The Canthofornix Incision (Lower Eyelid "Bypass") in the Management of Orbital and Zygomatic Fractures

Richard A. Pollock, MD *
M. Douglas Gossman, MD†

Abstract:

Background and Objectives. *The canthofornix incision has been suggested as an alternative to the subciliary incision in the management of orbital and zygomatic fractures; yet, some surgeons anticipate difficulty with the release of the lateral canthus or reattachment of the eyelid. To address these concerns, the authors of this article have prospectively evaluated the canthofornix approach.*

Methods and Materials. *Using selected surgical cases from more than 200 patients in two centers, this report reviews the surgical anatomy of the canthofornix incision, the major intraoperative techniques, and the benefits and limitations of this particular approach. The two authors independently judge the degree of exposure provided, teachability, and complications. The canthofornix and the subciliary incisions are compared.*

Results and/or Conclusions. *The exposure and execution of the canthofornix incision equal or exceed those provided by the subciliary incision. The canthofornix approach is superior to the subciliary when the zygomatic process of the frontal bone and the frontozygomatic suture must be exposed, providing an extended access. The initial learning curve of the canthofornix incision is steep, requiring intensive instruction. Complications are outlined in Table 2.*

Key Words: *Canthofornix incision, lower eyelid "bypass."*

*Southeastern Center for Plastic and Reconstructive Surgery. Private practice in Sikeston, Missouri. Formerly: Division of Plastic Surgery, Department of Surgery, Piedmont Hospital and the Facial Reconstruction Unit, Division of Plastic Surgery (Trauma Service), Georgia Baptist Medical Center, Atlanta, Georgia.

†Oculoplastic Surgery Service, Department of Ophthalmology/Visual Sciences, University of Louisville, School of Medicine, Louisville, Kentucky.

Corresponding author: Richard A. Pollock, MD, Southeastern Center for Plastic and Reconstructive Surgery, 1118 N. Main Street, Sikeston, MO 63801. Tel: 573-472-4411, Fax: 573-472-6426, E-mail: deltaplasticsurg@clas.net.

The Journal of Cranio-Maxillofacial Trauma 2001;7(1):13-22

A short lateral canthal soft tissue incision that releases the lateral attachments of the lower eyelid and extends across the conjunctiva of the fornix offers certain benefits, when compared to the subciliary incision: The dissection of the pretarsal orbicularis oculi fibers is precluded,[1] bleeding is minimized, the scar is hidden, and the incidence of ectropion appears to be reduced.[2,3] These advantages are derived primarily from bypassing the anterior lamella of the lower eyelid.[4]

The use of fornix incisions has been reported by numerous authors.[1,5-12] However, some experienced surgeons, as well as those in training, have expressed concerns regarding the possibility of injury to the globe or eyelid during conjunctival dissection. The concerns also include difficulty in releasing

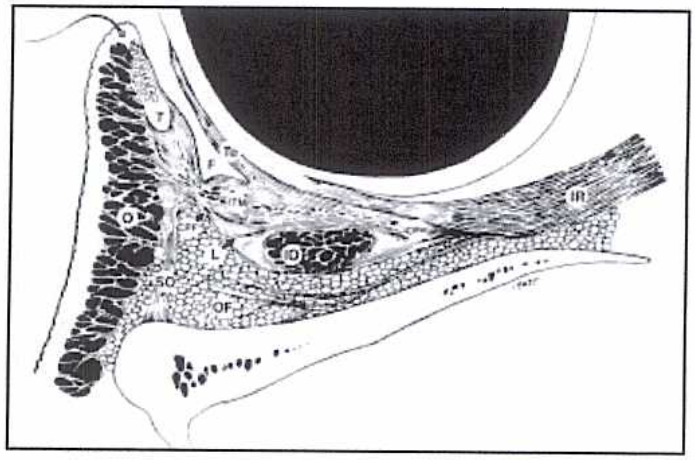

Figure 1. The anatomy of the lower fornix and lower eyelid. O=orbicularis oculi muscle; T=tarsus; F=lower fornix; ITM=inferior tarsal muscle; CPH=capsulopalpebral head; CPF=capsulopalpebral fascia; IO=inferior oblique muscle; OS=orbital septum; OF=orbital fat; IR=inferior rectus muscle. (Adapted from: Hawes MJ, Dortzbach RK. The microscopic anatomy of the lower eyelid retractors. Arch Ophthalmol 1982;100:1313, with permission from American Medical Association.)

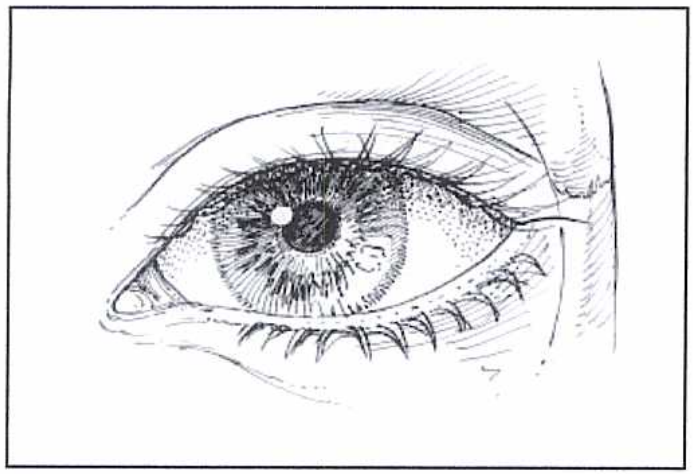

Figure 2. Canthal skin is incised, using a scalpel for a distance of 4 mm to 8 mm, then extended through the orbicularis oculi muscle via needle electocautery. A drill hole is made in the lateral orbital rim to mark the level of the lateral canthal tendon.

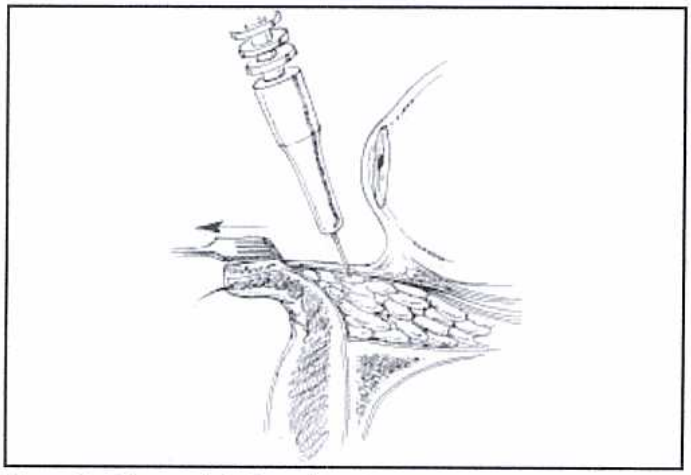

Figure 3. Release of the lateral attachments of the eyelid at the canthus permits the eversion of the eyelid and full exposure of the lower fornix.

