VIDEO CLIP

CHAPTER 14

Canthopexy and Canthoplasty

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The positions of the lateral and medial canthi are important functional and aesthetic facial landmarks. Canthal malposition changes the width and shape of the palpebral fissure as well as the position of the lower eyelid, resulting in the round-eye deformity. Inferior displacement of the lower eyelid may cause lagophthalmos leading to inadequate globe protection and exposure keratitis. Epiphora resulting from a displaced lower punctum and impaired tear drainage may also occur. The causes of canthal malposition may be hereditary, senile, paralytic, traumatic, or iatrogenic. Medial canthal malposition is most often caused by a traumatic injury or oncologic resection. Malposition of the lateral canthus most often occurs after surgical access to the orbit and periorbital structures. To achieve the best surgical result, one should be familiar with the periorbital anatomy as well as the features of a normal and aesthetically pleasing eye.[1,2,3,4]

OBJECTIVE

To restore and enhance the correct anatomical position of these landmarks to create a natural, appealing palpebral fissure.

RELEVANT SURGICAL ANATOMY

The lateral canthus is more correctly termed a lateral retinaculum. The retinaculum receives contributions from the lateral horn of the levator aponeurosis, the lateral extension of the preseptal and pretarsal orbicularis oculi muscle (lateral canthal tendon), the inferior suspensory ligament of the globe (Lockwood's ligament), and the check ligament of the lateral rectus muscle. It has a broad attachment to the periosteum over Whitnall's tubercle. Variations of the point of attachment or length of the retinaculum will alter eyelid shape, tension, and contour.[2,5,6]

The medial canthus or retinaculum is a tripartite structure with histologic and biomechanical properties more similar to a ligament than a tendon. It acts as a "ligamentous" attachment for the tarsi of the eyelids, providing a hinge for the eyelids and maintaining the normal angular shape of the eye. The medial canthus also functions to assist the lacrimal pump mechanism, maintain the shape of the palpebral fissure, and prevent dystopia. The normal position of the medial canthus corresponds to the three limbs of the tendon. The anterior limb is attached to the anterior lacrimal crest and continues in the periosteum of the nasal bones; the superior limb is fixed to the medial orbital rim several millimeters cephalad; and the posterior limb crosses the lacrimal sac and is attached to the posterior lacrimal crest.

The lateral canthal angle is normally superior to the medial canthal angle, lying 4.1 degrees or approximately 1.2 mm higher. This relationship is important for effective tear film distribution, lacrimal drainage, and for an aesthetically pleasing contour (**Fig. 14.1**).

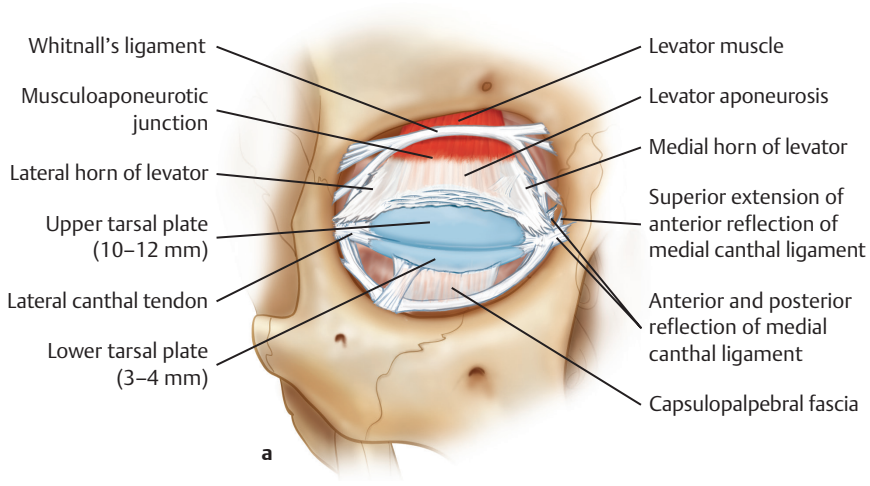

Fig. 14.1 (a) Position of the medial and lateral canthal ligaments with respect to the bony orbit, tarsal plates, and underlying ligamentous structures (*continued*).

