Thomas Procedures in
FACIAL PLASTIC SURGERY
Blepharoplasty

英文原版

Thomas 面部美容整形
眼睑成形术

IRA D. PAPEL

人民卫生出版社
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英文原版

Blepharoplasty

Thomas Procedures in Facial Plastic Surgery

Thomas 面部美容整形：眼睑成形术

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1

Surgical Anatomy of the Eyelid

Eugene A. Chu, MD, Theda C. Kontis, MD and Ira D. Papel, MD

Introduction

The eyes are the most prominent facial feature and provide important cues for recognition and emotion. The eyelids serve a critical function by protecting the anterior surface of the globe from dessication and local trauma. Furthermore, they aid in tear film maintenance, and their movement distributes the tear film evenly as it makes it way to the medial canthus to enter the lacrimal system. Blepharoplasty is an important component of the surgical treatment of the aging face and understanding the detailed anatomy of the eyelid is critical to its success.

The eyelids are multilamellar structures divided into an anterior lamella containing skin and orbicularis oculi muscle and a posterior lamella composed of the tarsal plate and conjunctiva (**Figure 1-1**). This chapter reviews key structures of lid anatomy: skin and subcutaneous tissues, orbicularis oculi muscle, submuscular areolar tissue, tarsal plates, lid margins, orbital septum, preapneurotic fat pads, lid retractors, and conjunctiva. Additionally, the neurovascular anatomy and relevant related surgical anatomy will be discussed.

Surface Anatomy

The upper and lower eyelids (palpebrae) are folds of tissue that meet at the medial and lateral aspects of the globe at each canthus. The upper lid extends superiorly to the eyebrow, whereas the lower lid merges with the cheek below the inferior orbital rim. The lateral canthus lies 2 to 4 mm superior to the medial canthus. While the lids are open, they form an elliptical space—the palpebral fissure—which is approximately 10–12 mm high and 28–30 mm wide (**Figure 1-2**). With age, height may decrease to only 8–10 mm.

The surface of the eyelid and periorbital region has multiple folds and mounds that are visible (**Figure 1-2**). The superior palpebral sulcus is formed by the attachment of the levator aponeurotic fibers to the skin of the upper eyelid and is located approximately 8–11 mm superior to the eyelid margin. The inferior palpebral sulcus, which is more prominent in children, is seen 3–6 mm below the lower lid margin and roughly delineates the inferior edge of the tarsal plate and the transition zone from pretarsal to preseptal orbicularis oculi. The nasojugal fold runs inferolaterally from the medial canthal region forming the so called tear trough. The adjacent malar fold is oriented inferomedially from the lateral canthus toward the inferior aspect of the nasojugal fold.

Eyelid Skin and Subcutaneous Tissue

The skin of the eyelids, measuring less than 1 mm in thickness, is the thinnest in the body. It is largely devoid of hair as well as subcutaneous fat. The epidermis lacks blood vessels and lymphatics, instead receiving its nutrients from a deeper layer of connective tissue—the corium. Just deep to the corium lays a very thin layer of subcutaneous loose connective tissues. The thin, delicate skin of the eyelid transitions to thicker, coarser skin as it extends beyond the superior lateral orbital rim and as it merges into the cheek. These textural differences should be considered in reconstructive surgery.