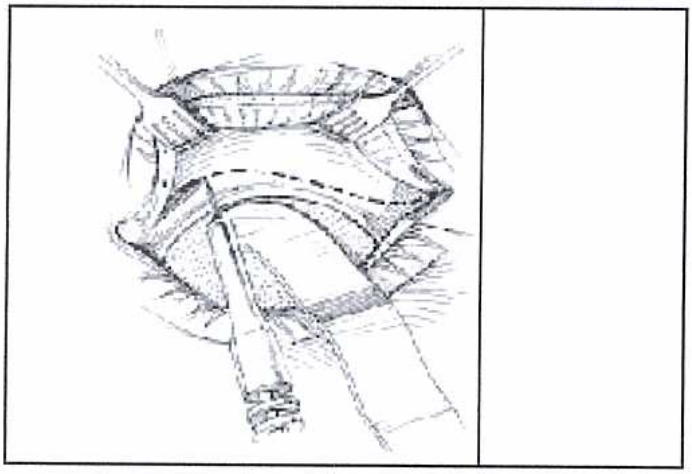

Figure 4. The conjunctival incision begins medially in the lower fornix, extends laterally approximately 8 mm to 10 mm below the central inferior tarsal margin, and then turns outwardly to reach the lateral canthus. A contoured lens protects the globe, and an insulated malleable retractor displaces the globe posteriorly (toward the orbital apex), fully revealing the fornix.

the lateral attachments of the eyelids and the execution of operative methods that restore the canthus to its anatomic (preoperative) position.[13,14] To address these concerns, the authors have prospectively evaluated the canthofornix approach in 200 patients with 236 orbital, zygomatic, and zygomaticomaxillary fractures. This article reviews the surgical anatomy of the canthofornix incision, details the key intraoperative techniques (some of which are original), and demonstrates the benefits and limitations of the canthofornix incision in the management of orbital and periorbital fractures. In this report, the combination of a conjunctival incision and lateral canthotomy[2,9-11,15] is termed the "canthofornix incision," since the canthal release and the conjunctival incision are made in continuity, and the procedure is initiated with surgical release of the lateral attachments of the lower eyelid from the lateral orbital rim.

ANATOMY

Resident surgeons regard managing the subtle anatomy of the lateral eyelid attachments to the zygoma and the fornix as the greatest challenge. Those who wish to become surgically proficient engage in extensive fresh cadaver dissections of the lateral canthus prior to surgery with live patients. The use of high-power loupe magnification and the subsequent review of videotapes, taken with overhead cameras during such dissections, are useful teaching aids.

The Concept of the Anterior and Posterior Lamellae

Functionally, the lower eyelid has two dominant layers or lamellae.[16,17] The anterior lamella contains skin, the orbicularis muscle and its fascia, and the orbital septum. The posterior lamella of the lower eyelid includes the conjunctiva, postseptal fascia, the capsulopalpebral fascia, and the inferior tarsal muscle (the lower eyelid retractors) (Figure 1).[17] When the canthofornix incision is utilized, the anterior lamella is not violated, except at the lateral canthus.

The Lateral Eyelid Attachments to the Zygoma

Three dominant band-like structures bind the upper and lower eyelids to the superior and inferior aspects of the lateral orbital rim. The first band is part of the posterior lamella and is encountered as a thick confluence superior to the conjunctiva. It has been called the posterior crus (limb) of the lateral canthal tendon and arises from the lateral orbital wall in the area of Whitnall's tubercle, along with Lockwood's ligament and the lateral horn (extension) of the levator aponeurosis.[16] A second band encountered at the orbital rim during controlled

laboratory dissection appears to be a confluence of periosteum, orbital septum (arcus marginalis), and temporalis fascia. A third band is in the plane of the posterior fascia of the orbicularis muscle and probably represents a portion of the submuscular aponeurotic system (SMAS). The middle and outer bands are parts of the anterior lamella and have been referred to as the anterior limb (crus) of the lateral canthal tendon.

To reveal the definitions of the attachments at surgery, the eyelids are divided at the raphe, and the lower lateral eyelid is retracted anteriorly, away from the underlying orbital rim. Tactile clues provided by a cautery tip or anatomical dissector offer identification of each band. The bands are lysed close to the lateral orbital rim. Lysis begins with the posterior crus and proceeds outwardly. As each band is lysed, notably the first, increasingly greater outward mobilization of the eyelid is possible.[10,11,15]

The Concept of the Lower Fornix

The palpebral and bulbar conjunctiva meet near the orbital floor in a sulcus, called the lower fornix (Figure 1).[5,18] Immediately inferior to the tarsal plate in the subtarsal area, the conjunctiva and orbital septum are in close proximity. In contrast, in the lower fornix where the canthofornix incision is made, the conjunctiva and orbital septum are at a relative distance from each other. The lower eyelid retractors (the capsulopalpebral fascia and the inferior tarsal muscle) are beneath the conjunctiva of the fornix and ascend (conjoined with the orbital septum) to insert on the inferior tarsus.[18]

Pertinent Orbital Osteology

Whitnall's tubercle is approximately 10 mm below the frontozygomatic suture and 3.5 mm to 4 mm inside the lateral orbital rim.[16] The periorbita attached to the tubercle receives the lateral canthal tendon, the lateral horn of the levator aponeurosis, Lockwood's ligament, and the check ligament of the inferior rectus muscle.[17] The eyelids are reattached during the closure of the canthofornix incision.

THE CANTHAL INCISION

The lateral canthus and deep fornix are infiltrated with lidocaine containing epinephrine and hyaluronidase (1.0 cc hyaluronidase added to 9.0 cc of 0.5% or 1.0% lidocaine with epinephrine). A contoured protective lens (Danker Laboratories, Sarasota, FL) is inserted prior to initiating the incision, and a suture may be applied to the tarsus of the lateral eyelid to aid retraction. Operating loupes that provide at least 3× magnification are utilized.