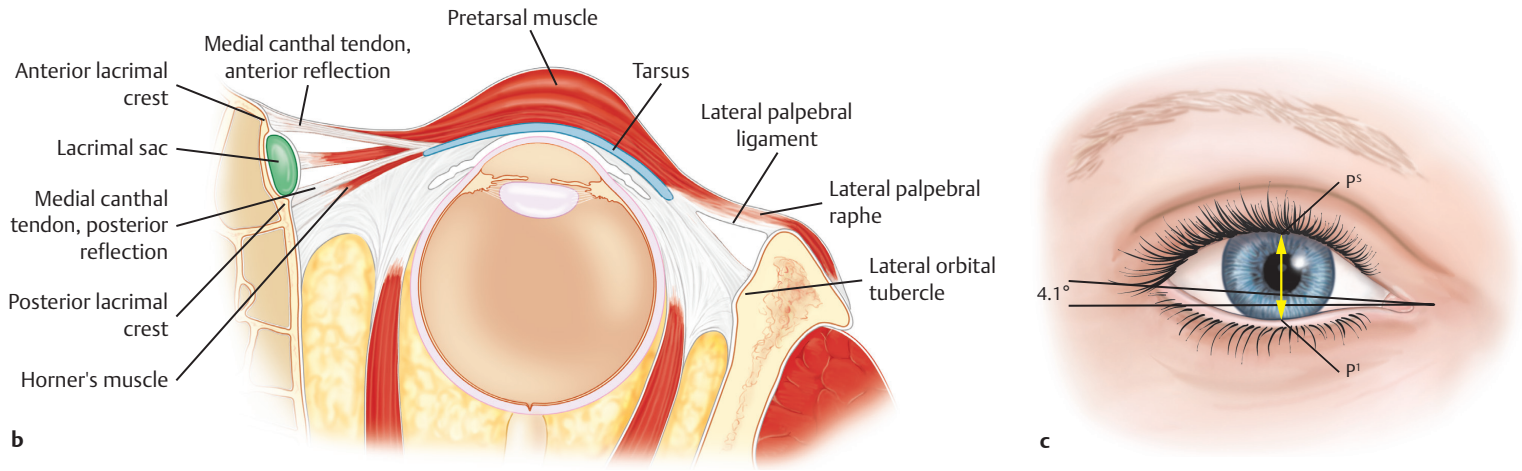

Fig. 14.1 (*continued*) (b) Cross-section of the orbit demonstrating the anterior and posterior limbs of the medial canthus in relation to the lacrimal sac and bony lacrimal crest. **(c)** Dimensions of the palpebral fissure, as measured in young white women. The mean height of the palpebral fissure measured from the upper lid (palpebrae superior, P^S) to lower lid (palpebrae inferior, P^I) margin at the midpupil was 10.8 ≤ 1.2 mm (n = 200). The mean length of the eye fissure measured from the medial commissure to the lateral commissure was 30.7 ≤ 1.2 mm (n = 200). The mean inclination of the eye fissure was 4.1 degrees ± 2.2 degrees.

PATIENT SELECTION

Patients who have alterations in the position of their medial or lateral canthus are candidates for surgery, as detailed next.

INDICATIONS AND CONTRAINDICATIONS

Indications

Medial Canthopexy and Canthoplasty

Indications for the procedure include acute or delayed post-traumatic deformities, persistent epiphora, and telecanthus.

Lateral Canthopexy and Canthoplasty

Indications for the procedure include acute or delayed post-traumatic deformities, lateral canthal dystopia, horizontal lid laxity, ectropion, entropion, lid margin eversion, lid retraction with or without soft tissue deficiency, and aesthetic improvement.

Contraindications

There are no absolute contraindications to performing this procedure, other than those related to pre-existing medical conditions or contraindications to general anesthesia.

Proptosis is a relative contraindication to performing lateral canthal repositioning. The procedure in these patients will create a hammock-like effect and worsening of the condition.

PREOPERATIVE PLANNING

Patient history and physical examination are the most important elements of preoperative assessment and planning for both reconstructive and cosmetic procedures. Standard preoperative photographs are taken.

A history of recent eye surgery, dry eye, or visual acuity changes should be specifically elicited. Physical examination findings for lower eyelid malposition include canthal tilt, lid snap-back test, lid distraction test, vector analysis, scleral show, intercanthal distance, and the presence of chemosis or keratoconjunctivitis. Other patient-directed examination includes visual acuity testing, Schirmer's test for lacrimation, and slit-lamp evaluation.

Although preoperative radiologic examination is uncommon for purely aesthetic surgery, CT evaluation is almost routine for reconstructive procedures. CT scans provide the ability to view anatomical features in different planes and in three dimensions (**Fig. 14.2**).

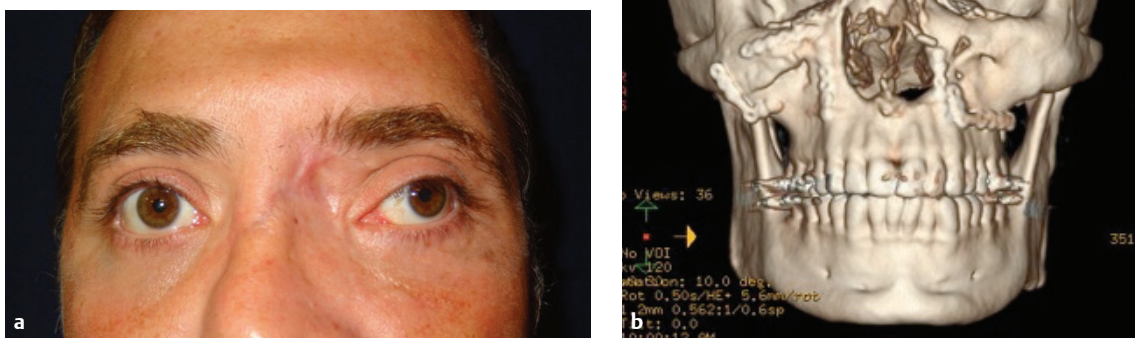

Fig. 14.2 **(a)** Preoperative frontal view of a 39-year-old man who presented with post-traumatic medial canthal dystopia. **(b)** Preoperative three-dimensional CT scan showing the patient's previously repaired facial fractures.

INSTRUMENTS

The instruments required for canthopexy and canthoplasty surgery are shown in **Fig. 14.3**.

Fig. 14.3 Needle holder, also used as a wire twister (*1*); fine Iris scissors and Kaye scissors for dissection (*2*); fine hemostat (*3*); Adson and fine Bishop-Harmon forceps (*4*); wide and micro double skin hooks (*5*); fine Ragnell retractors (*6*); periosteal elevator (*7*); scalpel (*8*); malleable retractor (*9*).

OPERATIVE PROCEDURE: STEP-BY-STEP TECHNICAL DETAILS[7,8,9,10]

The steps of bridge of bone lateral canthopexy are detailed in **Figs. 14.4–14.11**.