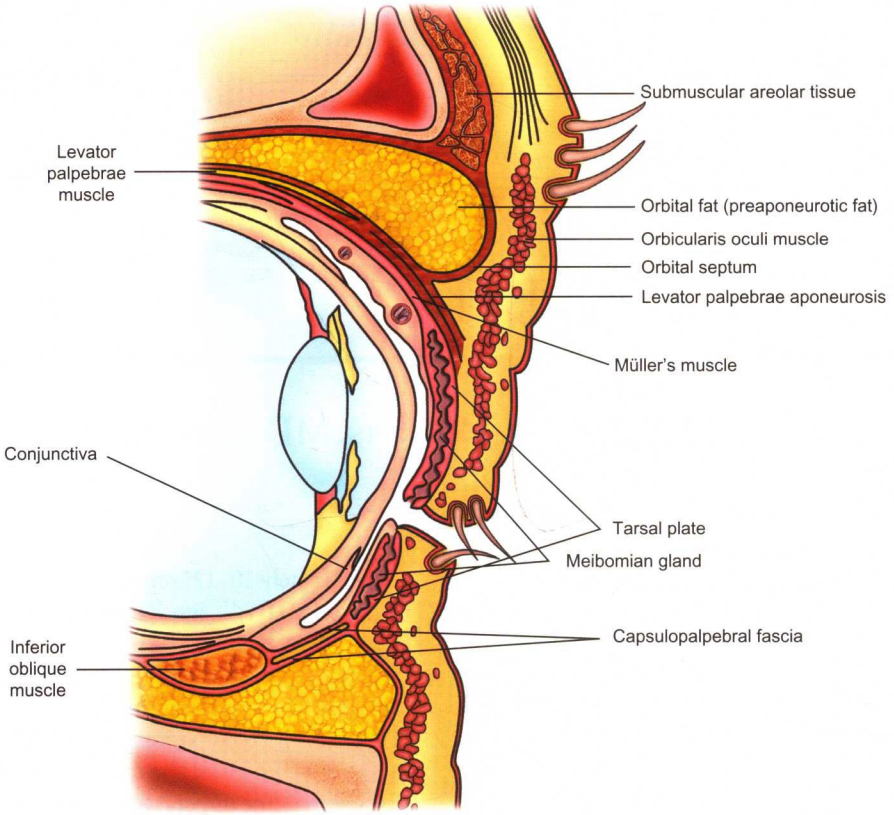

Figure 1-1. Sagittal section of the eyelid through the midpupillary line demonstrating its multilamellar structure.

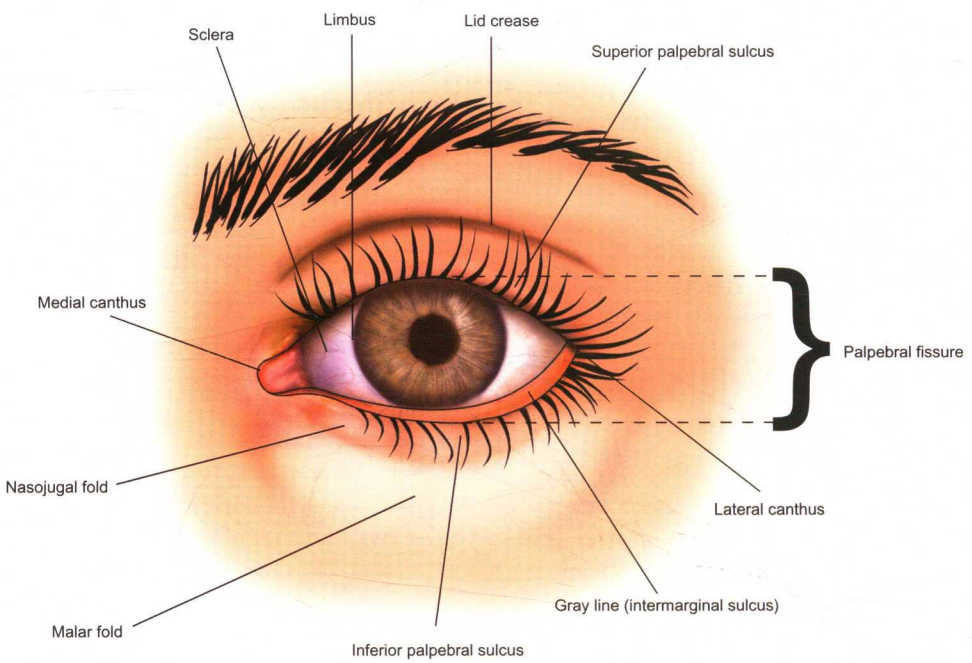

Figure 1-2. External landmarks of the eyelids and orbital region (left eye).

Orbicularis Oculi Muscle

The orbicularis oculi muscle is a complex striated muscle sheet deep to the skin and subcutaneous tissue of the eyelids. It is divided into two contiguous parts (orbital and palpebral) based on the region it overlies. The orbital portion is formed by concentric loops of muscle fibers that originate at the medial canthal tendon and travel around the orbital rim. Its action is to close the eyes tightly as in squinting. This portion of the muscle is generally not encountered during routine blepharoplasty surgery.

The palpebral portion extends from medial canthus to lateral canthus and can be further divided into preseptal and pretarsal components which overlie the orbital septum and tarsal plates respectively (**Figure 1-3**). Both divisions originate from two heads at the medial canthus. The superficial head of the preseptal and pretarsal portion arise from the medial canthal tendon, whereas the deep head of the preseptal division is attached to the posterior lacrimal crest and the deep head of the tarsal division to Horner's muscle (tensor tarsi). The muscle fibers of the preseptal component insert along the lateral horizontal raphe. The pretarsal fibers arc around the eyelids and insert onto the lateral canthal tendon and raphe. Contraction of these fibers aid in the lacrimal pump mechanism.

During blepharoplasty, conservative resection of the orbicularis oculi muscle is common. Overzealous resection can lead to loss of the muscular contractions necessary to move the tear film medially to the lacus lacrimalis. Additionally, inadvertent removal of tissue deep to the muscle can result in injury to the levator aponeurosis and subsequent ptosis. Careful dissection with identification of each anatomic layer will circumvent such injuries.