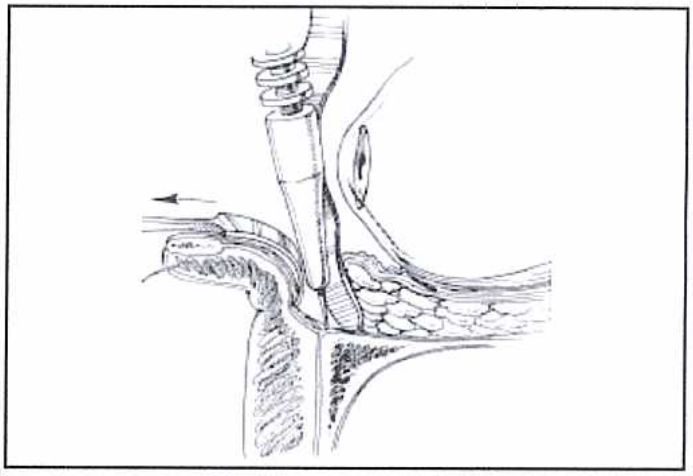

Figure 5. The eyelid retractors are stretched over the inferior orbital rim, and the lens-covered globe is displaced posteriorly toward the apex of the orbit using retractors. Only then is the incision extended to the inferior orbital rim.

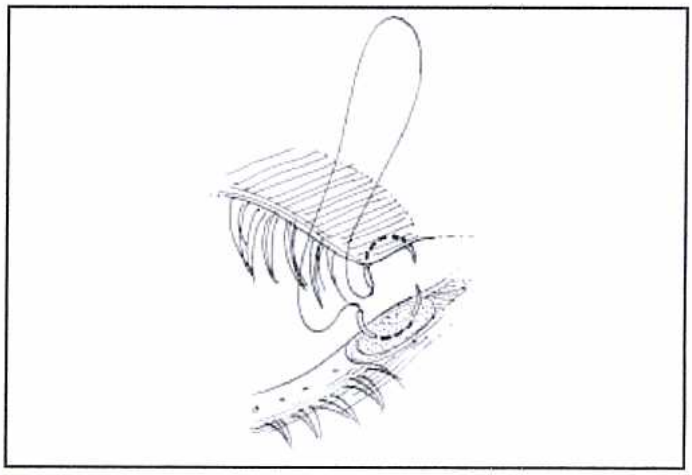

Figure 6. Half-circle needles bisect the upper and lower tarsi.

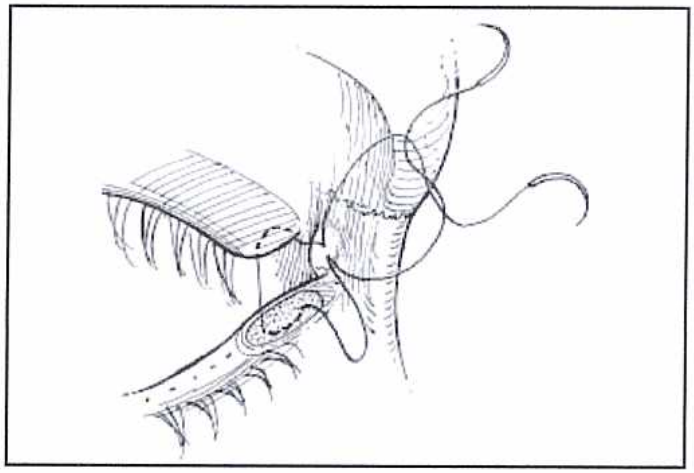

Figure 7. The suture engages periosteum on the lateral orbital wall just below the plane of the upper limb of the lateral canthal tendon, if it has been preserved.

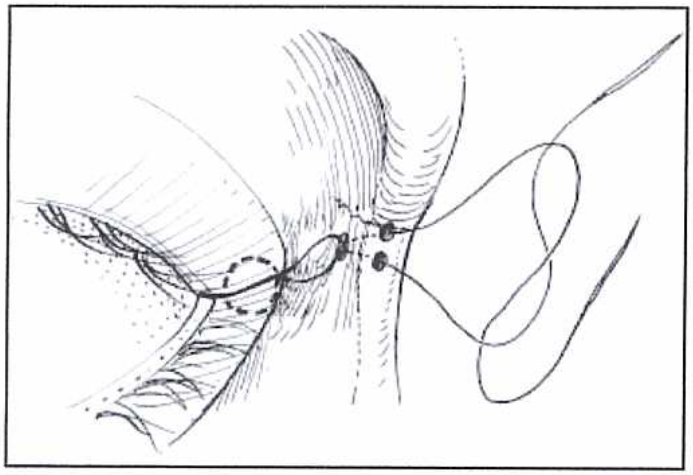

Figure 8. When the lateral periorbita has been widely elevated in complex fractures, two drill holes are placed in the lateral orbital rim for passage of the needles and suture.

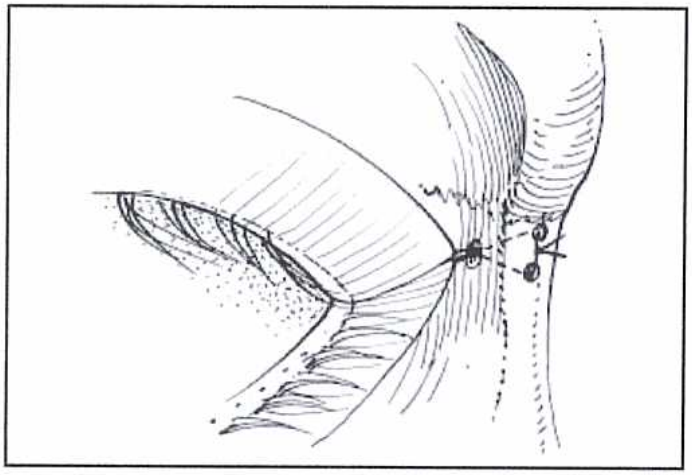

Figure 9. Tension upon the suture binds the eyelids to the orbital rim.

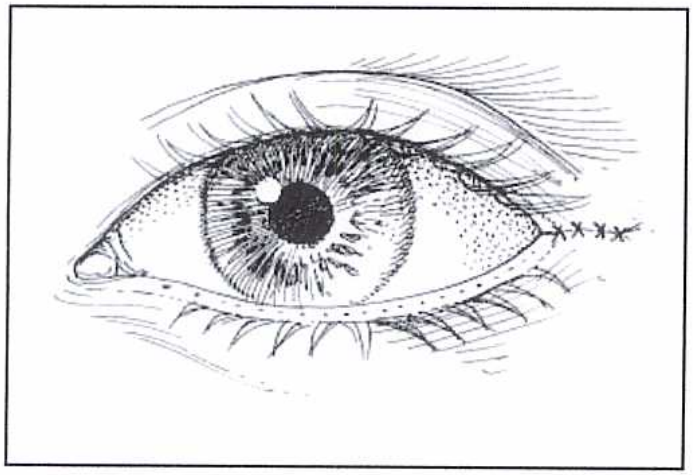

Figure 10. Careful eversion of the skin margins, with perhaps a vertical mattress cross-stitch, minimizes canthal scar formation.

