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Lacrimal Trauma

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Canalicular lacerations are common after blunt trauma to the periorbital region. The tissue surrounding the canaliculi is relatively fragile, as the tarsal plate ends at the punctum, leaving only soft tissue for medial canthal area support. Lacerations from blunt trauma likely result from lateral traction of the eyelid during trauma.[1] The most common mechanism for canalicular laceration is blunt trauma from a fist punch, which accounts for 23% of such injuries.[2] Dog bites account for 19% of canalicular lacerations[3] and are the most common cause of these lacerations in children.[2] Concomitant medial canthal tendon injury has been reported to occur in 36% of insults resulting in canalicular lacerations.[4]

Canalicular lacerations should be repaired within 72 hours to ensure the best possible outcome. Surgery usually involves placement of a stent to assist in apposition of the canalicular edges. If a medial eyelid and canalicular laceration is repaired without placement of a stent, the canaliculus will likely scar closed. Late repair is difficult, and patients often require conjunctivodacryocystorhinostomy (CDCR) to resolve their tearing problem.

Lacerations of the inferior canaliculus occur more frequently than the superior canaliculus. One study used meta-analysis to determine that in patients with canalicular lacerations, 72% were inferior and 16% were superior. Twelve percent of patients had both superior and inferior canalicular lacerarations.[3]

Examination

A thorough ophthalmic examination should be performed in all cases of suspected eyelid and canalicular lacerations (Figure 10.1). Ruptured globe and other sequelae secondary to ocular trauma should be addressed immediately. The eyelids should be examined for lacerations. If an injury lies medial to or involves the punctum, a canalicular laceration must be suspected.

To inspect an eyelid with suspected canalicular laceration, the surgeon should manually inspect tissue with suspected injury. Often,

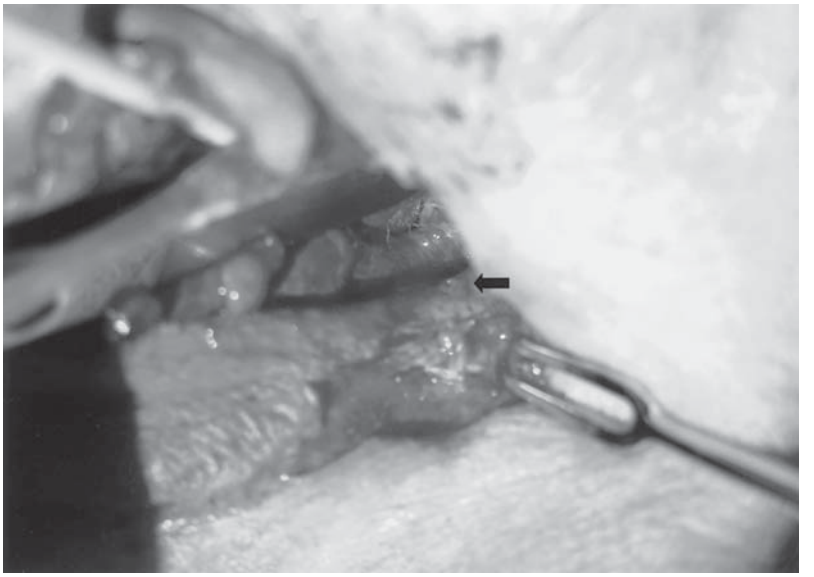


FIGURE 10.1. Canalicular laceration. Medial cut edge is visible (arrow).

an area that appears to have superficial abrasions is determined to have deeper injury. The eyelids should be everted. In unusual circumstances, injury can include the conjunctival surface or a small section of the lid margin, leaving the skin completely intact.

To inspect the canaliculus, the punctum is dilated and a size 0 Bowman probe is passed through the canaliculus until a hard stop is felt at the nose. If complete passage is not accomplished, the suspicion for a canalicular laceration should be high and the eyelid must be meticulously inspected to visualize the probe within the wound. If the probe is not seen, it should be removed. An irrigating cannula should be placed in the proximal canaliculus and gentle irrigation should be performed. Flow of irrigation solution out of the eyelid through the wound confirms the presence of a laceration. The same procedure should be performed for both upper and lower canaliculi.

Dog bites to the face have a propensity to involve the medial canthus and canalicular system. Canine-induced injuries often result in deep facial lacerations without soft-tissue loss.[5] Patients with this type of injury should receive a broad-spectrum antibiotic intravenously and a tetanus toxin injection if indicated. The wound must be irrigated profusely before surgical repair.

