Procedure Appendix

This procedure appendix is designed to provide you with a summary of all of the procedures described in the text. It is a duplicate of the descriptions in the text except that the references to the illustrations have been deleted. The procedure appendix is designed as a quick reference for you to use before heading up to the operating room. You may want to copy this section and put it in the bag you carry to the operating room. I hope you find it helpful.

The Diagnosis and Treatment of Ectropion

THE LATERAL TARSAL STRIP OPERATION (SEE PAGES 77-81)

The lateral tarsal strip operation involves shortening the lower lid at the lateral canthus. The lower lid is released from the lateral orbital rim. A tab, or strip, of lower lid tarsus is fashioned and denuded of conjunctival epithelium and skin. The strip is shortened to provide appropriate tension. The strip is then reattached to the inner aspect of the orbital rim.

To complete a lateral tarsal strip procedure, you will:

- Perform a lateral canthotomy
- Perform a cantholysis
- Form the strip
- Shorten the strip
- Reattach the strip
- Trim redundant anterior lamella
- Close the canthotomy

The steps of the tarsal strip procedure are the following:

Prepare the patient.

Instill topical anesthetic drops.

Inject a *local anesthesic* with epinephrine into

The lateral canthal skin.

On the inner aspect of the orbital rim against the bone.

The lateral third of the lower lid skin and conjunctiva.

Perform a lateral canthotomy.

Perform a *lateral canthotomy* using Westcott scissors.

Bipolar cautery is usually necessary to stop the small amount of bleeding.

Take a few extra seconds to dissect through the orbicularis overlying the lateral orbital rim to actually visualize the periosteum. This will make reattachment of the strip much easier. Do not cut the periosteum off the bone.

Perform a cantholysis.

Cut the lower limb of the lateral canthal tendon off the inferior orbital rim. This maneuver is known as a *cantholysis.*

Pull the lateral aspect of the lid margin laterally and toward the ceiling of the operating room. You will notice that the eyelid does not pull away much from the rim. Using Westcott scissors identify the fibrous tissues holding the eyelid on the rim. A *strumming action* across the tissue will help you to find the taut tissues to be cut.

As you cut these tissues *the lid should release from the rim.* Although we say we are cutting the lower limb of the lateral canthal tendon, we are also cutting some of the septum and the lower eyelid retractors that attach to the tendon at the lateral canthus.

Make your goal to complete the cantholysis in one or two cuts. Some bleeding usually occurs with each cut.

Form the strip.

Split the anterior and posterior lamellae.

Form a tarsal strip by splitting the anterior lamellae off the posterior lamellae for approximately 5 mm (you will learn to estimate the appropriate amount).

Slide a Westcott scissors between the tarsal plate and the orbicularis muscle. Skin, muscle, and lashes are freed from the tarsus.

Make sure that the plane of the scissors blades is *parallel to the plane of the* tarsus.

Cut along the inferior margin of the tarsus.

Cauterize along the inferior margin of the tarsus.

Then *cut* where you have just cauterized, freeing the tarsus from the conjunctiva and retractors. Additional cautery is often necessary at this point.

Remove the skin and conjunctiva from the strip.

Denude the conjunctival epithelium off the posterior surface of the tarsal plate using a no. 15 blade.

Cut the skin off the lid margin using Westcott scissors.

The strip is now complete.

Shorten the strip.

Pull the tarsal strip to the periosteum and estimate the *amount of tarsus to be shortened.* This amount should be *conservative.* In some cases, no removal is necessary.

Reattach the strip.

Reattach the strip to the *inner* aspect of the lateral orbital rim using a 4-0 Vicryl sutures on a *P2 needle* (Ethicon J504 P-2 needle). I use two interrupted sutures.

This particular step is difficult for surgeons learning the lateral tarsal strip operation. It is made much easier by cleaning the soft tissues off the periosteum well during the canthotomy as explained above.

Remember: do not clean the periosteum off the bone. If you do, there will be no way to suture the tarsal strip to the bone.

If you have trouble passing the suture, make sure that you are seeing the periosteum well. If necessary clean the periosteum again by scraping the rim with a Freer elevator.

Load the needle as far back as possible while staying on the flat part of the needle. *Back the needle into the wound,* keeping the needle tip pointed toward the ceiling. It will help to push any orbital fat away from the rim. *Rotate the needle.* Do not try to push the needle into the bone.

Have a Paufique forceps handy to grasp the needle and rotate it out of the wound. As I said, I use two interrupted sutures.

The appropriate point to reattach the strip is immediately inferior to the intact superior crus of the lateral canthal tendon. You will find that this recreates the slope of the eyelid naturally.

Some surgeons prefer to use a double-armed suture, feeling that the position within the lateral orbital rim is more posterior.

Once you have placed the sutures, they can be *temporarily tied and the tension of the eyelid can be checked.* When you pull the lower lid off the eye, there should be minimal movement of the eyelid. This is a good time to remind you not to over tighten the eyelid in a patient with hemiproptosis.

Be conservative. If the eyelid is too lax, a little more tarsus can be trimmed and the sutures can be repassed.

Once the tension is correct, tie the sutures.

Trim redundant anterior lamella.

Trim redundant anterior lamella including eyelashes. I try to excise enough anterior lamellar tissue so that lashes do not extend into the lateral canthus.

Close the canthotomy.