- Lateral canthopexy: The terminology of lateral canthal surgery is confusing. A lateral canthopexy repositions the lateral canthal mechanism without violating the commissure. Canthoplasty procedures, by design, alter the shape of the palpebral fissure, because they disassemble and reassemble the lateral commissure while often shortening the lower lid margin.
- Lateral retinacular canthopexy: This procedure involves suturing the lateral canthus to the periosteum of the inner aspect of the lateral orbital rim.
- Bridge of bone lateral canthopexy: Bridge of bone lateral canthopexy requires exposure of the lateral orbit and mobilization of the lateral canthus soft tissue mechanism. Its efficacy is based on the stable suture fixation point provided by drill holes placed in the bone of the lateral orbit. It is our preferred technique for most surgical indications.

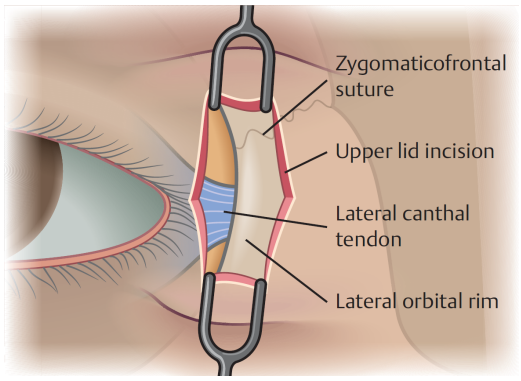

Fig. 14.4 This procedure can be performed under local or general anesthesia. Bridge of bone lateral canthopexy requires access to the lateral orbital rim from the level of Whitnall's tubercle to the zygomaticofrontal suture.

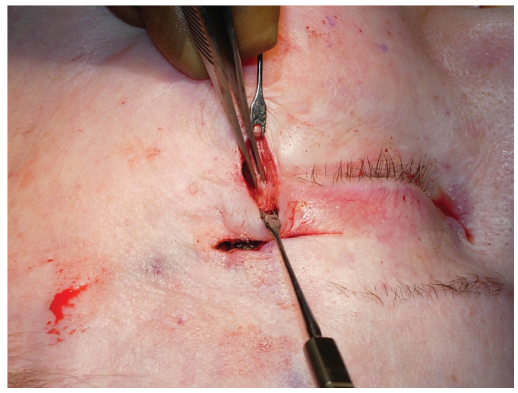

Fig. 14.5 Through the lateral extent of the lower lid blepharoplasty incision, the lateral canthus is identified and released from Whitnall's tubercle by subperiosteal dissection.

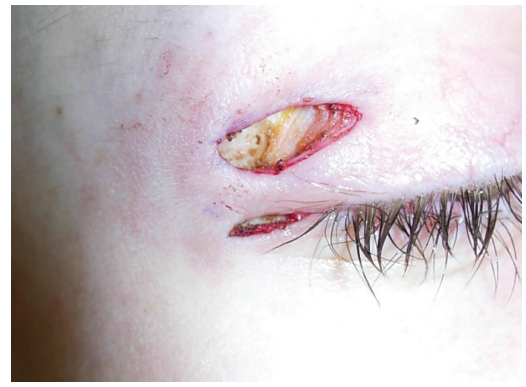

Fig. 14.6 This can be accomplished through the lateral extent of an upper blepharoplasty incision. Most often, the lateral extents of both upper and lower blepharoplasty incisions are used. The lower blepharoplasty incision provides superior visualization of the lateral canthal tissue. This anatomy can also be approached from the access provided by a bicoronal incision during exposure of traumatic fractures or an aesthetic browlift.

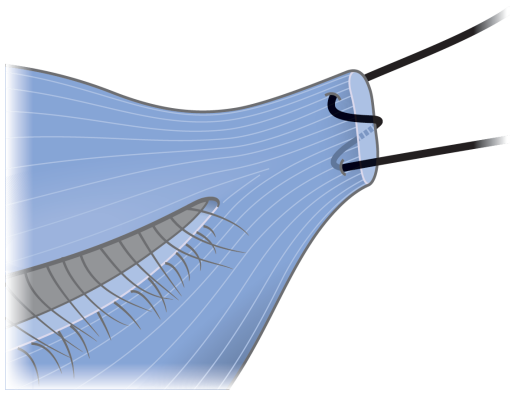

Fig. 14.7 When only 1 or 2 mm of superior or lateral movement of the lateral canthus and adjacent lid margin is desired, one or both limbs of the lateral canthus may be purchased with a figure-of-eight suture without freeing of the lateral retinacular structures from the lateral orbit. The amount of commissure movement will be limited by the length of the ligament, the point of suture purchase relative to the lateral commissure, and the position of the lateral orbit drill holes. This approach is most appropriate when there is minimal commissure malposition and no local scarring from previous lid surgery. When more significant movements of the lateral commissure and lid margin are desired, complete subperiosteal freeing of the lateral retinacular structures is required before figure-of-eight suture purchase of both limbs of the ligament. Through the lateral extent of the lower blepharoplasty incision, the lateral retinaculum is identified and dissected, and both limbs of the lateral canthus are purchased with a figure-of-eight nonabsorbable suture or 30- or 32-gauge titanium wire suture. If scarring from previous lower lid surgery restricts canthal movement, the lateral third of the middle lamellae is incised with needle-tip electrocautery.