The skin incision begins at the lateral raphe and ascends in a subtle curve from the lateral canthus following the relaxed skin tension lines (Figure 2). The length of the canthal incision varies from 0.4 cm to 0.8 cm in length, according to the extent of the planned exposure of the lateral orbit. Greater or lesser lengths may be selected; if the superior aspect of the lateral orbital rim is to be exposed, notably the zygomatic process of the frontal bone, a longer incision is preferred.

Following the skin incision, an insulated needle electrocautery (eg, E-Z Clean Needle Electrode, MegaDyne, Draper Medical Products, UT) is used to divide the orbicularis muscle. The sequential use of scalpel and cautery facilitates the control of bleeding that invariably results from transection of vessels penetrating the undersurface of the muscle. Attachments of the eyelid(s) to the lateral orbital rim are located and cut close to the lateral orbital rim, and full eversion of the lower eyelid becomes possible (Figure 3). Without total canthal release, the lower fornix cannot be exposed, and the conjunctival incision would be placed too close to the tarsal plate.

In fractures limited to the orbital floor and lower medial wall, the upper arm of the posterior crus of the lateral canthal tendon is not transected. In these cases, the crus is used to guide the reattachment of the lower eyelid during closure. In more extensive fractures, in which the frontozygomatic suture and the upper lateral orbit are to be exposed, a partial-thickness 1.0 mm drill hole is first placed in the lateral orbital rim, at the lateral canthal angle. Only then the entire lateral canthal tendon is taken down, and both eyelids are released. This osseus marker designates the position of the lateral canthus and is a key in determining the proper level of canthal reattachment during the closure.

CONJUNCTIVAL AND RETRACTOR RELEASE

With the eyelid held in eversion by small rake retractors, the lens-covered globe is displaced (and protected) posteriorly by a malleable retractor, completing the exposure of the fornix. Sharp retractors reduce the risk of tissue slippage and injury to the eyelid by cautery or scissors. Beginning at the inferior pole of the caruncle, the cautery is used to extend the incision across the fornix, at least 4 mm below the tarsus, before terminating it at the lateral canthal raphe (Figure 4).

Prior to extending the incision to the orbital rim, the rake-type retractors are replaced by the right-angle retractors (eg, Ragnelle-Davis or Mathieu, Padgett Instruments, Kansas City, MO). An insulated malleable retractor is also placed into the fornix to retract the cut conjunctival margin. The assistants use these instruments to stretch the eyelid retractors over the orbital rim. The incision is then extended directly to the inferior orbital rim (Figure 5). The appearance of orbital fat confirms the retroseptal plane of the dissection. The fat is held away from the incision site by the malleable retractor during subsequent subperiosteal dissection. If exposure of the superior aspect of

Figure 11. Case 1. Preoperative view of a 5-year-old boy with fractures of the right zygoma, sustained when struck by an automobile.

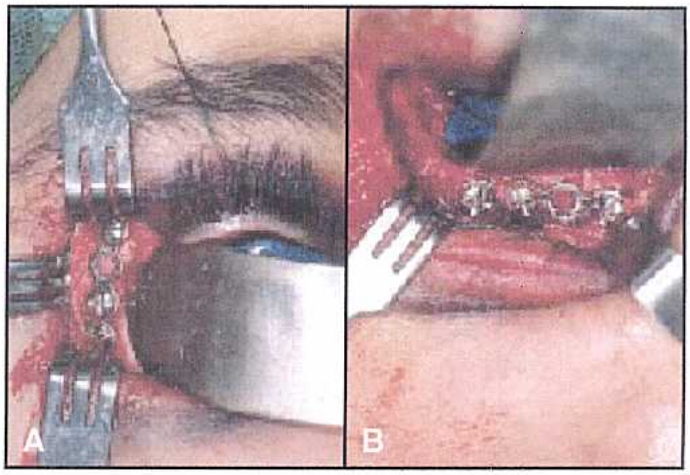

Figure 12. Two-point fixation at the frontozygomatic suture and the inferior orbital rim preceded reattachment of the right eyelids to the lateral orbital rim.

Figure 13. Closure of lengthy canthal incision that allowed exposure of the lateral orbital plate and the zygomatic portion of the frontal bone.

Figure 14. Three-year postoperative view. A minimal scar remained following the removal of the metal appliances.

the orbital plate of the zygoma and zygomatic process of the frontal bone is necessary, the periosteal elevation is carried to the superior aspect of the lateral orbital rim.

CLOSURE

After the osseus repair, the periosteum is resuspended to the inferior orbital rim to correctly position the facial tissue mask. The conjunctiva of the lower fornix is closed with two or three interrupted resorbable 7-0 sutures. Interrupted sutures allow fluids to drain through the incision in the early postoperative period, reducing postoperative edema. Nonresorbable suture in a half-circle needle (eg, 4-0 Polydek, Deknatel, Atlanta, GA, with an ME-2 double-armed needle) is passed vertically through the lateral tarsus of each eyelid to restore proper eyelid apposition at the lateral canthal angle (Figure 6). The vertical passage of the needle must bisect the tarsus perfectly, in order to avoid iatrogenic canting of the eyelid, outwardly and inwardly.[10] If it has been preserved, both needles engage the lateral orbital periosteum, 4.0 mm posterior to the rim (Figure 7). As noted earlier, this technique is usually possible only with fractures limited to the orbital floor, inferior orbital rim, and lower medial wall, in which degloving of the lateral orbital periosteum can be avoided and in which the superior arm of the lateral canthal tendon has been preserved.

Table 1

Fracture Type and Frequency by Center

Fracture Site	Center	
	Louisville, KY	Atlanta, GA
Orbital floor	18	5
Orbital floor and medial wall	22	5
Zygoma	10	30
Zygomatic and orbital fractures	29	40
Zygomaticomaxillary fractures	10	44
Bilateral zygomaticomaxillary and orbital fractures	6	16
TOTAL:	**96**	**140**

Figure 15. Case 2. Preoperative view of a 13-year-old patient with complex fractures of the right zygoma, orbit, and maxilla, sustained in a sporting event.