If you have separated the anterior lamella from the tarsus more medially than necessary, use a single suture to reattach the separated anterior lamella to the tarsal plate. If you estimate the amount of lamellar split correctly, this step is not necessary.

The usual skin closure is with interrupted 7-0 Vicryl sutures, but any absorbable suture will work. Some surgeons prefer to use a fast-absorbing 5-0 gut suture. Use a minimal number of sutures. Usually two interrupted sutures are passed in the skin beyond the lateral canthus to close the canthotomy.

Do not pull the upper lid down (creating "hooding") by putting too many sutures in the canthotomy closure.

The canthotomy will almost close itself with the natural blinking so don't be concerned if the wound gapes a bit.

At the conclusion of the lateral tarsal strip operation the lower lid should be drawn up tightly with the lateral canthal height overcorrected.

Provide instructions for postoperative care.

Postoperative care after the lateral tarsal strip procedure is routine.

At the conclusion of each procedure, topical antibiotic ointment is instilled.

Generally, no patch is applied.

Postoperatively, patients use ice for 48 hours and then warm, wet compresses for a few days.

Discontinue use of the antibiotic ointment after 1 week. If you have corrected a severe ectropion, you will notice that the lower eyelashes will remain pointed upward for a few weeks postoperatively but will eventually return to a normal position. The 4-0 Vicryl suture at the lateral orbital rim dissolves slowly over a period of 4 to 6 weeks. Some tenderness is associated with this suture. Reoperations are rare.

THE MEDIAL SPINDLE OPERATION (SEE PAGES 82-83)

The medial spindle operation involves excision of a diamond of conjunctiva inferior to the lower punctum and closure with a suture, causing mechanical inversion of the punctum.

The medial spindle operation includes the following:

- Excision of a diamond of conjunctiva inferior to the lower punctum
- Closure of the conjunctiva to provide inversion of the punctum

The steps of the medial spindle operation are the following:

Prepare the patient.

Instill topical anesthetic drops.

Inject local anesthetic into the inferior fornix of the medial conjunctiva.

Inject local anesthetic under skin at the orbital rim inferior to the punctum.

Excise a diamond of conjunctiva inferior to the lower punctum.

Place a no. 1 Bowman probe into the canaliculus and evert the lid margin.

Excise a "diamond" *of conjunctiva* (and theoretically lower eyelid retractors) inferior to the punctum and the tarsal plate (3 to 4 mm by 3 to 4 mm).

The diamond-shaped excision can be made by grasping the conjunctiva with a Paufique forceps and using Westcott scissors to excise a V of conjunctiva inferiorly. A similar V of conjunctiva is cut superiorly so the two incisions form into a diamond. The excision of conjunctiva will be closed vertically, shortening the posterior lamella and turning the punctum inward.

Take care not to cut the vertical portion of the canaliculus when performing the excision.

Close the conjunctiva to provide inversion of the punctum.

Use a double-armed *5-0 chromic suture* (Ethicon 792 G-3 needle double armed) to close the diamond, incorporating a pass through the lower lid retractors in the center of the diamond excision. (You will not always be able to recognize retractors.)

Next pass the two arms of the suture backhanded through the apex of the diamond adjacent to the punctum. This part of the operation theoretically advances the lower lid retractors to the top of the diamond.

The remainder of the closure involves collapsing the diamond and passing the sutures out through the eyelid. Pass each suture arm through the inferior apex of the diamond and continue the full-thickness pass through the lid, exiting at the junction of the eyelid and cheek skin. The suture pass can be visualized as a spiral if viewed laterally. The conjunctival suture passes close to the posterior lamella, resulting in posterior lamellar shortening. The full-thickness pass of the suture through the eyelid, emerging inferiorly, causes a mechanical inversion of the punctum. A significant mechanical inversion of the punctum will occur when the sutures are pulled tightly on the skin side of the eyelid.

Do a lateral tarsal strip operation (usually).

Cut the needles of the spindle suture off and clamp the suture ends out of the way. If a lateral tarsal strip operation is also being done (as is usually the case), it should be performed at this point.

The medial spindle suture should be tied after the strip is sewn into position. The amount of inversion can be titrated by tying the suture with more or less tension. At the conclusion of the medial spindle procedure, a *slight overcorrection (inversion) is* desired .

Provide postoperative care.

No special care is required after the medial spindle operation.

The chromic suture will fall out on its own in approximately 7 days.

The overcorrection will reduce spontaneously, leaving the punctum in its normal position. Overcorrection is rare, but undercorrection can occur, leaving the punctum vertical. If the patient is asymptomatic, no reoperation is required.

Remember that the medial spindle operation must be performed before the eyelid is tightened with a lateral tarsal strip operation. Once the lateral tarsal strip sutures are tied, the medial eyelid cannot be everted to perform the medial spindle operation.

TREATMENT OF CICATRICIAL ECTROPION WITH A FULL-THICKNESS SKIN GRAFT (SEE PAGES 83-88)

Cicatricial ectropion is caused by a shortage of the anterior lamella. Lengthening of the anterior lamella, usually with a full-thickness skin graft, returns the scarred lid to its normal position. A lateral tarsal strip operation is often used in conjunction with a full-thickness skin graft. The procedure begins with cutting the scar tissue, allowing the posterior lamella of the eyelid to return to the normal position. The lateral tarsal strip is performed next. Finally, a full-thickness skin graft is harvested and sewn into the defect created by cutting the scar tissue.

