



Anatomic Properties and Specific Peculiarities of the Eye

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Abstract: The eye is protected from mechanical injury by being enclosed in a socket, or orbit, which is made up of portions of several of the bones of the skull to form a four-sided pyramid, the apex of which points back into the head. Thus, the floor of the orbit is made up of parts of the maxilla, zygomatic, and palatine bones, while the roof is made up of the orbital plate of the frontal bone and, behind this, by the lesser wing of the sphenoid.

Key words: eye, foramen, artery, layer, fluid.

The optic foramen, the opening through which the optic nerve runs back into the brain and the large ophthalmic artery enters the orbit, is at the nasal side of the apex; the superior orbital fissure is a larger hole through which pass large veins and nerves. These nerves may carry nonvisual sensory messages—e.g., pain—or they may be motor nerves controlling the muscles of the eye. There are other fissures and canals transmitting nerves and blood vessels. The eyeball and its functional muscles are surrounded by a layer of orbital fat that acts much like a cushion, permitting a smooth rotation of the eyeball about a virtually fixed point, the centre of rotation. The protrusion of the eyeballs—proptosis—in exophthalmic goitre is caused by the collection of fluid in the orbital fatty tissue. It is vitally important that the front surface of the eyeball, the cornea, remain moist. This is achieved by the eyelids, which during waking hours sweep the secretions of the lacrimal apparatus and other glands over the surface at regular intervals and which during sleep cover the eyes and prevent evaporation. The lids have the additional function of preventing injuries from foreign bodies, through the operation of the blink reflex. The lids are essentially folds of tissue covering the front of the orbit and, when the eye is open, leaving an almond-shaped aperture. The points of the almond are called canthi; that nearest the nose is the inner canthus, and the other is the outer canthus. The lid may be divided into four layers: (1) the skin, containing glands that open onto the surface of the lid margin, and the eyelashes; (2) a muscular layer containing principally the orbicularis oculi muscle, responsible for lid closure; (3) a fibrous layer that gives the lid its mechanical stability, its principal portions being the tarsal plates, which border directly upon the opening between the lids, called the palpebral aperture; and (4) the innermost layer of the lid, a portion of the conjunctiva. The conjunctiva is a mucous membrane that serves to attach the eyeball to the orbit and lids but permits a considerable degree of rotation of the eyeball in the orbit. The conjunctiva lines the lids and then bends back over the surface of the eyeball, constituting an outer covering to the forward part of this and terminating at the transparent region of the eye, the cornea. The portion that lines the lids is called the palpebral portion of the conjunctiva; the portion covering the white of the eyeball is called the bulbar conjunctiva. Between the bulbar and the palpebral conjunctiva there are two loose, redundant portions

forming recesses that project back toward the equator of the globe. These recesses are called the upper and lower fornices, or conjunctival sacs; it is the looseness of the conjunctiva at these points that makes movements of lids and eyeball possible.

The fibrous layer, which gives the lid its mechanical stability, is made up of the thick, and relatively rigid, tarsal plates, bordering directly on the palpebral aperture, and the much thinner palpebral fascia, or sheet of connective tissue; the two together are called the septum orbitale. When the lids are closed, the whole opening of the orbit is covered by this septum. Two ligaments, the medial and lateral palpebral ligaments, attached to the orbit and to the septum orbitale, stabilize the position of the lids in relation to the globe. The medial ligament is by far the stronger. Closure of the lids is achieved by contraction of the orbicularis muscle, a single oval sheet of muscle extending from the regions of the forehead and face and surrounding the orbit into the lids. It is divided into orbital and palpebral portions, and it is essentially the palpebral portion, within the lid, that causes lid closure. The palpebral portion passes across the lids from a ligament called the medial palpebral ligament and from the neighbouring bone of the orbit in a series of half ellipses that meet outside the outer corner of the eye, the lateral canthus, to form a band of fibres called the lateral palpebral raphe. Additional parts of the orbicularis have been given separate names—namely, Horner's muscle and the muscle of Riolan; they come into close relation with the lacrimal apparatus and assist in drainage of the tears. The muscle of Riolan, lying close to the lid margins, contributes to keeping the lids in close apposition. The orbital portion of the orbicularis is not normally concerned with blinking, which may be carried out entirely by the palpebral portion; however, it is concerned with closing the eyes tightly. The skin of the forehead, temple, and cheek is then drawn toward the medial (nose) side of the orbit, and the radiating furrows, formed by this action of the orbital portion, eventually lead to the so-called crow's feet of elderly persons. It must be appreciated that the two portions can be activated independently; thus, the orbital portion may contract, causing a furrowing of the brows that reduces the amount of light entering from above, while the palpebral portion remains relaxed and allows the eyes to remain open. Opening of the eye is not just the result of passive relaxation of the orbicularis muscle but also is the effect of the contraction of the levator palpebrae superioris muscle of the upper lid. This muscle takes origin with the extraocular muscles at the apex of the orbit as a narrow tendon and runs forward into the upper lid as a broad tendon, the levator aponeurosis, which is attached to the forward surface of the tarsus and the skin covering the upper lid. Contraction of the muscle causes elevation of the upper eyelid. The nervous connections of this muscle are closely related to those of the extraocular muscle required to elevate the eye, so that when the eye looks upward the upper eyelid tends to move up in unison.

The orbicularis and levator are striated muscles under voluntary control. The lids also contain smooth (involuntary) muscle fibres that are activated by the sympathetic division of the autonomic system and tend to widen the palpebral fissure (the eye opening) by elevation of the upper, and depression of the lower, lid.

In addition to the muscles already described, other facial muscles often cooperate in the act of lid closure or opening. Thus, the corrugator supercilii muscles pull the eyebrows toward the bridge of the nose, making a projecting "roof" over the medial angle of the eye and producing characteristic furrows in the forehead; the roof is used primarily to protect the eye from the glare of the sun. The pyramidalis, or procerus, muscles occupy the bridge of the nose; they arise from the lower portion of the nasal bones and are attached to the skin of the lower part of the forehead on either side of the midline; they pull the skin into transverse furrows. In lid opening, the frontalis muscle, arising high on the forehead, midway between the coronal suture, a seam across the top of the skull, and the orbital margin, is attached to the skin of the eyebrows. Contraction therefore causes the eyebrows to rise and opposes the action of the orbital portion of the orbicularis; the muscle is especially used when one gazes upward. It

is also brought into action when vision is rendered difficult either by distance or the absence of sufficient light.

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