Submuscular Areolar Tissue

Just deep to the orbicularis oculi muscle lays the submuscular areolar tissue (**Figure 1-1**). These gossamer fibers are contiguous with the subaponeurotic layer of the scalp. The potential plane of the submuscular areolar tissue, which is accessed by division at the gray line (**Figure 1-2**) of the lid margin, separates the eyelid into an anterior and posterior portion. In the upper lid, this plane contains fibers of the levator aponeurosis as they pass through the orbicularis to attach to the skin forming the lid crease. As previously mentioned, injury to these fibers during blepharoplasty results in ptosis. Continuing superiorly in the same plane leads to the retro-orbicularis oculi fat (ROOF). Analogously, the lower lid potential plane is traversed by fibers of the orbitomalar ligament and is continuous inferiorly with the suborbicularis oculi fat (SOOF).

Tarsal Plates

The tarsal plates are the main supporting structures of the eyelid and are composed of dense fibrous connective tissue and a small amount of elastic tissue. The upper lid tarsus, which extends from the

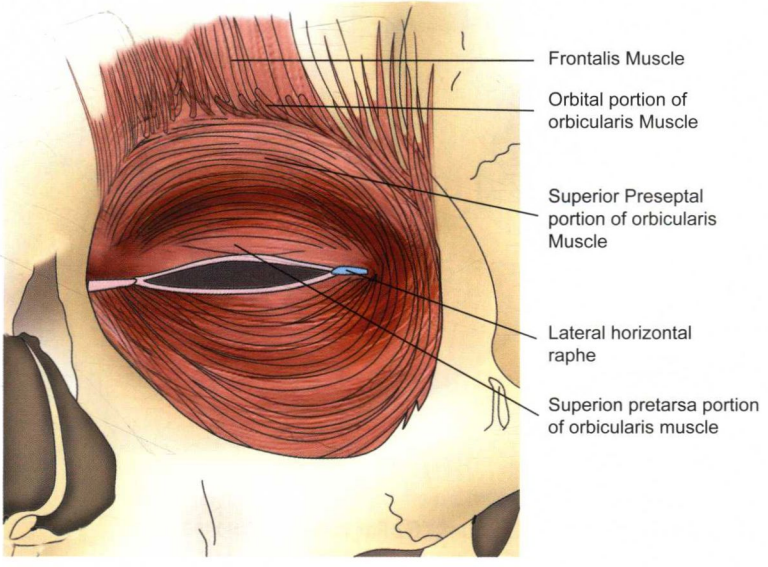

Figure 1-3. The subdivisions of the orbicularis oculi muscle and its relationship to medial canthal structures.

punctum to the lateral canthus, is approximately 30 mm long and 10 mm wide at its center. The lower tarsus is similar in length to the upper plate but only half as wide. Both plates are widest at the center, tapering at both ends. The plates contain grooves along their ciliary borders in which some 25 sebaceous meibomian glands can be found spanning the vertical height of the tarsus (**Figure 1-1**). The medial and lateral ends of the tarsi are attached to the orbital rims though the medial and lateral palpebral tendons (medial and lateral canthal tendons).

The medial canthal tendon (MCT), the medial extension of the fibrous tarsal plate, lies between the orbicularis muscle anteriorly and conjunctiva posteriorly. The superior and inferior crura fuse to form a common tendon that inserts into the orbit through three limbs (anterior, posterior, superior). The lateral canthal tendon (LCT), similarly formed by dense fibrous tissue arising from the tarsi, passes laterally deep to the orbital septum and inserts into the lateral orbital tubercle 1.5 mm posterior to the lateral orbital rim. The LCT is distinct from the orbicularis oculi muscle and is approximately 1 mm thick, 3 mm wide, and 5–7 mm long.

Lid Margins

The free lid margin is approximately 25–30 mm long and 2 mm wide. The gray line (mucocutaneous junction) partitions it into anterior and posterior margins. The anterior margins contains the eyelashes, glands of Zeis and Moll (sebaceous glands). The posterior margin is in contact with the globe and also contains sebaceous glands—tarsal glands along the lid margin.

Septum

The orbital septum is a fibrous connective tissue structure that represents the continuation of the periosteum from the orbital margin (the arcus marginalis) (**Figure 1-4A**). It lies just beneath the orbicularis muscle between the tarsus and orbital rim and functions as a partition between the lid and orbital contents. It is also an important anatomic landmark separating the orbit into an anterior and posterior compartment. Functionally, the septum acts as a barrier to infection and hemorrhage. With aging, the septum—which lies superficial to the orbital fat pads—weakens, allowing the prolapse of preaponeurotic fat (**Figure 1-4B**).