Full-thickness skin grafting for cicatricial ectropion requires that you:

- Mark the skin for incision
- Release the cicatricial forces
- Harvest the full-thickness skin graft
- Suture the full-thickness skin graft in place

The steps of full-thickness skin grafting for cicatricial ectropion are the following:

Mark the skin for incision.

Instill topical anesthetic drops.

Identify the cicatricial bands to be cut.

For diffuse cicatricial skin changes mark a *subciliary incision* that extends approximately 5 mm horizontally beyond the canthi (or any involved cicatricial change).

If a localized area of scar tissue exists, mark a skin incision to release this scar tissue (don't forget to extend beyond the scar tissue).

Inject local anesthetic with epinephrine into the area of the planned incision.

The patient is prepped and draped while you scrub.

Release the cicatricial forces.

Place two 4-0 silk sutures in the lid margin and clamp them to the drape to stabilize the lid in superior direction.

Make a subciliary incision with a no. 15 blade.

You will notice that the skin edges separate as the incision is made.

Use a blade or the Westcott scissors to continue sharp dissection of the scar tissue until the eyelid margin easily returns to its normal position apposing the globe. Usually you will cut skin, muscle, and scar tissue. You will know when you are finished because the plane of dissection will start to go deep to the skin and muscle without any further release of the eyelid.

Next perform a *lateral tarsal strip* procedure .

This will help to prevent the lid from developing ectropion again as the skin graft shrinks with healing.

Remember to reattach the strip to the lateral orbital rim slightly high to over correct the height at the lateral canthus.

Harvest the full-thickness skin graft.

Draw a *template* indicating the size of the defect to be repaired.

The template can be made by tracing the area onto a piece of the clear plastic surgical drape.

A clever alternative method is to use a piece of Gelfoam pressed into the surgical defect. Blood in the defect stains the Gelfoam in the precise size and shape of the defect.

The template is then cut, and its outline is transferred onto the skin of the preauricular area or other donor site. The *graft should be slightly oversized.* By tracing the proposed graft size on the outside of the template, some oversizing is accomplished.

Harvest the full-thickness skin graft.

Use a *no. 15 blade to cut full thickness through the skin* along the mark of the template.

Use a *Westcott scissors to separate the subcutaneous fat from the dermis* of the skin. Try to leave as little "yellow" on the dermis as possible.

Close the donor bed using subcutaneous interrupted 4-0 Vicryl sutures. Generally, little or no undermining is required.

Close the skin with a running 5-0 Prolene suture.

Suture the graft into place.

Before transferring the graft, remove any remaining fat from the posterior surface of the graft. In most cases you will want the thinnest graft possible.

Suture the skin graft into position using an absorbable skin suture.

Place topical antibiotic ointment over the graft.

No pie-crusting is necessary.

Tape the two 4-0 silk lid margin sutures to the forehead to place the graft on stretch.

Use four 4-0 silk sutures at the perimeter of the graft to tie a bolster into position over the graft. Tape a patch over the eye. For effective healing the graft must not move.

No postoperative oral antibiotics are prescribed. The patch and bolster are removed after 1 week. Postoperatively, the graft often looks dark, and the lower lid position appears overcorrected. With time the normal color of the full-thickness skin graft returns and the lid assumes a normal position. Start massage of the lid after 2 weeks to help prevent shrinkage of the graft.

The Diagnosis and Treatment of Entropion

THE RETRACTOR REINSERTION OPERATION (SEE PAGES 95-98)

The goal of the retractor reinsertion operation is to correct the laxity of the lower lid retractors. During this procedure the retractors are identified and advanced onto the lower lid tarsus. This provides a greater inferior and posterior pull on the inferior edge of the tarsal plate and an eversion of the lid margin. A slight eversion of the lid margin is recommended. This slight intraoperative overcorrection usually resolves postoperatively. *Using a lateral tarsal strip operation in combination with the retractor reinsertion operation* eliminates overcorrection from a practical point of view.

To perform a retractor reinsertion operation, you will:

- Make a subciliary incision
- Identify the lower lid retractors
- Dissect the retractors off the conjunctiva
- Advance the lower lid retractors on to the tarsus
- Add a lateral tarsal strip operation if necessary
- Close the skin.

The steps of the retractor reinsertion operation are the following:

Prep the patient.

Instill topical anesthetic.

Mark for the subciliary incision.

Inject local anesthetic containing epinephrine into the lower lid fornix and anteriorly under the skin.

Make a subciliary incision.

Stabilize the lower lid with a 4-0 silk traction suture *(Ethicon no. 783 P-3 cutting needle)* and clamp to the drape.

Cut along the mark with a no. 15 blade or Colorado needle through the skin.

Use Westcott scissors (or Colorado needle) to cut the orbicularis muscle. Usually the subciliary incision is superior to the inferior edge of the tarsus.

After cutting into the pretarsal orbicularis muscle stay anterior to the septum, if possible, and dissect inferiorly toward the inferior orbital rim.

Identify the lower lid retractors.

Remember that the preaponeurotic fat is the landmark for the lower lid retractors. Open the orbital septum to find the preaponeurotic fat. In many older patients, the fat will be retracted and difficult to see. Frequently the white layer of the retractors will be visible before the fat is seen. If you are not sure that these are the retractors, have the patient look way up and way down to see if the retractors move. Don't expect the lower lid retractors to move as much as the levator aponeurosis in the upper lid.