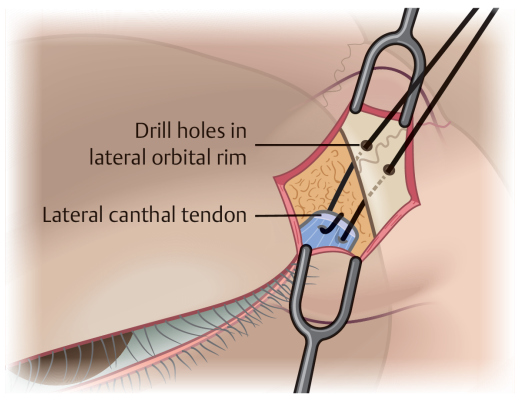

Fig. 14.8 Drill holes are made in the lateral orbital rim. Using the zygomaticofrontal suture as a landmark, two drill holes are placed in the lateral orbital rim. The position of the lower drill hole is a key factor, since it determines the maximum upward movement of the canthus. The upper drill hole is necessary to create the "bridge of bone"—a stable fixation point.

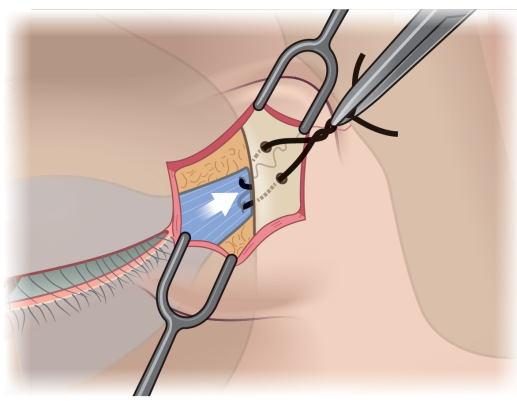

Fig. 14.9 Each end of the wire suture is passed from within the orbit through drill holes made in the lateral orbital rim that were placed at the zygomaticofrontal suture and 2 to 3 mm below it. The ends of the wire suture are twisted to one another over the bridge of bone.

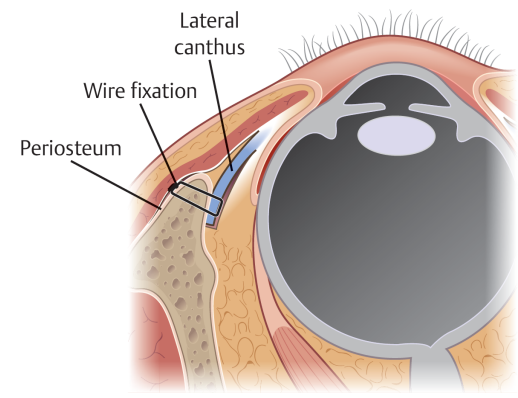

Fig. 14.10 Passing the suture wire from the inside of the orbit to the outside will apply the lid to the globe.

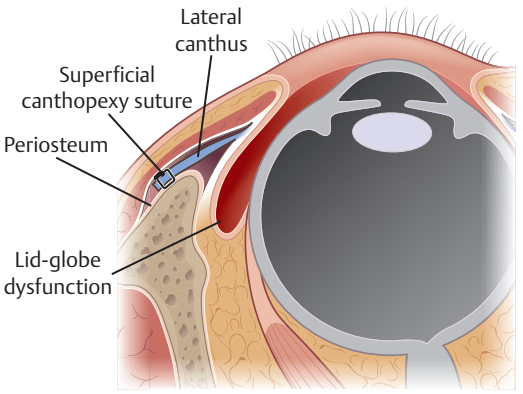

Fig. 14.11 Attaching the canthal mechanism to the outer surface of the lateral orbital rim is a common technical error. When this occurs, the lid is distracted away from the globe, resulting in a gap, or phimosis.

It is not necessary to repeat the suturing process. In addition, this length allows the ends to be placed into one of the drill holes or into the orbit. This avoids postoperative visibility or palpability of the wire ends. If local incisions are used for access, an ellipse of skin and muscle is removed from the lateral aspect of the upper lid to remove the lid redundancy caused by the upward movement of the canthus. The wounds are closed in layers. Canthoplasty procedures (such as tarsal strip or Weir excision) shorten the lower lid margin and are usually indicated to treat lid laxity (such as senile ectropion or entropion).

SURGICAL TIPS

- A bridge of bone lateral canthopexy requires access to the lateral orbital rim from the level of Whitnall's tubercle to the zygomaticofrontal suture.
- The zygomaticofrontal suture provides a landmark to allow symmetrical placement of drill holes made in the lateral orbital rim.
- Most often, the lateral extent of both upper and lower blepharoplasty incisions are used.
- This anatomy may also be approached from the access provided by bicoronal incision, ensuring exposure of traumatic fractures or an aesthetic browlift.
- Complete subperiosteal freeing of the lateral retinacular structures is required before figure-of-eight suture purchase of both limbs of the ligament.
- The position of the lower drill hole is key, because it determines the maximum upward movement of the canthus.
- The lateral canthal position should be 2 to 3 mm above the medial canthal plane to give the intercanthal axis a slight upward tilt.
- The drill holes should be placed in the internal orbit about 3 to 4 mm posterior to the anterior margin of the lateral orbital rim so the lateral lid will not be drawn away from the globe.
- Tension on the wires will determine canthal movement.
- Passage of the wires must occur from within the orbit to outside.

Medial Canthopexy: Transnasal Wiring

The goals of transnasal wiring medial canthopexy are to restore normal canthal position along the lacrimal crest, re-establish normal palpebral shape, and preserve normal palpebral function.[3,4]

This procedure is performed either in the acute setting or in a delayed fashion. It is required in the presence of naso-orbitoethmoid (NOE) fractures (see Chapter 12) with associated soft tissue degloving injuries or bony disruption. Medial canthopexy is performed following realignment of all displaced bone segments and reconstruction of the orbital volume and shape. Medial canthopexy requires precise identification of the correct anatomical location for tendon placement and secure fixation of the tendon to the bone.