Surgical Technique

The traditional method for repair of mono- or bicanalicular lacerations involves repair of the eyelid defect after placement of a bicanalicular stent. This usually entails a procedure in the operating room, using

intravenous sedation or general anesthesia. The introduction of monocanalicular stents has allowed repair of simple monocanalicular lacerations that do not involve the punctum with only local anesthesia, without the need for intranasal manipulation and sedation. Most of these repairs can now be performed in the office, reducing the need for surgery in the operating room.

The most difficult part of canalicular repair is locating the medial end of the severed canaliculus. Under magnification, the edge of a canaliculus appears as a white, glistening ring surrounded by the medial canthal tissue usually posterior to the canthus. As a rule, in more medial lacerations, the distal canaliculus is more difficult to detect. The surgeon should remember that the canaliculus normally progresses posteriorly and further from the skin surface. In other words, the more medial the laceration, the more posterior the cut edges will be. With monocanalicular lacerations, if the cut edge cannot be found, the surgeon may slowly inject viscous lidocaine mixed with methylene blue through the intact canaliculus and observe for reflux from the distal cut end (Figure 10.2).

Choice of Stent

Bicanalicular intubation is the gold standard for mono- or bicanalicular lacerations. This tube creates a "closed loop" system that is unlikely to become dislodged. Placement does, however, require local anesthesia (intranasal packing with topical anesthesia or infiltration with lido-

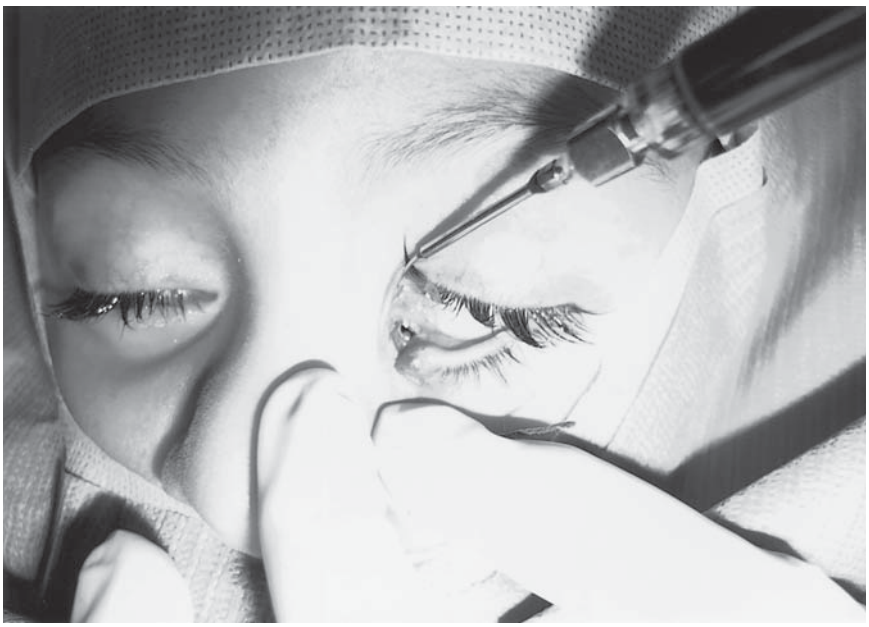


FIGURE 10.2. Technique for finding cut edge of canaliculus. Viscous lidocaine with methylene blue is injected through superior canaliculus. Blue dye shows medial cut edge of inferior canaliculus.

caine with epinephrine) along with intravenous sedation, or general anesthesia.

The main attribute of a monocanalicular stent is it allows for placement under local anesthesia alone or in conjunction with monitored anesthesia care. However, these stents are less secure compared with the bicanalicular type and can be dislodged in children quite easily. Punctal injury precludes the use of a monocanalicular stent.