Dissect the retractors off the conjunctiva

After you have identified the retractors, use Westcott scissors to free the fat from the anterior surface of the retractors.

Next free up the posterior aspect of the retractors from the underlying conjunctiva.

Start a few millimeters below the inferior edge of the tarsus. Cutting through the retractors causes some bleeding. Dissect a plane between the conjunctiva and the retractors.

It is not possible or necessary to separate the retractors into the voluntary and involuntary parts. The full thickness of the retractors should be advanced as a whole.

If you buttonhole the conjunctiva, it is not a problem.

Free up 5 to 10 mm of the retractors.

Note that most patients do not have a disinsertion of the retractors. You have to create an edge of retractors to reattach onto the tarsus.

Advance the lower lid retractors on to the tarsus.

Reattach the edge of the retractors to the inferior margin of the tarsus using three interrupted 5-0 Vicryl sutures on a spatula needle (Ethicon J571 5-0 Vicryl S-14 needle).

Release the traction suture and you will immediately notice that the lid margin is turned outward slightly. If the retractors do not seem tight enough, advance them a bit more. It is ideal to have a small amount of overcorrection.

If you are not going to add a lateral tarsal strip operation (LTS) to the procedure be careful not to overcorrect much.

LTS is usually necessary. If there is associated lower lid laxity, this is the time to do the lateral tarsal strip procedure. The lateral tarsal strip procedure is performed in the same way as in any ectropion repair. When the lid is tightened appropriately, you will see the lid well apposed to the globe.

Close the skin

Close the subciliary skin incision with a running suture using fast-absorbing gut or 7-0 Vicryl sutures.

During the skin closure, combine the canthotomy with the subciliary incision closure, reforming the lateral canthal angle.

Provide postoperative care. Instill topical antibiotic ointment.

The retractor reinsertion operation is a very powerful procedure. Recurrence of entropion is rare, because the procedure addresses all the factors contributing to entropion. Adding the lateral tarsal strip procedure corrects the etiologic factor of lid laxity and prevents overcorrection.

TREATMENT OF SPASTIC ENTROPION WITH QUICKERT SUTURES (SEE PAGES 99-101)

A quick solution to spastic entropion is the use of *Quickert sutures* to mechanically tighten the lower lid retractors without any skin incision.

The steps of the Quickert suture procedure are the following:

Instill local anesthesia. Instill topical anesthetic, inject local anesthetic with epinephrine in the conjunctival fornix and the skin.

Pass double-armed sutures from the fornix through the lid to emerge under the lashes.

Load a double-armed *4-0 chromic (Ethicon 793, G-3 needle)* suture back-handed.

Pass each arm of the suture through the lid from deep in the conjunctival fornix, passing anteriorly and superiorly to emerge from the skin just inferior to the eyelashes. Repeat, placing medial, central, and lateral sutures in position.

Tie the sutures.

Tie the sutures on the skin, creating a slight eversion of the eyelid margin. Remember that you will not be correcting any horizontal lid laxity if it is present, so be conservative with the overcorrection.

A few surgeons use Quickert sutures as a primary method of repair for all instances of involutional entropion. In many patients, this technique will provide a long-term cure for the entropion. However, any lower lid laxity is not addressed, and the advancement of the retractors is not as secure. In theory, recurrence is more likely to occur. The main indication for Quickert sutures is spastic entropion, in which the irritation is likely to resolve, or the rare situation for which a retractor reinsertion operation is not practical in debilitated patients. For those patients, Quickert sutures can be performed at the bedside or in the examination chair.

TREATMENT OF CICATRICIAL ENTROPION (SEE PAGE 101)

- Mild lower- or upper-lid cicatricial entropion: Use the tarsal fracture operation (discussed in detail in Chapter 5).
- Mild to moderate upper-lid cicatricial entropion: Use the terminal tarsal rotation operation.
- Severe lower- or upper-lid cicatricial entropion: Use a mucous membrane graft.

The Diagnosis and Management of Misdirected Eyelashes

TREATMENT OF MARGINAL ENTROPION OF THE LOWER EYELID: THE TARSAL FRACTURE OPERATION (SEE PAGES 110-112)

The tarsal fracture operation returns the lid to a more normal position. Its use has dramatically changed my approach to the treatment of trichiasis and has almost eliminated cryotherapy from my practice. This operation has not found its way into the hands of most ophthalmologists. *You should learn the tarsal fracture operation.* A horizontal incision is made across the posterior surface of the tarsus. This incision allows the lid to "bend" or "fracture" anteriorly. Sutures are placed through the eylid to hold the eyelid margin in an everted position.

The tarsal fracture operation includes the following:

- Stabilizing the lid
- Making a horizontal tarsal incision
- Passing double-armed 6-0 Vicryl sutures
- Tying the sutures to evert the margin

The steps of the tarsal fracture operation are the following:

Prep the patient.

Instill topical anesthetic.

Inject local anesthetic with epinephrine under the skin and conjunctiva of the eyelid.

Stabilize the lower eyelid.

Pass a 4-0 silk suture through the lid margin.

Evert the lid over a Jaeger lid speculum ("shoehorn").

Make a horizontal tarsal incision.

Use a no. 15 blade to make a full-thickness horizontal incision *through the tarsus* 2 to 3 mm laterally beyond the area of entropion. A Colorado needle works nicely for this.