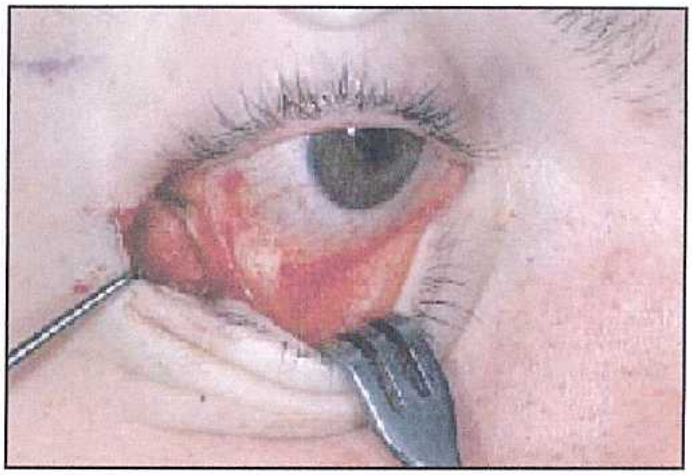

Figure 16. Complete release of the lateral attachments of the lower eyelid allows full exposure of the lower fornix, followed by a subsequent release of the lateral attachments of the upper eyelid.

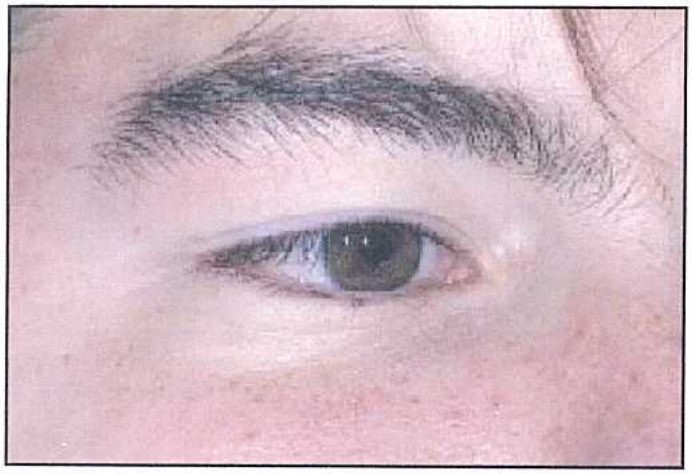

Figure 17. Following extensive periosteal elevation, the application of appliances, and orbital grafting, the canthal scar healed well.

Figure 18. Two-year postoperative view of palpebral symmetry, achieved by surgical intervention and 2-hole suture fixation of the eyelids.

When both eyelids have been released, and the lateral periorbita has been widely elevated, direct fixation of the tarsi to the zygoma is necessary. The drill hole, previously placed as a marker, is now extended to the inner orbital wall, exiting at Whitnall's tubercle on a plane that is approximately 1.0 mm superior to the medial raphe. A second hole is drilled, intersecting the first (hole) at the inner orbital wall. Typically, the drill holes are placed approximately 3 mm to 4 mm apart. The arms of the suture attached to the lateral tarsi are then carried through one of the predrilled holes, using a 30-gauge wire fashioned into a snare (Figure 8). Appropriate tension is applied to the suture, binding the lateral raphe to the orbital rim (Figure 9). Two or three interrupted resorbable sutures reconstitute the fascia of the orbicularis muscle. Lateral traction with a skin hook simplifies approximation of the skin margins, using fine nonresorbable suture (eg, 7-0, P-6 needle, Ethicon, Somerville, NJ) (Figure 10).

CLINICAL CASE SUMMARIES

Case 1

A 5-year-old male patient sustained fractures of the right zygoma when he was struck by an automobile (Figure 11). Two-point fixation at the frontozygomatic suture and the inferior orbital rim preceded reattachment of the right eyelids to the lateral orbital rim (Figure 12). Closure of lengthy canthal incision allowed exposure of the lateral orbital plate and the zygomatic portion of the frontal bone (Figure 13). Following the removal of metal appliances 3 years postoperatively, a minimal scar remained (Figure 14).

Case 2

A 13-year-old male patient sustained complex fractures of the right zygoma, orbit, and maxilla during a sporting event (Figure 15). Complete release of the lateral attachments of the lower eyelid allowed full exposure of the lower fornix, fol-

lowed by a release of the lateral attachments of the upper eyelid (Figure 16). Palpebral symmetry was achieved by surgical intervention (Figure 17), and the postoperative result is presented (Figure 18).

Case 3

An electrical lineman sustained orbital and periorbital fractures and ecchymosis, without significant contusion or laceration, in an accident involving an electrical utility pole (Figure 19). The canthal portion of the canthofornix incision is presented (Figure 20); a traction suture in the upper eyelid aided exposure. The postoperative scar was almost undetectable (Figure 21 and 22).

Case 4

An elderly patient presented with a fracture of the left zygoma, sustained in a fall, with minimal displacement that required little subsequent operative periosteal elevation (Figure 23A). A skin hook (at gravity) was used in this and other cases to aid in aligning the wound margins. A corneal protector was also used in all cases, throughout the procedure. The incision was placed in a natural wrinkle in the direction of the relaxed skin tension lines, and good scar prognosis was anticipated. Symmetry of the palpebral fissures may be achieved when a soft-tissue marker (superior crus of the lateral canthal tendon) has been reserved or when an osseous marker (drill hole) is placed in the frontal process of the zygoma, prior to detaching the eyelid (Figure 23B).

AUTHORS' EXPERIENCE AND DISCUSSION

The canthofornix incision was evaluated prospectively, first in 100 patients with 107 orbital and/or periorbital fractures[4] and then in 100 patients with 129 fractures, following some modifications in the operative technique and the selection of equipment (Table 1). The two authors judged the degree of exposure provided, teachability, and complications (Table 2) of the canthofornix incision, used in a myriad of fracture types. Other regional incisions were added, as required, for broad exposure of the fractures. For example, the exposure of most zygomatic and maxillary fractures required the addition of an upper vestibular incision. Fractures of the upper medial orbital wall typically merited the additional exposure provided by the bicoronal incision. We found, in general, that the canthofornix incision is compatible with a decade of general experience, embracing regional incisions that offer minimal tissue distortion and concealed scars following craniofacial fracture repair. With the modifications in our technique to improve the accuracy of reattachment of the eyelids to the lateral orbital rim, we have become committed advocates of the incision.

Figure 19. Case 3. Preoperative view of an electrical lineman, who sustained orbital and periorbital fractures and ecchymosis without significant contusion or laceration in an accident involving an electric utility pole.

Figure 20. The canthal portion of the canthofornix incision is apparent; a traction suture in upper eyelid aids exposure.