The procedure is best performed early since a delay results in scarring and secondary maladaptive changes that compromise the re-establishment of the three-dimensional anatomy. The deformities that result from unrepaired NOE fractures and resulting canthal malposition are severe and difficult to correct, requiring osteotomies and grafting.

This procedure is performed under general anesthesia. The steps of bridge of medial canthopexy with transnasal wiring are detailed in **Figs. 14.12–14.17**.

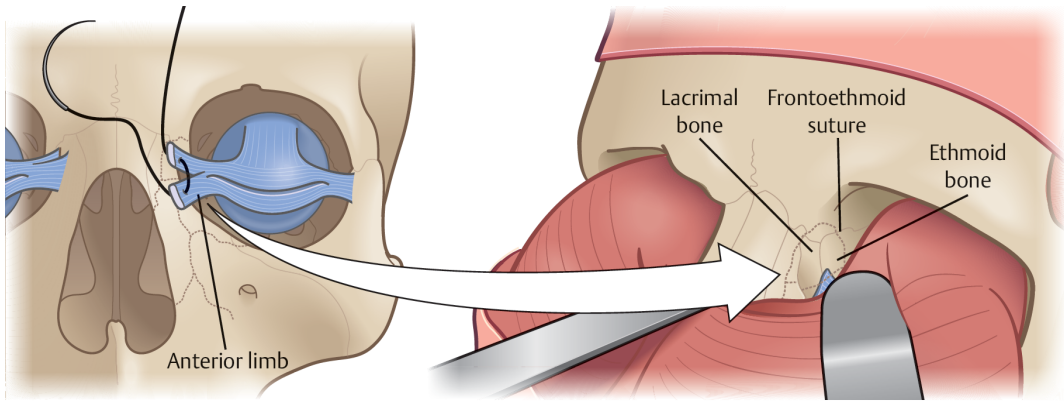

Fig. 14.12 Transnasal wiring requires wide exposure sufficient to allow transverse passage of wires across nasal and ethmoid structures. Access through local or bicoronal incisions allows excellent exposure to the canthal area. Pre-existing lacerations from trauma are typically used on the affected side. The medial canthus is identified using forceps, observing the stretch on the skin to confirm the proper structure. The anterior and posterior limbs are secured with a figure-of-eight nonabsorbable suture of 30- or 32-gauge titanium wire suture.

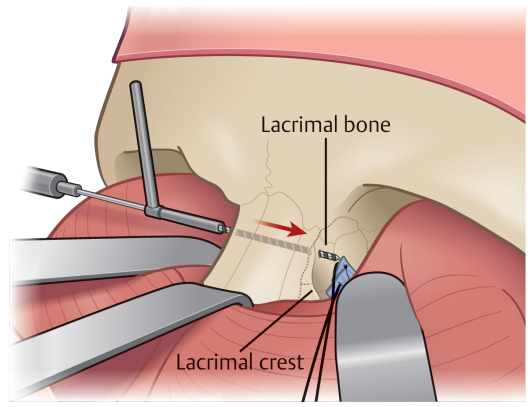

Fig. 14.13 Dissection of the medial orbital wall is carried out in a subperiosteal plane to the anterior one third of the uninjured eye to accommodate passage of the wire. A single hole is then drilled from the uninjured side directed posterior and superior to the lacrimal crest of the affected side using a 2.0- to 2.4-mm drill bit. A malleable retractor is placed to protect the globe and retractors are placed anteriorly to displace the lacrimal sac.

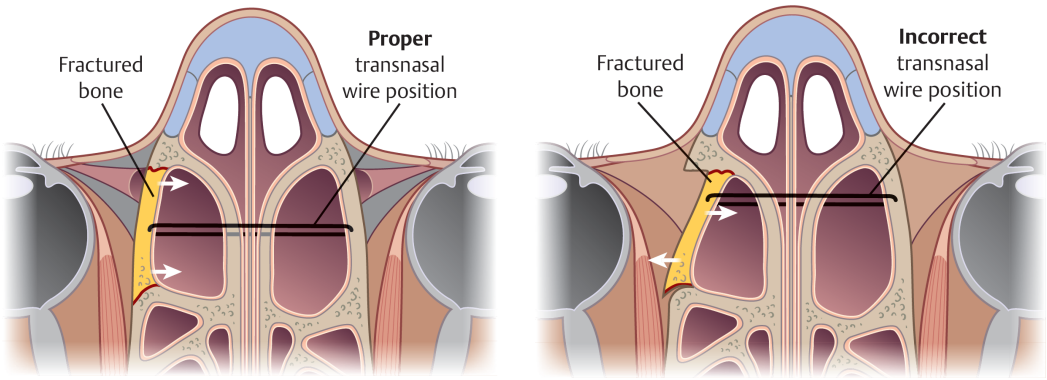

Fig. 14.14 For reconstructing an NOE fracture requiring a transnasal wire, it is important to place the wire fixation in its proper posterior position. If it is placed anteriorly, this will result in lateral splaying of the bone supporting the medial canthus and a worsening of the telecanthus.