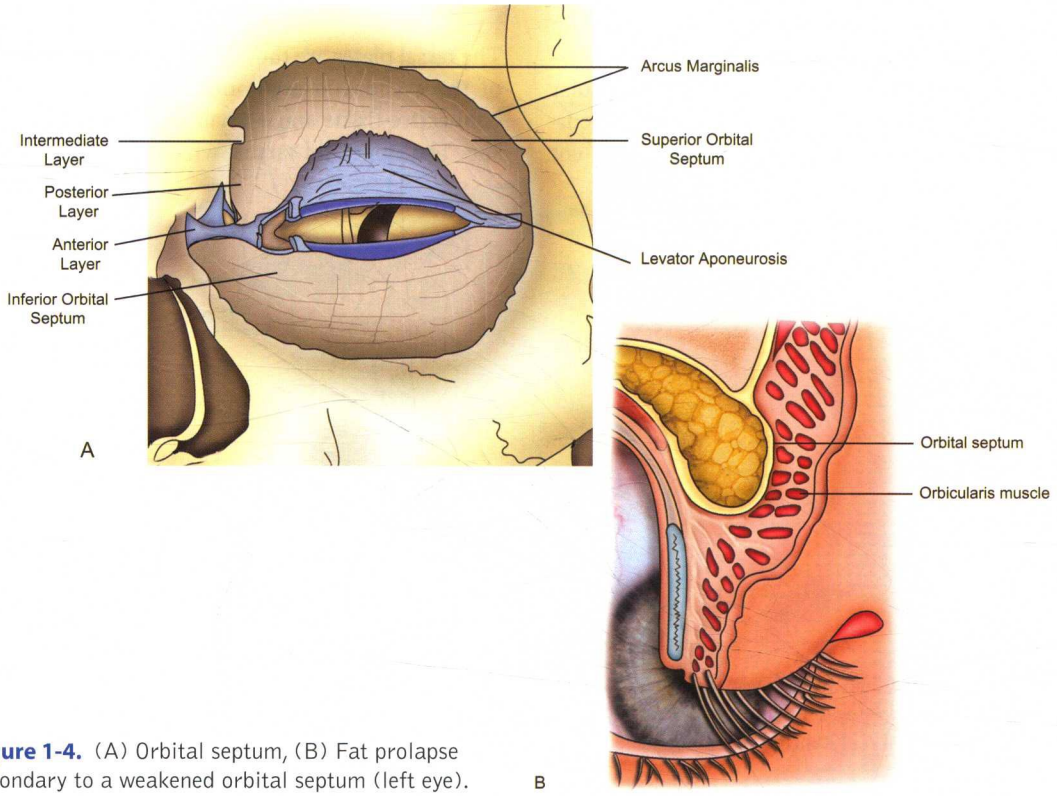

Figure 1-4. (A) Orbital septum, (B) Fat prolapse secondary to a weakened orbital septum (left eye).

Although the thickness of the septum varies, it is generally thicker laterally where it lies superficial to the LCT. Medially, the septum passes in front of the trochlea of the superior oblique muscle. Inferiorly, the orbital septum of the upper lid meets the levator aponeurosis approximately 2–5 mm above the tarsal plate (except in the eyelid of a person of Asian descent). The septum does not extend over the superficial aspect of the tarsal plates.

In the lower lid, approximately 5 mm inferior to the tarsus, the orbital septum joins the capsulopalpebral fascia—the anatomic analogue of the levator aponeurosis. Medially, the septum attaches to the anterior and posterior lacrimal crest and blends laterally with the LCT.

Preaponeurotic Fat Pads

The preaponeurotic fat pads are among the most important landmarks in eyelid surgery. They represent the anterior extension of extraconal orbital fat (**Figure 1-1**) and identify a plane immediately posterior to the orbital septum and anterior to the major eyelid retractors. Their distinctive color and location helps to guide dissection in revision surgery, when distinction between orbital septum and levator aponeurosis may be difficult.

Classically, two fat compartments are identified in the upper lid—medial and central. The lacrimal gland fills the lateral compartment of the upper lid and at times may be mistaken for a third fat pocket. However, several authors have recently reported the presence of a third, accessory, fat pad that was identified in about 20% of cases and located lateral to the central fat pad extending under the inferior border of the lacrimal gland (**Figure 1-5**). In both the upper and lower lids, the medial compartment is filled with a white, more fibrous fat pad. The central pad is usually pale yellow or white, whereas the lacrimal gland appears pinkish and is firm and lobulated in structure. The upper lid fat pads are separated by fascial strands arising from Whitnall's ligament. This white fibrous band extends from the lacrimal gland fascia to the trochlea, traveling parallel and superior to the levator aponeurosis. The ligament both suspends the globe and allows for changes in the direction of levator pull-up acting as a fulcrum.

