Surgical Anatomy of the Orbit

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Most of the available texts that depict anatomy of the orbital region have a lifeless quality about them. The currently available volumes vary in the methods of illustrating the anatomy from simple diagrammatic line drawings or photographs of fixed tannish-brown cadaver material to elaborately colored artistic interpretations. We are in the process of producing an anatomic atlas of fresh dissections that represents the essential anatomy from a purely surgical viewpoint. Since unembalmed specimens should be used for only short periods, many different bodies were required to show the entire orbital region. However, certain specimens were earmarked to provide valuable anatomic insights, and that is what we aim to present here.

We became aware that a few of the slides could dramatically enhance a surgeon’s understanding of the anatomy. Due to space limitations, we chose to present six key demonstrations. For the purpose of orientation and identification of the essential anatomy, artist’s line diagrams are also employed.

INFRAORBITAL REGION

The right nasal bone has been removed as well as a portion of the inferior orbital rim (Fig. 1). The infraorbital nerve (ION) is lifted by a probe, and one can see the anterior superior alveolar nerve (ASAuv) emanating from it. The nasolacrimal duct (NLD) descends from the lacrimal sac (LS), ending in the inferior meatus.

Comment

The infraorbital nerve (ION) supplies sensation to the skin and conjunctiva of the lower eyelid, the lateral aspect of the nose, the anterior cheek, and the upper lip. The anterior superior alveolar nerve descends from the infraorbital nerve into or along the maxillary bone, supplying sensation to the anterior maxillary dentition and gingiva. This explains the occasional anesthesia

Fig. 1. (Left) Infraorbital region dissection. (Right) Infraorbital region schematic.

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of the incisors seen following the Caldwell-Luc approach or severely comminuted maxillary wall fractures. Following trauma to the anterior maxillary region, one should check for numbness to the gingiva over the anterior three teeth on the side of the injury. Since this nerve is more likely injured by disruption of the anterior maxillary plate, such a numbness would provide stronger...
evidence for fracture in this region as opposed to simple neuropraxia due to hematoma or swelling around the infraorbital nerve.

Medial to the infraorbital nerve, the nasolacrimal canal exits into the inferior meatus about 15 mm from the nasal floor. The medial sinus wall is thin here and is easily penetrated for antral drainage with minimal fear of injuring important structures. This view shows the absolute length of the bony nasolacrimal canal to be about 12 mm.

**Orbital Septum**

The orbital septum comprises that unique diaphragm at the entrance to the orbit (Fig. 2). Peripherally, this structure attaches at the arcus marginalis, i.e., the thickened edge where periosseum becomes periorbitum. In a prior publication, one author\(^1\) (Zide) stated that the orbital septum usually appears to thicken laterally in the lower lids, which might possibly explain the higher incidence of medial fat herniation. Also noted was the feeling that the thickness of the orbital septum probably varies from place to place in the eyelids and from person to person. We would like to add that age seems to be a critical factor in septum thickness. This structure probably thins with time, just as do all the other supporting structures of the orbit. Thus, as shown in Figure 2 (left), an inelastic orbital septum of considerable thickness in the third decade might, in fact, become gossamer by the time the patient is in the sixth or seventh decade (Fig. 2, right).

In this prior publication, the author postulated that herniation of the lower lid fat may be due
to other causes: (1) the lack of steepness of the infraorbital rim, (2) the presence of a potential space in front of the orbital rim laterally (recess of Eisler), and (3) lack of tone in the lower lid. We also believe that as the patient ages, the interlacing multiple orbital fascial structures, including Lockwood's ligament, become lax, allowing the globe to move downward, thus illowing out the thinning orbital septum. Upper lid medial fat pad herniation could result from fascial weakening among the lobules, thinning of the orbital septum, and perhaps the downward displacement of the globe (producing a potential space for this herniation).

**Lower Lid Retractors**

During full downgaze, the lower lid descends approximately 2 mm in conjunction with movement of the globe itself (Fig. 3). The inferior rectus muscle (*IR*), which rotates the globe downward simultaneously, uses its fascial extension (*Inf Retrctrs*) to retract the lower eyelid. This extension, which arises from the inferior rectus, is commonly called the *capsulopalpebral fascia*.