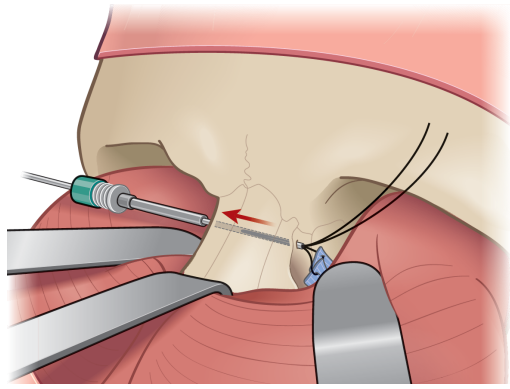

Fig. 14.15 Once the drill hole has been created, the two ends of the titanium wire or nonabsorbable suture are delivered in a single pass with the aid of a wire-passing instrument to the contralateral side.

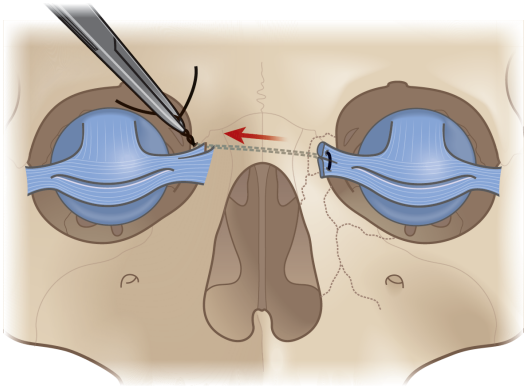

Fig. 14.16 The transnasal wire is secured to the frontal bone on the contralateral side with a screw. The wires are pulled and placed under tension to secure the medial canthus in the desired position.

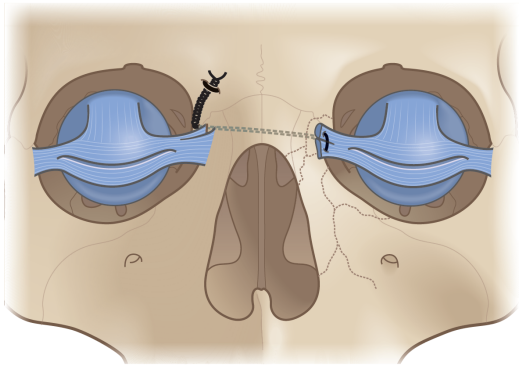

Fig. 14.17 The incisions are then closed in a layered manner.

Percutaneous bolsters or an external nasal splint should be applied to ensure adaptation of the medial canthal skin to the underlying bone.

SURGICAL TIPS

- Wide exposure is required, typically by a local, bicoronal incision or pre-existing lacerations.
- Drilling should be done from the uninjured side to the affected side.
- The drill must be directed posterior and superior to the lacrimal crest.
- The globe and lacrimal sac must be protected with insulated retractors.
- A wire passer is used through the drill bit or awl to grasp the wire through the tunnel.
- The wire is secured to the frontal bone on the contralateral side with a screw and is checked tension to ensure adequate movement of the medial canthus.

POSTOPERATIVE CARE

- The patient's head is maintained in a raised position to minimize edema and pain.
- Ice packs are applied to counteract swelling.
- Analgesic agents are given as necessary for pain control. Antiemetics are given as required to prevent nausea and emesis. A single dose of intravenous antibiotics (first-generation cephalosporin or clindamycin for patients with penicillin allergies) is given 30 to 60 minutes before the incision is made. Oral antibiotics are continued no longer than 24 hours after surgery. Corticosteroids may help with postoperative edema.
- Patients are seen 1 week after surgery for suture and bolster/external nasal splint removal (in the case of medial canthopexy). Thereafter, they are seen every other week for 1 month, and for long-term follow-up, they are seen at 6 months and 1 year postoperatively.

When extensive dissection is performed, postoperative chemosis is common. In addition to ophthalmic lubricants, a temporary tarsorrhaphy stitch is left in place for 5 to 7 days. The tarsorrhaphy is performed by placing a single 5–0 nylon suture through the upper and lower lid margins and adjacent skin approximately 2 to 3 mm lateral to the lateral limbus.

CLINICAL EXAMPLES

This 35-year-old woman with Treacher Collins syndrome underwent augmentation of her coloboma with custom-carved porous polyethylene implants and a bridge of bone canthopexy (**Fig. 14.18**).

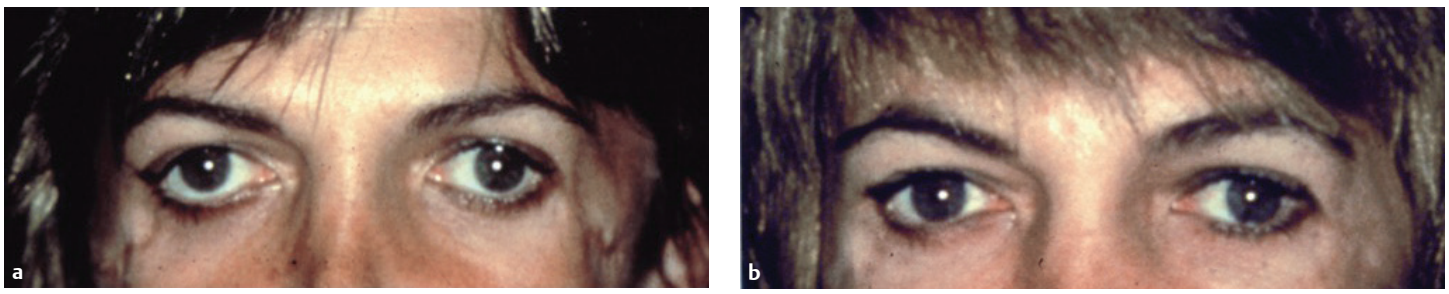

Fig. 14.18 **(a)** Preoperative frontal view. **(b)** Frontal view 2 years postoperatively.