In contrast to the upper lid, the lower lid has three compartments: medial, central, and lateral (**Figure 1-5**). The inferior oblique muscle separates the medial and central compartment and can be injured

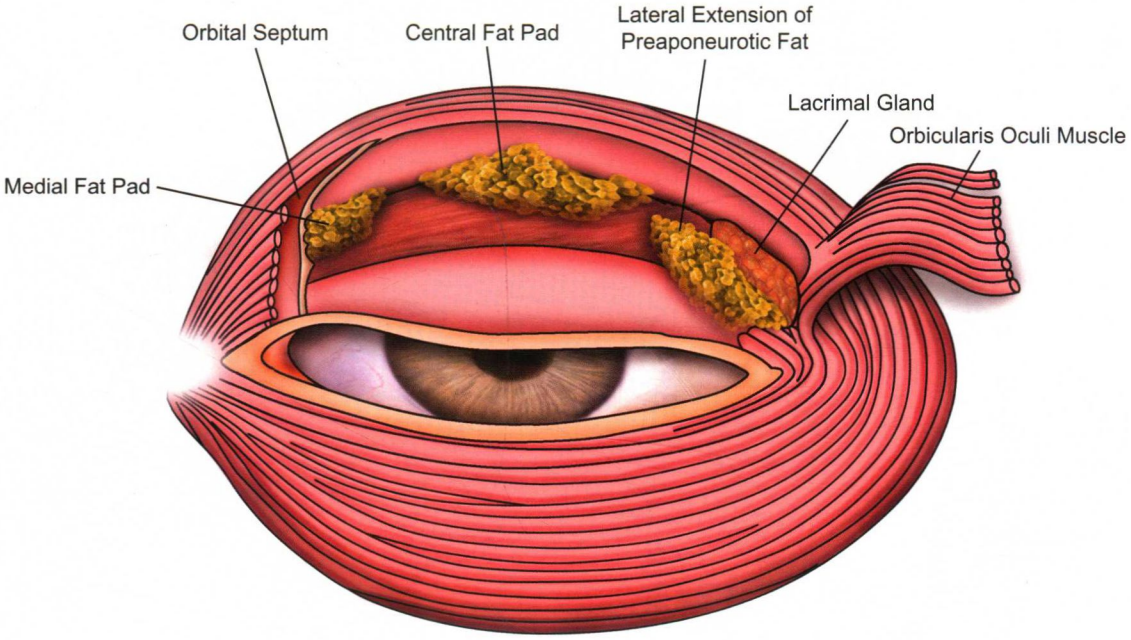

Figure 1-5. Adipose compartments of the upper and lower lid (left eye). This figure depicts the occasional occurrence of a lateral extension of preaponeurotic fat beneath the lacrimal gland.

during indiscriminant removal of the medial fat pad. Anatomic variants of the extent of compartmentalization have been reported and include the medial and lateral compartments positioned inferior to the central compartment, only two compartments, and loss of compartmentalization altogether. Nevertheless, the appearance of all three compartments side by side remains the common presentation.

Relatively large blood vessels supply the fat pads. Meticulous hemostasis is imperative during blepharoplasty to avoid retro-orbital hematomas and the potential for permanent ocular injury and blindness.

Lid Retractors

Lid retractors open the eyelids and are formed by a musculofascial complex with striated and smooth muscle components known as the levator complex in the upper lid and the capsulopalpebral fascia in the lower lid (**Figure 1-6**).

Upper Lid Retractors

The retractors of the upper lid consist of the levator palpebrae and Müller's muscle (**Figures 1-1 and 1-6**). The levator palpebrae superioris muscle is the primary elevator of the upper eyelid and is innervated by the oculomotor nerve. It is a striated muscle and arises from the orbital apex from the undersurface of the lesser wing of the sphenoid bone and courses anteriorly where it thins to a broad aponeurosis that inserts onto the anterior surface of the tarsal plate. In the lid of non-Asian persons, the supratarsal crease is created by the anterior extension of the levator into the pretarsal orbicularis oculi muscle and overlying skin. These aponeurotic fibers begin to send slips to the skin 2–3 mm above the superior margin of the tarsus. The levator aponeurosis then fans out to form medial and lateral horns that attach to the medial and lateral retinacula, respectively. The muscular portion is approximately 40 mm long, whereas the aponeurotic portion measures 15–20 mm.

During blepharoplasty, the integrity of the levator aponeurosis must be evaluated. Acquired ptosis of the upper eyelid often results from dehiscence of the levator from the tarsal plate. Additionally, overresection of the orbicularis muscle can inadvertently injure the aponeurosis.