Try to avoid cutting the marginal artery by making the incision at least halfway down on the tarsal plate.

Bleeding usually occurs if you are using a scalpel blade, so have a cautery device ready.

Pass double-armed 6-0 Vicryl sutures.

Pass double-armed 6-0 Vicryl sutures full thickness through the lid (Ethicon J-570 with S-14 needle). Start with a "backhanded" pass entering the inferior edge of the wound and exiting just under the lashes anteriorly.

Pass as many pairs of double-armed sutures as required to evert the length of the lid margin involved. Usually the majority of the tarsus is incised and three pairs of sutures are used.

Tie the sutures to evert the margin.

Tie the sutures as you pass them or wait until all are passed.

Aim for a slight overcorrection. Recognize that some inversion will occur with healing.

Provide postoperative care.

Apply topical antibiotic ointment.

You do not need to remove the sutures. They will absorb over 6 weeks, allowing the eyelid to heal in normal position.

You will find the tarsal fracture operation to be an effective technique for repositioning the lashes. The procedure is quick to perform and easy to learn.

CRYOTHERAPY (SEE PAGES 113-114)

Cryotherapy is indicated for broad areas of misdirected lashes. In most cases the diagnosis is actually a marginal entropion, and you should consider the tarsal fracture procedure as a better alternative. However, some patients may prefer a "freezing" operation over a "cutting" operation. In some cases, a quick cryotherapy may be the best practical treatment for removing the offending lashes.

Cryotherapy includes the following:

- Local anesthetic with epinephrine to promote freezing
- Fast freeze followed by slow thaw
- Repeat fast freeze followed by slow thaw, using a slight overlap of the freeze spots
- Epilation

The steps of cryotherapy are the following:

Prep the patient.

Instill topical anesthesic.

Inject local *anesthetic with epinephrine under the skin and conjuctiva and wait 10 minutes.* The vasoconstriction decreases the blood flow promoting a *fast freeze and slow thaw,* which gives the best result.

Prep the patient, usually with no drape.

Apply the cryoprobe.

Protect the eye with a *plastic* lid plate (it must be plastic to insulate the eyeball from the cold).

Place the cryoprobe onto the skin inferior to the misdirected lashes.

Leave the probe in position for *30 seconds on the upper lid or 25 seconds on the lower lid to give an ice ball that surrounds the probe for* 2 or 3 mm.

Let the probe *warm slowly* until it releases from the tissue.

Avoid the temptation to irrigate for faster warming.

Move to the adjacent tissue and repeat the application as needed along the lid. I use a *slight overlap of the ice ball edges.*

Let the tissues thaw slowly.

After the tissue is thawed repeat the freeze.

You will notice that the tissue freezes much more quickly, and a slightly shorter freezing time is required to get the same sized ice ball to form. This is not a precise procedure. It will take a few times to get the feel of how much overlap to apply and how long to leave the probe in place for each patient.

Epilate the misdirected lashes.

You will notice that the lashes "slide" out rather than "pop" out, suggesting that you have damaged the lash root.

Provide postoperative care.

Apply an antibiotic ointment.

Warn the patient that there will be significant swelling. The freezing creates a mild frostbite with some associated burning pain. Postoperative narcotic treatment is appropriate for most patients.

Cryotherapy is easy to administer and destroys about 75% of the lashes treated. Some reoperations will be necessary. Most patients are surprised by the postoperative pain and swelling. You should warn them about this.

PENTAGONAL WEDGE RESECTION FOR A SEGMENT OF EYELASH MISDIRECTION (SEE PAGES 114-116)

Pentagonal wedge resection is a useful solution for removing a *localized segment of lashes.* This situation usually occurs after trauma. In many patients a coexisting lid deformity, such as an eyelid margin notch, can be repaired. The *strength of the closure is in the sutures placed in the tarsal plate. Eyelid margin eversion* is necessary to prevent lid notching.

Pentagonal wedge resection and repair include the following:

- Excising the abnormal segment of lashes
- Aligning the lid margin
- Suturing the tarsal plate
- Suturing the lid margin
- Closing the skin

The steps of the pentagonal wedge resection and eyelid margin repair are the following:

Excise the abnormal segment of lashes.

Repair can be done with local anesthesia, unless excessive scarring exists.

Mark a pentagonal wedge excision on the eyelid to include the abnormal lashes and 2 to 3 mm of normal margin on each side.

Extend the vertical marking to the superior edge of the tarsus.

Angle the markings to meet at the apex of the pentagon.

Instill topical anesthetic drops and inject local anesthetic with epinephrine into the wound.

Use a no. 15 scalpel blade to make the initial lid margin cut so that the wound edges will be sharp and close easily.

Use scissors, preferably with straight blades, to excise the pentagonal wedge.

Align the lid margin.

Use a 7-0 Vicryl suture passed through the meibomian gland orifices to align the lid margin. Evert the wound edges slightly, using a vertical mattress suture pass. Keep this suture long.

Suture the tarsal plate.

Use two or three interrupted 5-0 Vicryl sutures passed in a lamellar fashion to align the tarsal plate. The initial lid margin suture will help with the positioning of your tarsal sutures.

Suture the lid margin.

Go back to the lid margin and place a 7-0 Vicryl suture in a *vertical mattress* fashion at the base of the eyelashes. This suture should provide *eversion* of the lid margin.

If you are unhappy with the alignment of the lid margin, replace the margin sutures.