Bicanalicular Repair

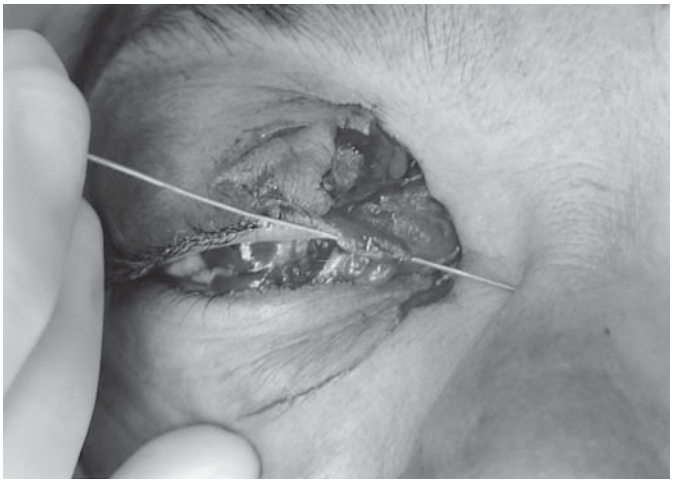
Bicanalicular stent trocars are passed through each punctum and proximal canaliculus (Figure 10.3A–C). Each end is then gently passed into the distal canaliculus and advanced until a hard stop is felt at the nasal bone. The stent is then rotated vertically along the brow and passed into the nasolacrimal duct and nose. An appropriate retrieval device is then used to remove the tubes from under the inferior turbinate.

The authors' preferred stent is a Crawford tube. Once both ends of the stent are brought out through the nose, the tubes should be placed on gentle traction and clamped with a small hemostat at the level of the nostril. This allows the tubes to provide traction on the canthal wound to aid in anatomic reapproximation. If the medial canthal tendon has been avulsed, it is closed by passing a 5-0 polyglactin (Vicryl) suture, preferably on a P-2 needle, through the periosteum of the medial wall and then through the canthal tendon, superior and inferior to the canaliculi. If the punctum is lacerated, it is sutured closed around the stent with 7-0 Vicryl sutures. The pericanalicular orbicularis muscle is reapproximated using a single 7-0 Vicryl mattress suture.[6,7] The medial canthal sutures are then tied. The wound is closed with 6-0 Vicryl deep sutures. The skin is closed with 6-0 gut sutures.

The ends of the tube can be tied in a square knot or can be tied together with an absorbable, long-lasting suture such as polydioxanone. If the tube is not tied, it will likely become dislodged within a few days. The stent is sutured to the lateral wall of the nose at the mucocutaneous junction with a 5-0 Vicryl suture in adults (or 6-0 Vicryl in children). This suture will dissolve by the time the tubes are removed in approximately 6 weeks.

To remove the tube, a drop of topical anesthetic is placed in the eye. The tube is grasped with forceps and elevated approximately 5 mm. Scissors are used to cut the tube, while the surgeon holds the tube with the forceps in the other hand. If the tube is released, both ends can retract into the canaliculi and complicate removal. After a monocanalicular laceration, the tube and knot can be removed from the opposite, uninjured canaliculus, to prevent reinjury. For example, if the superior canaliculus was injured, the surgeon should remove the tube through the inferior canaliculus. The surgeon grasps the tube with forceps and cuts the tube above the forceps. The tube can be gently removed with a single pulling motion.

The tubes can also be removed through the nose. The surgeon can cut the tubes between the puncta and ask the patient to forcefully



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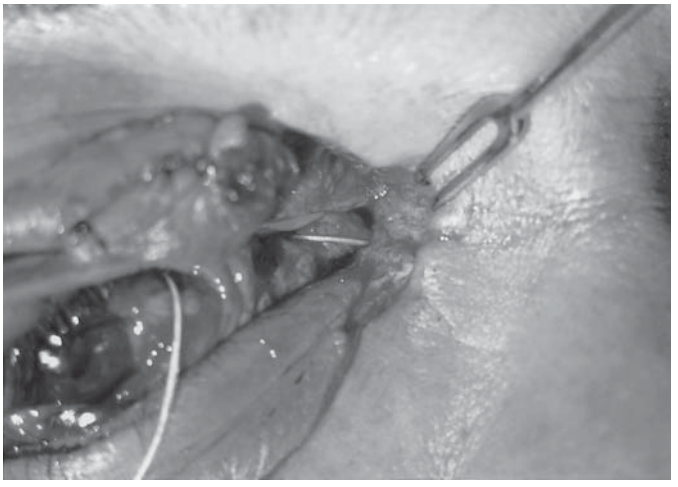

B

C

FIGURE 10.3. (A) Probe passed through superior punctum and out through canalicular laceration. **(B)** Stent has been passed across the laceration, through the medial cut edge, and into the nasolacrimal duct into nose. **(C)** Stent passed across superior and inferior canalicular lacerations.

exhale. This method is not as reliable, because the tubes often adhere to the nasal mucosa. Removal through the puncta is especially useful in children, who tend to be more uncooperative during tube removal through the nasal passages. Leaving the cut tube in the nose and assuming it will extricate itself is not recommended. The tubes may remain in place and cause scarring.