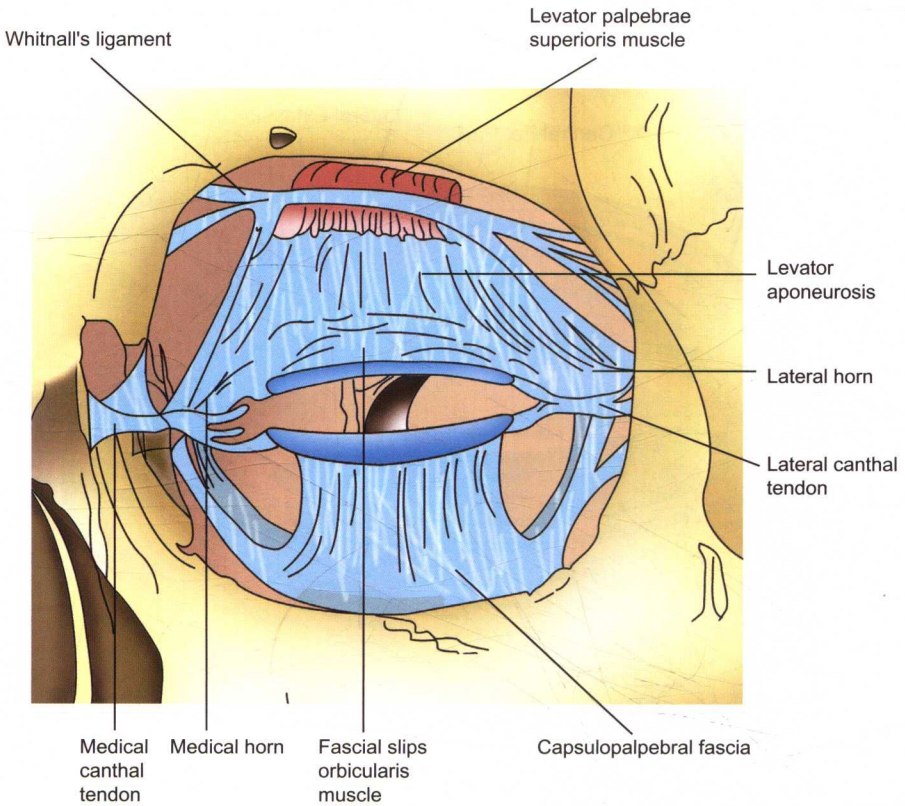

Figure 1-6. Eyelid retractors (left eye).

Deep to the levator lies Müller's muscle, a smooth muscle extension off the undersurface of the levator in the region of the aponeurotic-muscle junction (**Figure 1-1**). It is innervated by the sympathetic nervous system and travels inferiorly between the levator aponeurosis and conjunctiva, inserting into the superior margin of the tarsus. Fatty infiltration, as seen with aging, gives the muscle a yellowish color. Injury to the cervical sympathetic chain may results in Horner's syndrome with the triad of ptosis, miosis, and anhidrosis. Disruption of the sympathetic innervation to Müller's muscle typically results in about 2 mm of ptosis.

Lower Lid Retractors

The capsulopalpebral fascia is the lower eyelid equivalent of the levator aponeurosis (**Figure 1-6**). However, unlike the levator muscle, the fascia contains no muscle. The capsulopalpebral fascia envelops the inferior oblique muscle and then reunites as the inferior transverse ligament or Lockwood ligament (analogous to Whitnall's ligament in the upper eyelid) before passing anterosuperiorly onto the inferior border of the tarsus. The inferior rectus muscle acts as a lower lid retractor by transmitting its action to the capsulopalpebral fascia. When the capsulopalpebral fascia is dehiscent, entropion can occur.

Sympathetically innervated smooth muscle fibers are also found in the lower eyelid in the form of Horner's muscle—the inferior tarsal muscle (**Figure 1-1**). Horner's muscle does not insert directly onto the inferior tarsal border but rather into the fascia several millimeters below the tarsal border.

Conjuctiva

The conjunctiva is the mucous membrane covering of the eye. It covers the sclera and cornea, then reflects back to line the inner surface of the eyelids. It is firmly adherent to the overlying tarsal plates and the sympathetic tarsal muscle of Müller. The caruncle, a small mound of tissue, is found at the medial canthal angle. It consists of modified skin that contains fine hairs, sebaceous glands, and sweat glands.

Neurovascular Anatomy

Motor Nerves

The temporal and zygomatic branches of the facial nerve (CNVII) innervate the orbicularis oculi muscle (**Figure 1-7A**). The levator palpebra superioris is innervated by the superior branch of the oculomotor nerve (CNIII), whereas Müller's muscle and the inferior tarsal muscle rely on sympathetic innervation.

Sensory Nerves

Sensory innervation to the eyelids is supplied by branches of the trigeminal nerve (CNV) (**Figure 1-7B**). Terminal branches of the ophthalmic nerve (CNV_1)—supraorbital, supratrochlear, and