An additional suture may be used to help align the eyelid margin.

I prefer to use *7-0 Vicryl sutures for the eyelid margin.* Traditional teaching suggests the use of 6-0 or 8-0 silk sutures, which are left long and require removal later. The 7-0 Vicryl sutures can be cut on the knot and allowed to absorb.

Don't tie the margin sutures very tightly because the tissue may die, resulting in a lid margin notch.

Close the skin.

The skin can be closed with an interrupted simple or vertical mattress suture using permanent or absorbable sutures.

If the wound seems to be under tension, you may want to place 5-0 Vicryl sutures through the orbicularis muscle before closing the skin.

Provide postoperative care.

Postoperative care is routine. Occasionally the sutures will rub against the cornea and require removal.

Careful realignment of the wound corrects the eyelash misdirection and creates a continuous row of lashes.

INVOLUTIONAL PERIORBITAL CHANGES: DERMATOCHALASIS AND BROW PTOSIS

DIRECT BROWPLASTY (SEE PAGES 132-135)

Direct browplasty is the simplest technique to lift a ptotic brow. Limitations include a visible scar above the brow and problems with contour.

The direct complete browplasty is a relatively easy operation. Many of your patients with functional brow ptosis will be good candidates for this operation.

The direct browplasty includes the following:

- Skin marking
- Anesthesia
- Skin and muscle excision
- Closure

The steps of the complete direct browplasty are the following:

Mark the skin.

Mark the amount of resection preoperatively. Hold the eyebrow in the desired position at (men) or above (women) the rim. Place a ruler next to the inferior brow hairs. Allow the brow to drop to the relaxed position. Record

the distance that the eyebrow drops. Multiply this number by a factor of 1 to 1.5 times to give the final height of the planned excision. Measure at least two points above the eyebrow. Draw an ellipse from the eyebrow hairs to the marks placed above the brow.

The shape of the ellipse should correspond to the change in contour anticipated. Usually 8 to 15 mm of tissue is excised with the greater measurements being temporal.

Do not extend the temporal incision more than 1 cm lateral to the tail of the brow to avoid inadvertent damage to the frontal nerve.

Administer anesthesia.

Instill topical anesthetic drops.

Inject local anesthetic into the skin down to the periosteum. Avoid injection into the supraorbital vein.

Excise skin and muscle in one layer.

Use a no. 15 blade, CO_2 laser, or Colorado needle to incise *the skin to the subcutaneous fat. You must keep the excision superficial at the head of the brow to avoid damage to the supraorbital nerve.*

Some surgeons prefer to bevel the blade during the skin incision with the thought that fewer brow hair follicles will be cut. In my experience, this has not made much difference and in almost all patients some superior brow hairs are lost independent of the skin incision technique.

Use a Stevens scissors, Colorado needle, or CO_2 laser *to excise the skin and muscle layer.* You will be dissecting in the loose areolar layer anterior to the periosteum. Stay superficial to the frontalis near the tail of the brow.

You will need to use some *cautery* at this point. Cauterize the biggest vessels and cover the wound with a wet sponge and go on to the other eyebrow. Most of the smaller vessels will stop bleeding without cautery.

Close the wounds with a layered closure.

Use a 4-0 Vicryl suture (Ethicon J464 P-3 needle) to close the deep tissues with a few interrupted sutures and a 5-0 Prolene suture (Ethicon 8698 P-3 needle) for a continuous skin closure (the blue Prolene suture is easier to see than a black suture against dark brow hairs).

Place topical antibiotic on the wounds.

Remove the skin sutures in 7 to 10 days.

The postoperative care of the patient and side effects of this procedure are minimal. Scars take 6 months, or longer, to fade well. Numbness resolves slowly over the same time period, as long as you have not cut the supraorbital

nerve. Your patients will be much more tolerant of any scarring and numbness if they know what to expect from your preoperative discussions.

THE SUTURE SUSPENSION FOREHEAD LIFT (SEE PAGES 136-137)

The suture suspension midforehead lift involves formation of a skin flap and suture suspension of the eyebrows. It is a good choice for men with deep forehead furrows, because the scar is hidden and the brow contour can be kept flat.

The suture suspension midforehead lift includes the following:

- Marking the skin
- Injecting local anesthetic
- Making the skin incision
- Dissecting in the subcutaneous plane
- Suspending the brow with sutures
- Excising the redundant skin
- Closing the wound

The steps of the suture suspension midforehead lift (suture suspension) are the following:

Mark the skin.

Mark a horizontal forehead furrow 2 to 4 cm above each brow. No measurements are made.

Administer anesthesia.

Instill topical anesthetic drops.

Inject local anesthetic into the tissue down to the periosteum.

Make a skin incision.

Make an incision into the skin to the *subcutaneous* level .

If you cut more deeply through the subcutaneous fat, you will see the faint pink layer of the frontalis muscle. Try to avoid this.

Dissect a plane within the subcutaneous tissue: In the subcutaneous plane, anterior to the frontalis muscle, dissect inferiorly to the brow hairs. This is a *difficult step* because there is no true tissue plane. All the dissection is sharp. Make sure that you do not make the forehead flap so thin that a part of it will die.

Perform suture suspension.

Place two 3-0 Gore-Tex sutures (Gore 3N10 PH-24 CV-3 needle) at the junction of the thirds of the eyebrow.