In this view, the *orbital septum and retroseptal fat have been removed*. A blue marker has been placed in the inferior conjunctival cul-de-sac. Note the extension from the inferior rectus muscle (*IR*), which splays out and inserts into the region of the inferior tarsus (*Inf T*) of the lower lid. This represents the fanning of the capsulopalpebral head of the inferior rectus muscle. During the usual transconjunctival exposure for lower rim fractures, the surgical approach would automatically transect conjunctiva and lower lid retractors to become preseptal in the lower eyelid. Although the surgeon should be aware of this anatomy, careful layered closure after surgical exploration is not critical.

The importance of the lower lid retractor system should be emphasized, however. A frequent complaint of patients who have undergone lower eyelid reconstruction using a large chondromucosal strut centers around obstructed vision in downgaze.

**Lateral Retinaculum**

The lateral retinaculum is best described as a condensation of the supporting adnexal structures of the orbit and eyelids in the lateral region (Fig. 4). The lateral canthal tendon (*LCT*) is merely one component of this complex system. In this figure, forceps are holding the lateral horn of the levator aponeurosis (*Lev. L Horn*).

The lateral horn separates the lobes of the lacrimal gland into palpebral and orbital lobes. The lateral extension of Whitnall's ligament (*WL*) is seen just posterior to the levator attaching to the lacrimal fascia. A major portion of the retinaculum is formed by the insertion of the lateral canthal tendon on a bony tubercle (Whitnall's tubercle). Inferiorly, Lockwood's ligament (see

**Fig. 6. (Above and center)** The lateral orbital rim has been removed. The forceps hold the ligament where it attaches at the lateral retinaculum. The inferior rectus (*IR*) and the inferior oblique (*IO*) are easily seen. The hammock supports the globe; the lacrimal gland (*LG*) is noted. **(Below)** The arrows depict the anterior portion of the hammock.
Fig. 6, below) inserts and partially forms the inferior portion of the retinaculum. Other elements that contribute to the lateral retinaculum are the orbital septum as it passes posteriorly as well as the cheek ligaments from the lateral rectus muscle.

**Corrugator**

The corrugator muscle (corrM) arises at the junction of the frontalis (FM) and orbicularis oculi muscles in the medial portion of the upper lid and inserts onto the frontal bone above the nasofrontal suture (Fig. 5). This muscle may be cut during forehead lifts in an effort to reduce the amount of glabellar wrinkling. Because supraorbital vessels and nerves frequently pass deep to or through the muscle, careful dissection should be performed in this area. In this presentation, the frontalis muscle was incised and reflected to expose the corrugator (corrM). Large blood vessels and nerves are seen exiting quite close to this muscle inferiorly. One can easily understand how postoperative bleeding or numbness could occur after resection of the corrugator muscle.

**Lockwood’s Ligament**

The lower part of the fascia of the globe is thickened to form a sling or hammock on which the globe rests and which has been commonly called the **ligament of Lockwood (LL)** (Fig. 6). It is supposedly responsible for support of the eye even after removal of the orbital floor. Where this fascia is pierced by the extrinsic muscles of the eye, a round tubular reflection of this fascia occurs that encases the muscles. Laterally and medially in the anterior orbit, the extensions of these fascial envelopes to the orbital rims are known as the check ligaments to the lateral and medial recti. Although it is easy to understand the concept of Lockwood’s ligament acting as a true hammock for the globe, this is difficult to demonstrate in surgical dissections. Figure 6 (above and center) shows the forceps grasp of the lateral part of the ligament prior to attachment into the retinaculum. The lateral orbital rim has been removed while still holding the insertion with forceps (LatRet). The fascia is seen subjacent to the globe pierced by the inferior oblique (IO) muscle prior to its insertion. The final dissection depicts a portion of the lateral hammock prior to insertion into the retinaculum (suture).

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