This 27-year-old woman had not undergone any previous orbital surgery. She desired upward movement of her lateral canthus for which she underwent a bridge of bone canthopexy (**Fig. 14.19**).

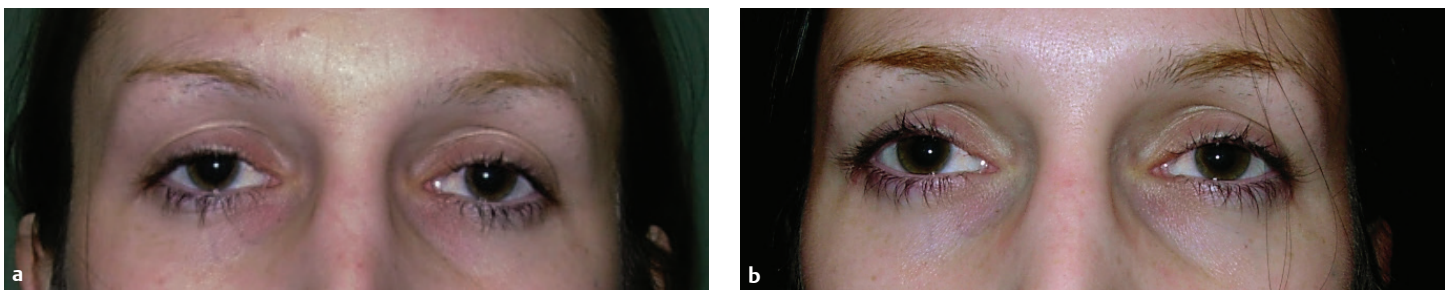

Fig. 14.19 **(a)** Preoperative frontal view. **(b)** Frontal view 6-month postoperative view.

This 50-year-old woman had undergone lower lid blepharoplasty in the past, with resulting lower lid malposition and scleral show. She underwent a subperiosteal midface lift and lateral canthopexy (**Fig. 14.20**).

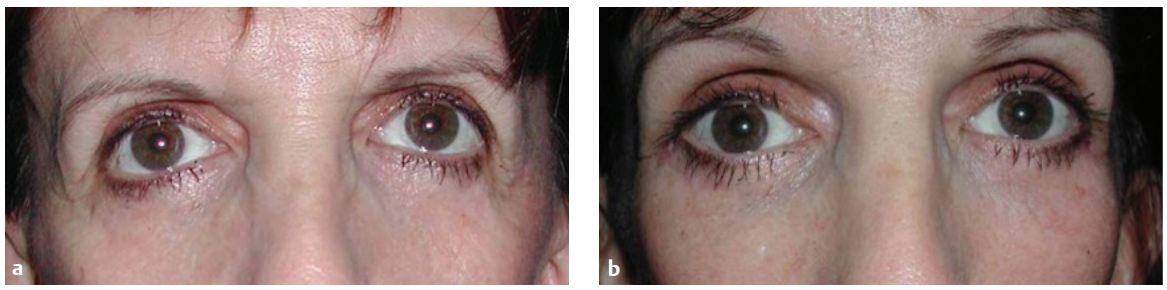

Fig. 14.20 **(a)** Preoperative frontal view. **(b)** Frontal view 1 year postoperatively.

This 52-year-old woman had undergone a previous browlift, rhytidectomy, and upper and lower lid blepharoplasty. Lower lid retraction was treated by multiple canthopexies, spacer grafts, and full-thickness skin grafts. Her dry eye symptoms persisted. An infraorbital rim augmentation, a midface lift, and lateral canthopexy resolved her symptoms (**Fig. 14.21**).

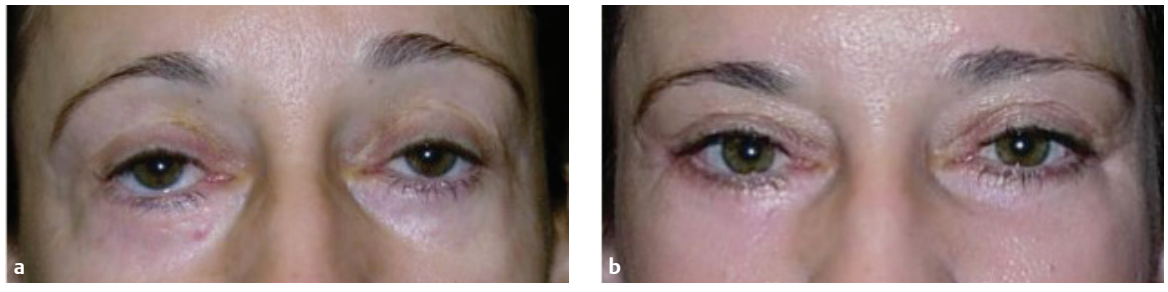

Fig. 14.21 The patient's brows and hairline were repositioned. **(a)** Preoperative frontal view. **(b)** Frontal view 2 years postoperatively.

This 44-year-old woman sustained multiple midface and orbital fractures and underwent several periorbital surgeries, leaving lower lid malposition and scleral show (**Fig. 14.22**).

