotonic solution
  - Contains bactericidal enzymes (lysozyme and lactoferrin), immunoglobulin A, and lipocalin

- **Tarsal or Meibomian glands:**
  - Sebaceous glands, produce meibum, which prevents evaporation of the tear film
  - Located within tarsal plate of eyelids (within the superior eyelid) with orifices at the rim of the marginal zone of the conjunctiva

- **Tear drainage system:** consists of
  - Lacrimal canaliculi
  - Lacrimal sac: dilated portion of the nasolacrimal duct
Nasolacrimal duct: drains into the inferior nasal meatus

Differential Diagnosis

**Orbital and preseptal cellulitis**: Possible complications to paranasal sinusitis or trauma to the eye orbit. Patients may present with fever, malaise, proptosis ophthalmoplegia, toxic shock, and impaired vision.

**Orbital fractures**: Fractures to the eye sockets and are classified as orbital rim fractures, direct orbital floor fracture, and blowout fractures. These fractures can present with blurry, decreased or double vision, and black and blue bruising around the eyes.

**Dacryoadenitis**: An inflammation of the lacrimal glands commonly due to a bacterial or viral infection. May present as swelling of the outer portion of the upper lid, with redness and tenderness, pain in the area of swelling, excess tearing, and swelling of the preauricular lymph nodes.

**Sjögren’s syndrome**: An autoimmune disease that affects the moisture-producing glands of the body. Primary symptoms are dry mouth and dry eyes.

**Strabismus**: A condition characterized by a misalignment of the eyes. If left untreated throughout childhood, it may result in amblyopia or loss of depth perception.

**Blepharitis**: One of the most common ocular conditions characterized by inflammation, scaling, reddening, and crusting of the eyelid. May also present with a burning, itching, or grainy sensation.

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