Pass each needle deep into the periosteum at the level of the skin incision.

Tie each suture temporarily in a "hang back" fashion, estimating the proper height and contour.

With the patient in the sitting position, check the height and contour.

Make adjustments as necessary until height and contour are acceptable. A second suture may be used at the junction of the medial and central thirds of the brow if there is a residual medial brow ptosis. Overcorrect the brow height moderately.

Tie the sutures.

Make a skin excision.

Drape the excess skin over the incision and mark the excess.

Excise the excess skin sharply with the scalpel.

Close the wound. Close the skin in a layered fashion as explained above.

Postoperative care is routine. Remove the skin sutures in 5 to 10 days. Most numbness will resolve if your plane of dissection was in the subcutaneous layer.

TRANSEYELID BROWPLASTY (SEE PAGES

137-138)

The transeyelid browplasty operation is useful for the patient with a *mild brow ptosis* who would benefit from a slight brow elevation in conjunction with blepharoplasty, but who does not want the scar of a direct temporal browplasty or a full brow lift using an endoscopic or coronal forehead lift.

The transeyelid browpexy operation includes the following:

- Marking the skin and injecting anesthesia
- Making the blepharoplasty incision
- Performing the brow dissection
- Elevating the brow
- Closing the blepharoplasty incision

The steps of the transeyelid blepharoplasty are the following:

Mark the skin and administer anesthesia.

Mark the excess skin for upper lid blepharo plasty.

Inject local anesthetic as you would normally do for blepharoplasty.

Inject additional local anesthetic at the superior orbital rim and under the eyebrow.

Make the skin incision and perform the standard blepharoplasty excision of skin and muscle.

Dissect the brow.

Dissect superiorly toward the brow, *beginning at the superior edge* of the blepharoplasty incision.

Extend the dissection superiorly in the *preseptal plane* to the orbital rim at the arcus marginalis.

Extend the dissection above the rim, anterior to the periosteum for approximately *1.5 cm* for the lateral half of the eyebrow.

You can *remove* and *sculpt brow fat* at this point. If the brow is particularly heavy, your patient may benefit from removal of the brow fat pad. Dissect in the subcutaneous fat posterior to the eyebrow hairs to meet the previous dissection anterior to the periosteum.

Elevate the brow.

To elevate the brow, pass a 4-0 Vicryl (Ethicon J464 P-3 needle) suture through the soft tissues under the inferior edge of the eyebrow hairs. Place the suture at the junction of the body and tail of the brow.

Next pass the same suture through the periosteum 1 cm above the supraorbital rim and make a temporary tie.

Repeat the browpexy on the other side and inspect to ensure symmetry. Check the final height and contour with the patient in the sitting position. Additional sutures can be passed if necessary to improve the brow contour.

A superficial pass of the needle under the eyebrow will create dimpling of the brow.

You will not be able to elevate the head of the eyebrow because of the position of the supraorbital nerve.

Close the wound. After the browpexy, perform the usual closure for a blepharoplasty.

Remember that you excise less skin and muscle for blepharoplasty when performing a browpexy. The trans eyelid browpexy should be considered as an addition to upper lid blepharoplasty in younger patients looking for a deeper superior sulcus. The elevation provided is not enough for a complete brow ptosis or more than mild to moderate amounts of temporal brow ptosis. As you might expect, some temporary numbness above the brow will occur. Despite these limitations, the transeyelid blepharoplasty is very useful for patients undergoing simultaneous blepharoplasty.

UPPER EYELID BLEPHAROPLASTY TECHNIQUE (SEE PAGES 141-145)

Review the indications for browplasty in association with blepharoplasty before you decide to do a blepharoplasty alone. Remember that patients who have a redundant upper lid skin fold commonly have an element of temporal brow ptosis or complete brow ptosis.

The upper lid blepharoplasty includes the following:

- Skin marking
- Anesthesia
- Skin incision
- Skin and muscle excision
- Fat excision
- Closure

The steps of the upper lid blepharoplasty are the following:

Mark the skin.

The most important part of the upper lid blepharoplasty operation is marking the appropriate amount and location of the skin and muscle to be removed. Perhaps a better way to think of this is *marking a symmetric amount of skin that will remain between the eyebrow and the skin crease on each* side .

There are two parts to blepharoplasty marking: *the skin crease* and *the upper limit of the skin excision.* The procedure for marking the skin crease has been discussed previously. Remember that with the brow manually elevated in position, the patient's natural skin crease can be identified by observing where the skin tucks in as the patient slowly looks from downgaze to upgaze. As the patient moves the eye, make a few small marks in the crease. With the patient's eyes resting closed, connect the marks and extend the skin crease from the punctum to the lateral canthus.

The upper limit of the skin incision should *leave between 10 and 15 mm of skin between the eyebrow hairs and the skin crease.* Remember that you must leave symmetric amounts of skin on each side.

Use a caliper to mark down from the base of the eyebrow hairs to the eyelid skin and place a mark. Do this in several locations across the eyelid, marking the upper limit of skin and muscle removal. *Some judgment and experience are necessary to know how much skin* to leave. To be on the safe side *15 mm* of skin is appropriate for all patients. When a more cosmetic result is necessary, the remaining skin can be left at 10 mm. If a browplasty or browpexy is undertaken at the same time, you will want to leave slightly more skin between the brow hairs and the skin crease.