Monocanalicular Repair

The monocanalicular stent (Figure 10.4) is a short silicone tube with a phalange at the proximal end. To insert the stent, the surgeon passes the distal end through the punctum and brings it out through the proximal end of the severed canaliculus. The phalange should be fixed securely in the punctum by gently pulling the distal end of the stent (Figure 10.5). The length of the tube may need to be shortened, so that it rests in the lacrimal sac. It does not need to pass into the bony nasolacrimal duct. When the distal canaliculus is identified, the stent can be threaded into it with forceps.

The monocanalicular stent cannot be used when a laceration to the punctum is present, because the proximal end cannot be fixed. Also, it should not be used with medial canthal avulsion, because the stent cannot provide the adequate inferior and posterior traction to close the wounds, as would a bicanalicular stent tied in the nose.

Pigtail Probe

Canalicular intubation with a "pigtail" probe is a method of last resort when a severed end of a canaliculus cannot be located (Figure 10.6).

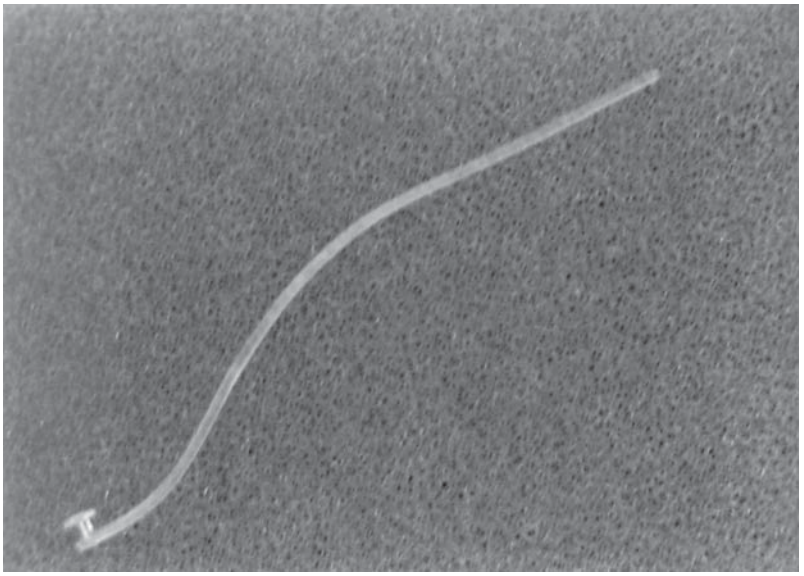

FIGURE 10.4. Monocanalicular stent. Mini Monoka (©FCI Ophthalmics Inc.).

FIGURE 10.5. Monocanalicular stent seated in punctum.

Passing a curved probe around the tight turn of the common canaliculus can inadvertently cause iatrogenic trauma to the patent canaliculus and the lacrimal system.

The pigtail probe, with an eyelet at its tip, is passed through the intact canaliculus with the probe handle maintained in a vertical position. It is gently rotated until the end of the probe is seen exiting the

FIGURE 10.6. Both ends of stent after being passed using a pigtail probe.

cut edge of the other canaliculus. A 5-0 nylon suture is passed through the eyelet of the tip of the probe. The probe is rotated backward, out of the canaliculi, bringing the suture with it.

The opposite end of the pigtail probe is passed through the other punctum and into the wound. The nylon is threaded into the probe and the probe is withdrawn. The nylon suture is threaded into a stent tube and a clamp is placed across the tube and suture. The other end of the suture is pulled so that the stent tube passes through both canaliculi. The nylon suture is left in place. The severed canaliculus is sutured over the stent and the laceration is closed. The stent is then trimmed appropriately and the suture is tied to itself, creating a circle within the stent tube. The closed edges of the stent are rotated into the canaliculus.

Stent Removal

Canalicular stents can usually be removed approximately 6 weeks after repair. They are preferably removed from the nose after the loop between the puncta is cut. An endoscope can aid in finding the nasal end of the stent. If this method is not possible, as in a small child, the stent may be removed by cutting the loop between the puncta and pulling the stent out of one of the puncta. Tying the ends of the Crawford tube with suture facilitates removal, because there is only a small knot in the silk suture that must pass through the system, thus avoiding damage to the canaliculus and punctum.

Cutting the stent without removing it, in the assumption that the patient will blow it out of the nose, is not recommended because the stent may remain lodged in the lacrimal duct and lead to granuloma formation.[8]

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