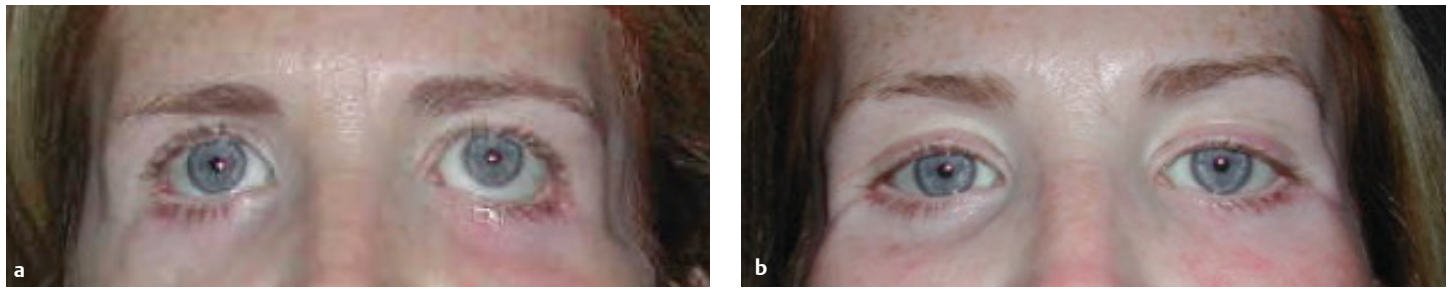

Fig. 14.22 **(a)** Preoperative frontal view of the patient before she underwent a lateral bridge of bone canthopexy and placement of a palatal mucosa spacer graft to her lower lids. **(b)** Frontal view 6 months postoperatively.

This 48-year-old man was involved in a motor vehicle collision and sustained a complex NOE fracture, with displacement of the right medial canthus (**Fig. 14.23**).

Fig. 14.23 **(a,b)** The patient underwent early operative intervention to realign and stabilize his bony fractures followed by transnasal medial canthopexy. **(c)** This 6-month postoperative photo shows malposition of the medial canthus. The transnasal wires were placed in an anterior vector, resulting in lateral splaying of the bone supporting the medial canthus and a worsening of the telecanthus.

This 34-year-old man was involved in a motor vehicle collision (**Fig. 14.24**).

Fig. 14.24 **(a)** Preoperative photo and **(b)** CT scan show NOE disruption, with resulting telecanthus. **(c)** Frontal view 1 year after a medial canthopexy shows normal intercanthal distance and medial canthal position. **(d)** Postoperative radiograph shows adequate alignment of his globe and transnasal wire in good position.

This 48-year-old woman sustained NOE fractures that were inadequately treated, with resulting telecanthus, lower lid malposition, and saddle-nose deformity (**Fig. 14.25**).

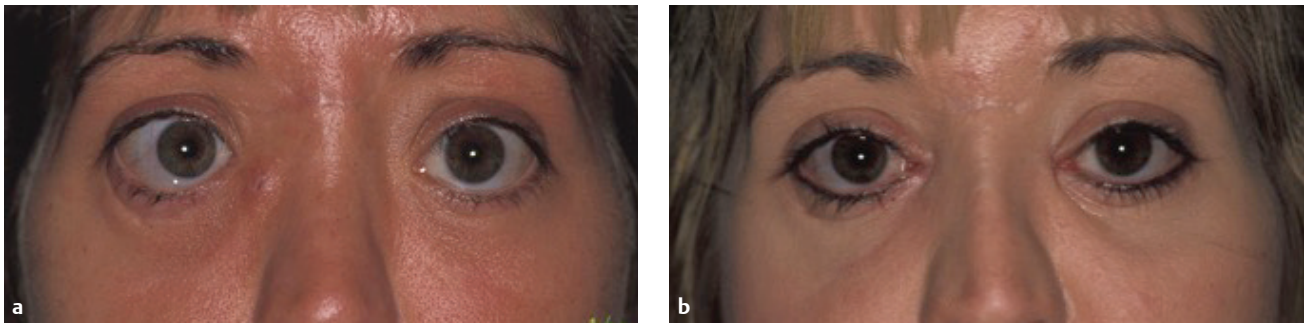

Fig. 14.25 **(a)** Preoperative frontal view of the patient's inadequately treated NOE fractures with resulting telecanthus, lower lid malposition, and saddle-nose deformity. **(b)** Secondary surgery was performed several years later, consisting of central and medial osteotomies, a cranial bone graft to the nasal dorsum, a medial canthopexy with transnasal wiring, a midface lift, and infraorbital rim augmentation.

COMPLICATIONS

Potential complications associated with canthopexy and canthoplasty include the following:

- Chemosis
- Canthal drift
- Epiphora
- Extrusion of wires or sutures
- Infection

CONCLUSION

Malposition of the medial and lateral canthi distorts the shape of the palpebral fissure and posture of the lower eyelid. Effective medial and lateral canthopexy can restore canthal and lid position.

SURGICAL PEARLS

Bridge of Bone Lateral Canthopexy

- Drill holes are placed in the lateral orbital rim using the zygomaticofrontal sutures as reference landmarks.
- This measured placement helps to achieve symmetrical canthal repositioning.
- The bridge of bone between the drill holes provides a stable platform over which the wire ends can be tied.
- The drill holes should be placed in the internal orbit about 3 to 4 mm posterior to the anterior margin of the lateral orbital rim.
- The position of the lower drill hole is vital, since it determines the maximum upward movement of the canthus.

Medial Canthopexy: Transnasal Wiring

- When reducing the medial canthus, it should be secured posteriorly and superiorly to where it normally attaches.
- The most developed and firmly adherent part of the medial canthus is the anterior limb.
- Care must be taken to identify the lacrimal sac and prevent compression, which would result in postoperative epiphora.
- Drilling should proceed from the uninjured side to preserve bone strength.
- The screw should be positioned on the frontal bone near the inner aspect of the medial orbit.
- The tension and position of the lower lid should be assessed before tightening the screw.

REFERENCES

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