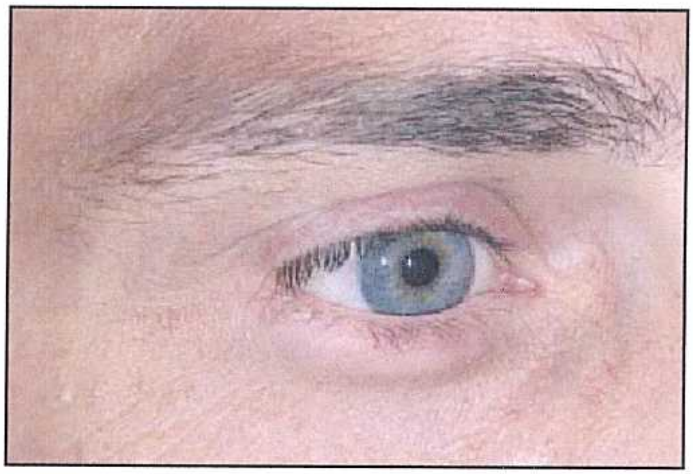

Figure 21. The postoperative scar is barely detectable in this and most cases.

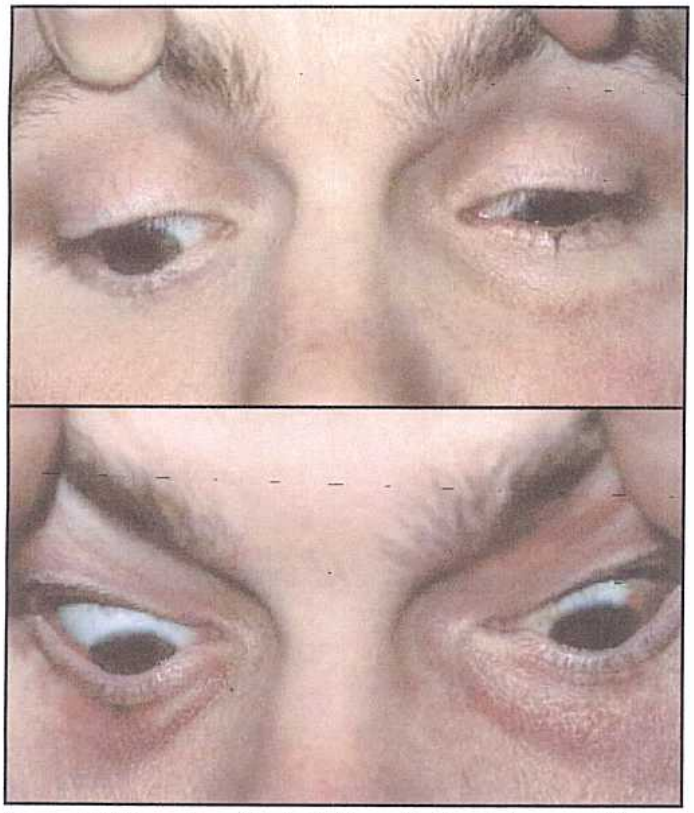

Figure 24. (Examples of Potential Complications): Lower eyelid retraction is transiently absent in the immediate postoperative period after the canthofornix incision, as depicted on the patient's left. Retraction returns with healing of the fornix incision.

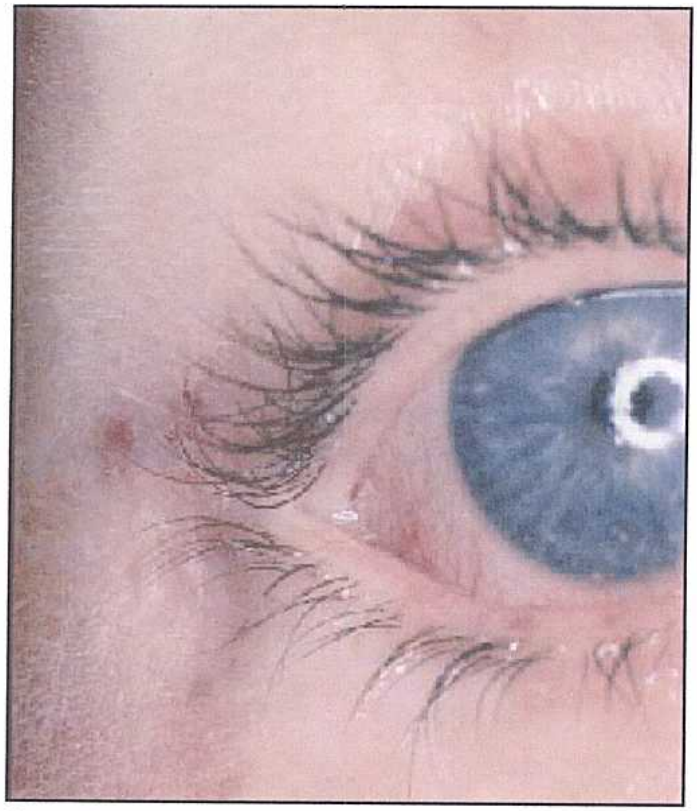

Figure 25. The canthus may be reattached more superiorly, more inferiorly, or (as in this case) more anteriorly than it should be. Adjustment of the eyelid position is a minor procedure.

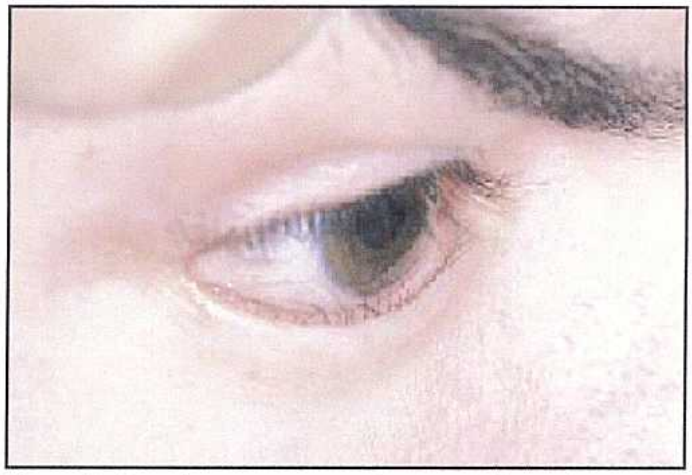

Figure 26. Entropion may occur transiently and will usually respond to conservative measures, such as suture tarsorrhaphy.