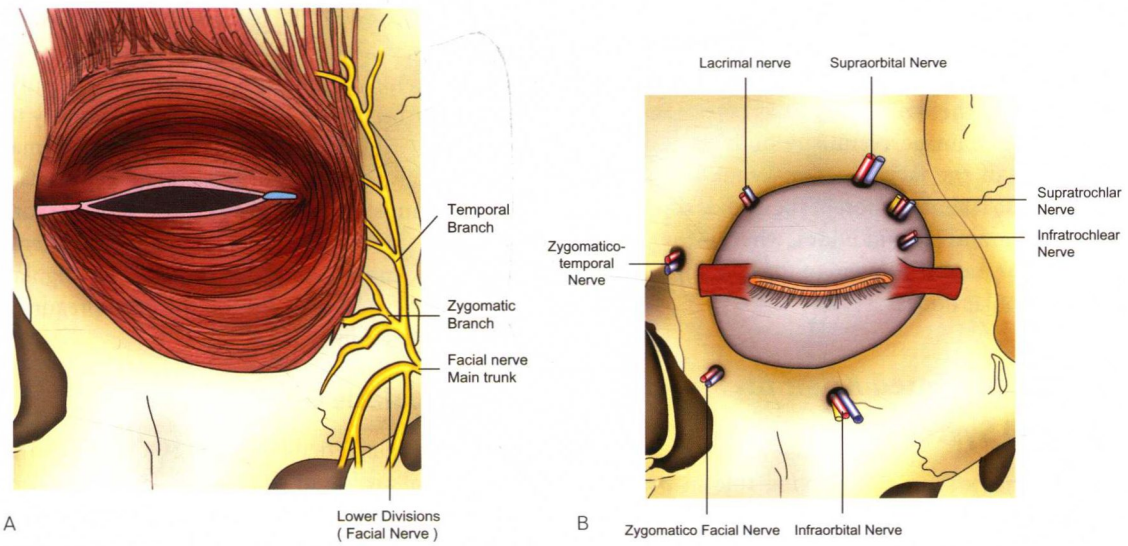

Figure 1-7. (A) Motor innervation to orbicularis oculi. (B) Sensory innervation to eyelids and periorbital region.

lacrimal—supply sensation to the upper eyelid and forehead. The infratrochlear nerve (branch of CNV_1) receives sensory information from the medial-most portion of both the upper and lower eyelids. Similarly, the zygomaticotemporal branch of the maxillary nerve (CNV_2) supplies the lateral portion of the upper eyelid and temple. The remainder of the sensory innervation to the lower lid is derived from branches of CNV_2. The infraorbital nerve supplies the central lower eyelid, whereas the zygomaticofacial nerve supplies the lateral portion of the lower eyelid.

Blood Supply and Lymphatics

The eyelids have an extensive and highly collateralized blood supply (**Figure 1-8**). The posterior eyelid lamellae receive blood through a series of vascular arcades. In the upper lid, the arterial marginal arcade (**Figure 1-8A**) runs approximately 4 mm from the lid's free margin and a peripheral arcade extends along the superior border of the tarsus between the levator aponeurosis and Müller's muscle where it is at risk to injuring during blepharoptosis surgery. The arterial vascular arcades are supplied medially by the superior medial palpebral vessel (terminal branch of the ophthalmic artery) and laterally by the superior lateral palpebral vessel from the lacrimal artery.

Similar to the upper lid, the lower lid also has an arterial marginal arcade, which is about 2 mm from the lid margin. There is no well-defined peripheral arcade in the lower lid. The lower lid arcade receives its bloody supply from the medial and lateral inferior palpebral vessels.

The venous drainage system (**Figure 1-8B**) is organized similarly to the arterial system but, as in most parts of the body, it is not as consistent. The bulk of the drainage eventually finds its way into the vessels of the facial system. Lymphatic drainage from the lateral portion of the eyelids drain into preauricular and parotid nodes, whereas the drainage from the medial segment of the lids empties into submandibular nodes.

Related Anatomy

Lacrimal System

The lacrimal system plays a vital role in protecting the globe. Tears are secreted by the lacrimal gland which is located laterally in the preaponeurotic compartment of the upper lid (**Figure 1-9**). The blinking action of the eyelid helps distribute the tear film evenly and propel the film medially to the medial canthus where they enter the lacrimal system via the upper and lower lid puncta—located approximately 5–7 mm lateral to the medial canthus. The superior and inferior canaliculus combine to form the common canaliculus before entering the lacrimal sac. The lacrimal sac lies within the lacrimal fossa, a bony groove in the nasal bone, and represents the dilated superior portion of the nasolacrimal duct and is about 15 mm long. The lacrimal sac empties into the nasolacrimal duct, which in turns opens into the inferior meatus at the valve of Hasner.

Retro-Orbicularis Oculi Fat Pad

The retro-orbicularis oculi fat pad (ROOF) is a layer of fibrofatty soft tissue deep to the orbicularis oculi muscle and superficial to both the orbital rim and septum (**Figure 1-10**). It extends medially from the superior orbital nerve foramen/notch to a varying distance laterally over the lateral orbit. The ROOF is crescent shaped and, in cadaver studies, was found on average to be roughly two-thirds the transverse orbital dimension in width and one-third the vertical orbital dimension in height.