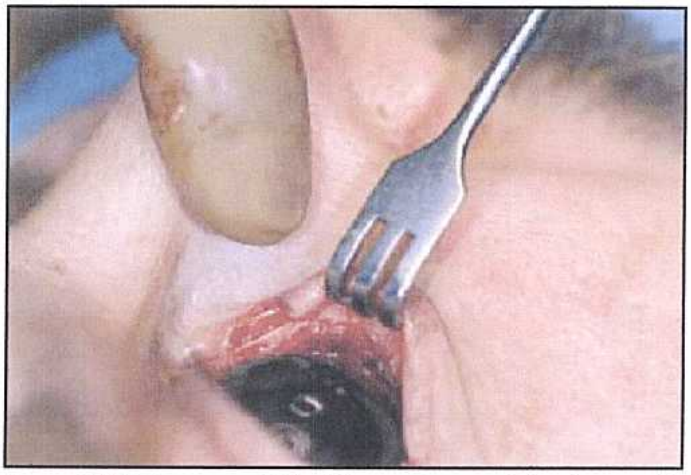

Figure 27. Lid trauma, notably at the margin, may follow the use of sharp instruments or injudicious retraction. The rent is repaired acutely with fine suture.

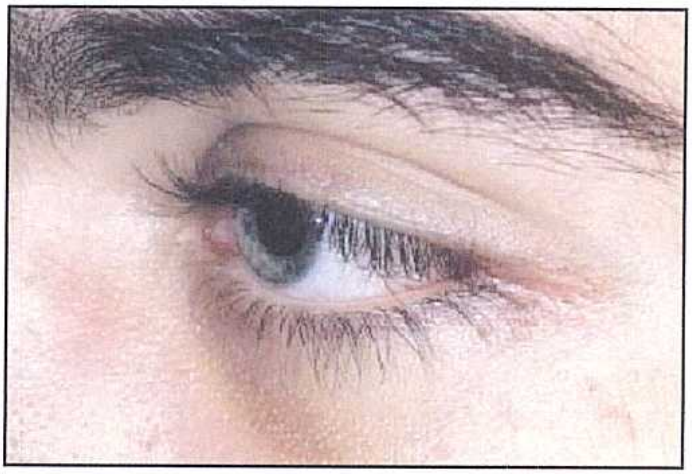

Figure 28. Untoward scar or "suture" granuloma may develop in the thicker skin of the lateral canthus and require secondary excision and repair.

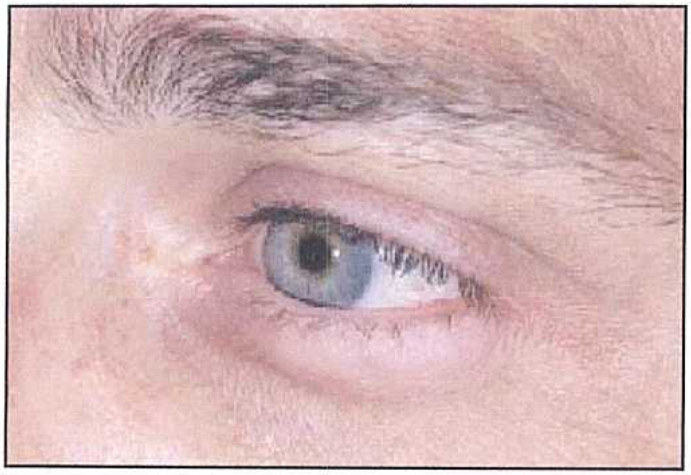

Figure 22. The size and contour of the right palpebral fissure (Figure 21) match that of the control (unoperated) side.

Figure 23A. Case 4. An elderly patient presented with a fracture of the left zygoma, sustained in a fall, with minimal displacement that required only a limited operative periosteal elevation.
23B. Symmetry of the palpebral fissures may be achieved when a soft-tissue marker (superior crus of the lateral canthal tendon) has been reserved or an osseus marker (drill hole) is placed in the frontal process of the zygoma, prior to detachment of the eyelid.

Experienced surgeons can execute the canthofornix incision rapidly, providing access to the orbital floor (including the preannular shelf)[19] and the lower medial wall. The exposure rivals that provided by the subciliary incision.[12-14] When the zygomatic process of the frontal bone and the frontozygomatic suture must be exposed, the canthofornix approach surpasses the subciliary,[11] since this extended access is obtained by the simple release of the eyelid from the rim and by further periosteal elevation.

The majority of the complications recorded in this report (Figures 24 through 28) occurred in the first 100 patients (Table 2). In the subsequent 100 patients, most complications

Table 2

Complications Following the Canthofornix Incision in 200 Patients With 236 Fractures

	Centers			
	Louisville	**Atlanta**	**Combined**	**Percentage**
First 100 Cases (107 Fractures)				
Eyelid Malposition:				
Ectropion	0	0	0	0
Entropion	0	2	2	1.9
Canthal Malposition:				
Superior	0	0	0	0
Inferior	4	3	7	6.5
Anterior	3	0	3	2.8
Lid Trauma	2	2	4	3.7
Canthal Scar	1	4	5	4.7
Second 100 Cases (129 Fractures)				
Eyelid Malposition:				
Ectropion	0	0	0	0
Entropion	1	0	1	0.8
Canthal Malposition:				
Superior	0	0	0	0
Inferior	0	3	3	2.8
Anterior	0	0	0	0
Lid Trauma	0	0	0	0
Canthal Scar	0	3	3	2.3

were avoided by finding better operative methods or by selecting more appropriate instruments that respect the integrity of the delicate tissue of the posterior lamellae. For example, a drill hole was made *before* completely detaching the eyelid with complex high-velocity fractures, so that reattachment of the eyelids was simplified and achieved more accurately. After the conjunctival incision was initiated in the lower fornix, toothed rakes (used to grip the conjunctiva during the incision of the conjunctiva) were replaced by retractors (Ragnelle-Davis or Mathieu, Padgett Instruments, Kansas City, MO). This procedure, we learned, minimized the risk of injury to the conjunctiva, as the conjunctival incision was completed.

Neither ectropion nor scleral show occurred in the series. Their absence suggests an advantage of the canthofornix incision over the subciliary incision, as noted by others.[2,3] However, our data (as well as data in other literature) are not controlled and do not permit definitive comparison. Nevertheless, while exploring eyelids with ectropion *after subciliary incisions,* notable scar tissue was occasionally encountered at the anterior surface of the tarsus and in the preseptal plane, beneath the orbicularis muscle, en route to the orbital rim. We surmise from this collective experience that subciliary incisions and subtarsal conjunctival incisions (that are followed by significant pretarsal and preseptal scar formation) predispose the tarsus and anterior lamella to retraction and outward malposition of the eyelid, manifested as ectropion.

Three of our patients developed entropion and corneal irritation that were not relieved by temporary suture tarsorrhaphy[15,20] and other conservative measures. During exploration of these cases, it was noted that the conjunctival portion of the canthofornix incision had been made near the inferior border of the tarsus. Scar tissue in these cases began at the posteroinferior margin of the tarsus and extended in the preseptal plane to the inferior orbital rim. Therefore, we speculate that conjunctival incisions, made at the lower margin of the tarsus (rather than in the lower fornix), predispose the tarsus and posterior lamella to retraction and inward rotation manifest as *entropion*. Notably, by positioning the conjunctival incision deep within the fornix, a generous cuff of conjunctiva precludes unplanned entry into a preseptal plane. We conclude that the septum and orbicularis oculi muscle are relatively "protected" when an incision is made in the lower fornix and when the anterior lamella of the lower eyelid is bypassed.

CONCLUSION

The canthofornix incision is a viable alternate to the subciliary incision in the repair of orbital and zygomatic fractures. The lengthy invasion of the anterior lamella below the lid lashes is avoided, and an incision is made in the lower fornix of the posterior lamella instead, where the scar is concealed. The authors suggest that the low incidence of eyelid malposition (ectropion) in their experience with the canthofornix incision in some 200 cases is the result of this anterior lamellar "bypass" and 2-hole suture fixation of the eyelid to the lateral orbital rim. The canthofornix approach is superior to the subciliary when additional exposure of the zygomatic process of the frontal bone and the frontozygomatic suture must be performed to facilitate fracture repair. The canthofornix incision appears to be a true regional incision that provokes minimal tissue distortion and offers concealed scars in craniofacial repair.

REFERENCES

1. Converse JM, Firmin F, Wood-Smith D, Friedland JA. The conjunctival approach in orbital fractures. Plast Reconstr Surg 1973;52:656-657.
2. Holtman B, Wray R, Little G. A randomized comparison of four incisions for orbital fractures. Plast Reconstr Surg 1981;67:731-735.
3. Pospisil OA, Fernando TD. Review of the lower blepharoplasty incision as a surgical approach to zygomatic-orbital fractures. Brit J Oral Maxillofac Surg 1984;22: 261-268.
4. Pollock RA, Gossman MD, Rudderman RH. Extended lateral canthotomy and the treatment of 104 consecutive orbital fractures (abstract). Plast Surg Forum 1988;11:178-179.
5. Bourquet J. Les hernies graisseuses de l'orbite: Notre traitement chirurgical. Bull Acad Med 1924;92:1270-1272.
6. Gillies H, Millard DR. Principles and Art of Plastic Surgery. Boston, MA: Little, Brown, and Co; 1957:402.
7. Tenzel RR, Miller GR. Orbital blow-out fracture repair, conjunctival approach. Amer J Ophthalmol 1971;71:1141-1142.
8. Tessier P. The conjunctival approach to the orbital floor and maxilla in congenital malformation and trauma. J Maxillofac Surg 1973;1:3-8.
9. Wray RA, Holtman B, Ribaudo JM, et al. A comparison of conjunctival and subciliary incisions for orbital fractures. Brit J Plast Surg 1977;30:142-145.
10. McCord CD Jr, Moses JL. Exposure of the inferior orbit with fornix incision and lateral canthotomy. Ophtahlmol Surg 1979;10:59-63.
11. Jackson IT, Schiele UU, Adham M. The conjunctival approach to the orbital floor and maxilla — advantages and disadvantages. Ann Plast Surg 1987;19:46-48.
12. Manson PN. Facial injuries. In: McCarthy JD (ed). Plastic Surgery. Philadelphia, PA: W.B. Saunders;1990:1071-1075.
13. Heckler FR, Songcharoen S, Sultani FA. Subciliary incision and skin-muscle eyelid flap for orbital fractures. Ann Plast Surg 1983;10:309-313.
14. Manson PN, Ruas E, Iliff N, Yaremchuk M. Single eyelid incision for exposure of the zygomatic bone and orbital reconstruction. Plast Reconstr Surg 1987;79: 120-126.
15. Gossman MD, Pollock RA. Acute orbital trauma, diagnosis and treatment. In: McCord CD, Tanenbaum M, Nunery WR (eds). Oculoplastic Surgery. New York, NY: Raven Press;1995:515-551.
16. Whitnall SE. Anatomy of the Human Orbit and Accessory Organs of Vision. Huntington, NY: Robert E. Kreiger Publishing; 1979:115-165.
17. Zide BM, Jelks GW. Surgical Anatomy of the Orbit. New York, NY: Raven Press; 1985.
18. Hawes MJ, Dortzback RK. The microscopic anatomy of the lower eyelid retractors. Arch Ophthalmol 1982;100:1313-1318.
19. Pollock RA. Orbital osseus anatomy: Cadaveric, three-dimensional radiographic and serial section features of clinical significance (abstract). Clin Anat 1990;3:75.
20. Gossman MD, Bowe B, Tanenbaum M. Reversible suture tarsorrhaphy for eyelid malposition and keratoplasty. Ophthal Surg 1991;22:237-239.

The Canthofornix Incision (Lower Eyelid "Bypass") In the Management of Orbital and Zygomatic Fractures

Richard A. Pollock, MD ▪ M. Douglas Gossman, MD

Discussion by Nicholas T. Iliff, MD*

The authors present a large series of patients with facial fractures, repaired through what they term a "canthofornix" incision. Certainly, the conjunctival approach to orbital fractures is not new. However, what is presented here is the authors' experience that is extensive enough to have identified some of the fine points needed for a successful utilization of this technique. They point out rightly that every effort should be made to minimize external scarring, while achieving adequate exposure to facilitate an effective and safe repair. The canthofornix incision allows the smallest visible scar and the least intrusion into the tissues of the lower lid. Pollock and Gossman stress protection of the eye, proper placement of the conjunctival incision, and techniques for a correct realignment of the lateral canthus.

While Pollock and Gossman do not go into detail about their results, they present some representative cases, and they list the complications encountered. The entropion that occurred in several patients was due to lid scarring, related to some earlier technique. They do not discuss what maneuvers were ultimately required to correct that problem when suture tarsorrhaphy and time failed.

The focus of the report is on the prevention of lower lid abnormality, and the details of the discussion to accomplish that objective are good. However, they neglect to discuss the position and the protection of another important structure — the inferior oblique muscle — although its location is identified in Figure 1 and labeled in the legend accordingly. When the inferior oblique muscle is encountered through a conjunctival approach to the orbit, knowledge of its position and protection is important in order to prevent damage.

The transconjunctival approach for repair of orbital and zygomatic fractures is gaining in popularity. The effectiveness and safety of this operation depends on attention to detail and an atraumatic technique. Those details and techniques are well reported here.

*Associate Professor of Ophthalmology and Plastic Surgery, Wilmer Ophthalmological Institute, Johns Hopkins University School of Medicine, 6000 North Wolfe Street / Maumenee 127, Baltimore, MD 21287-9218. Tel: 410-955-1112, Fax: 410-614-9987.