Although the ROOF is not anatomically part of the eyelid, its anatomy is relevant, as ROOF resection is increasingly being performed at the time of upper lid blepharoplasty to reduce thickness and heaviness over the lateral brow. Fullness due to ROOF can be distinguished from prominent preaponeurotic fat on physical examination, as gentle pressure on the globe will not accentuate ROOF fullness as it will with excess subseptal fat in the medial and central compartments. Care must be taken during ROOF resection to avoid injury to the superior orbital nerve medially and the lacrimal gland laterally. Furthermore, adequate hemostasis is of the utmost importance because the supraorbital vessels lie on the undersurface of the lateral orbicularis oculi muscle as it connects the angular and frontal vessels medially and the deep preauricular vessels laterally.

Suborbicularis Oculi Fat Pad

The suborbicularis oculi fat pad (SOOF) is the inferior orbital analog of the ROOF. The SOOF is a hockey puck–shaped collection of fat found below the orbicularis oculi muscle in the supraperiosteal plane at or just below the inferior orbital rim on the

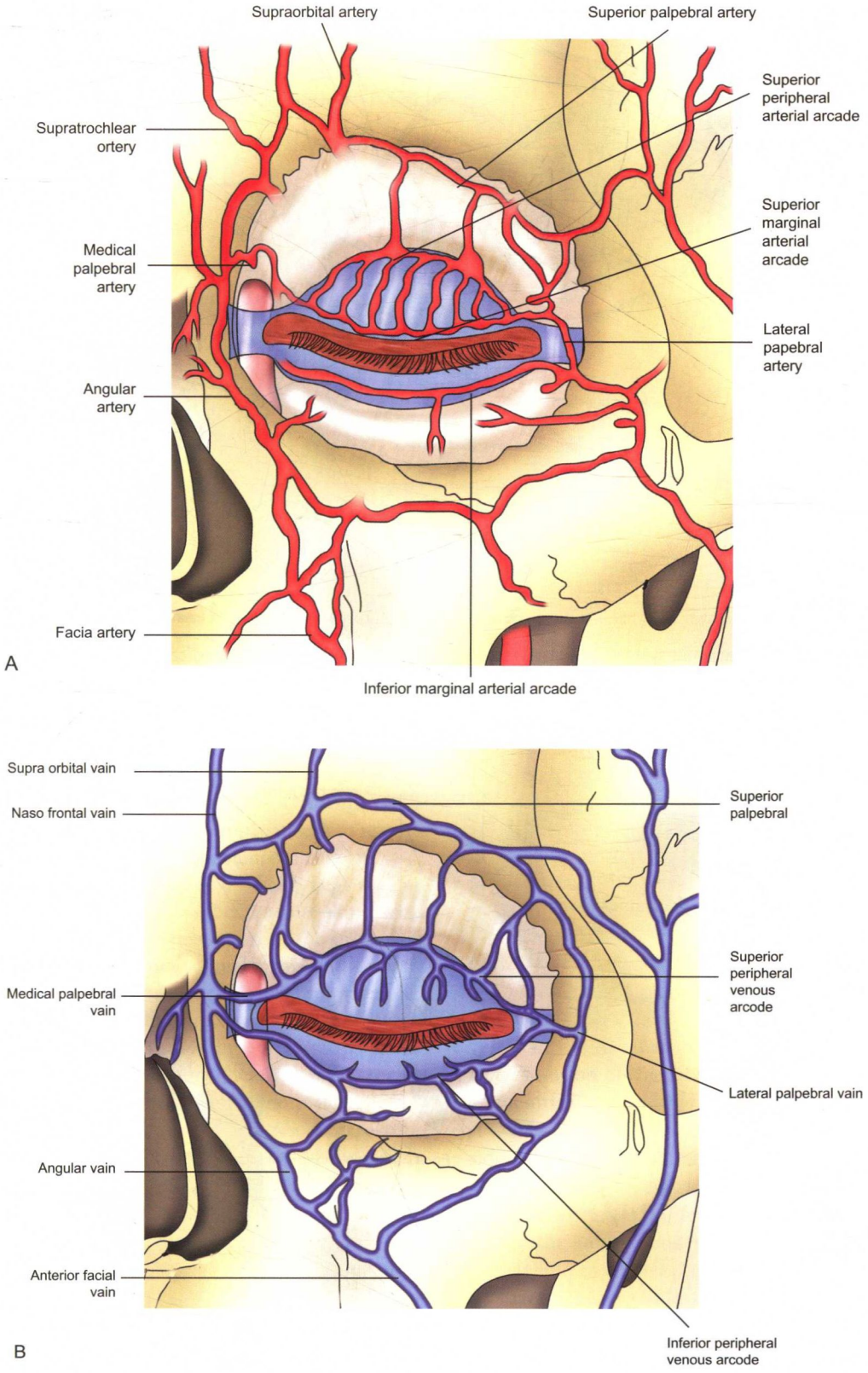

Figure 1-8. Arterial (A) and venous (B) blood supply to the eyelids (left eye).