Your patient is unlikely to have problems with lagophthalmos or cornea exposure if you leave 15 mm of skin. *You should reconsider your marking if you find that you are leaving 10 mm or less skin between the skin crease and the brow hairs.* You must preserve the *independent movement of the eyebrow and* eyelid. If you cut off too much skin you will pull the brow down, which distorts the normal anatomy and interferes with closure of the eyelids.

Have the patient sit up and extend the skin crease incision upward and laterally in one of the crow's feet. Watch the patient open and close the eyes, and you will see how symmetric the planned skin excisions will be.

Administer anesthesia.

Upper lid blepharoplasty is usually performed under local anesthesia. Your patient will probably benefit from some intravenous sedation as well.

You might like the following injection technique because it causes very little discomfort. Inject 1/10 ml of local anesthetic with epinephrine in two or three spots within the area of planned excision. Remember that the needle should be placed just underneath the skin and not in the muscle to avoid a hematoma. After 30 seconds, inject an additional 1 to 1-1/2 ml in each upper lid. Injection of this additional local anesthetic will not cause pain. Hold gentle pressure on the injection sites with a gauze pad to prevent any bleeding.

The patient can be prepped and draped while you scrub. Leave the entire face in the surgical field.

Incise the skin.

Stabilize the lid margin with a 4-0 silk suture passed through the meibomian gland orifices of the upper lid margin.

Make a sharp incision through the skin only using a blade, CO_2 laser, or Colorado needle (I am currently using a Colorado needle or CO_2 laser for all upper blepharoplasties). Extend the skin incision through the orbicularis muscle to the septum. With the Colorado needle, use "paintbrush"-like strokes across the skin with the tip of the needle just touching the tissue. Any tissue buildup on the needle suggests that you are moving too quickly or are placing the needle too deeply, "pushing the skin" rather than vaporizing it. The laser technique is similar, but there is no tissue contact. Learn to use scissors and the Colorado needle before using the laser.

As you pass through the thin orbicularis muscle to the orbital septum, you will notice that the *color changes from pink to white.* If you observe closely, you may see a few *small vessels and nerves running perpendicular to the direction of the orbicularis fibers* in the preseptal plane.

Excise skin and muscle.

After you have made the skin incision, *excise the skin and muscle as one layer.* It is a good exercise to try to preserve the orbital septum.

Dissect inferiorly from the superior incision toward the skin crease *in the preseptal plane.* This dissection is facilitated by your grasp of the septum with your nondominant hand as your assistant pulls the orbicularis muscle away from you. *You will see the fibrous bands of the orbital septum spread as they are pulled apart* (make sure you understand this technique of "pulling" the tissue planes apart). This is an avascular plane that is easy to work in. Continue the dissection inferiorly to the upper lid skin crease and then excise the skin and muscle flap. By not opening the septum you will be sure that the levator has not been violated.

If there is no prolapse of orbital fat or you are not planning fat excision, you can close the skin at this point.

Remove fat.

Fat removal is a common part of upper lid blepharoplasty especially when the goal is to provide a deep superior sulcus.

Open the septum at the superior edge of the ellipse. Your patient may not tolerate dissection posterior to the septum with the Colorado needle. If so, you will need to switch to Westcott scissors. Dissection posterior to the septum is possible with the CO_2 laser also.

Open the septum to the fullest extent of the wound.

Tease the septum off the fat moving inferiorly to the reflection of the septum on the levator aponeurosis. Now dissect the septum off the fat superiorly toward the superior orbital rim. As you pull the septum away from the orbital fat you will see fibrous strands that are easily identified and cut. At this point, the preaponeurotic fat should be clearly visible.

Now dissect the preaponeurotic fat off the levator toward the superior orbital rim. The fat seen at this point is the *preaponeurotic, or central, fat* pad .

You will see a *thin fibrous capsule with small vessels covering the fat.* Open the capsule. You will see the free-flowing *yellow fat* of the central or preaponeurotic fat pad.

Dissect medially to identify the *white nasal fat pad.* You may need to open the septum more medially. At this point, it is reasonable to inject some additional local anesthetic into the fat pads. If you are combining a blepharoplasty with a ptosis repair, finalize the aponeurosis advancement before injecting additional local anesthetic.

Open the medial fat pad capsule and dissect posteriorly. Take care not to *cut the palpebral artery.* If you cut this artery, brisk bleeding follows. If you cause bleeding, quickly place pressure on the area. Identify the source of the bleeding and use bipolar cautery to coagulate the vessel. Because you have already injected the additional local anesthetic into the fat, you can cauterize the artery without creating excess pain.

Once the two fat pads are exposed, you can trim the redundant fat anterior to the superior rim. Trim away slightly more fat in women than in men and *never take fat posterior to the superior orbital rim.* As with the skin and muscle excision, the most important point is to leave symmetric amounts of fat behind rather than to remove symmetric amounts of fat.

Fat excision generally proceeds without bleeding because there are very few vessels within the fat itself. If you are concerned about causing bleeding, the fat can be cauterized before cutting. Bipolar cautery can be used to melt away some fat to make perfect symmetry between the two sides.

Close the skin.

Reform the skin crease with two interrupted sutures. Use one or two interrupted 7-0 Vicryl sutures passed from the skin edge to the aponeurosis at the level of the skin crease (top of tarsus). Pass one suture at the peak of the lid and an additional suture medial to the lateral canthus. Some surgeons do not reform the crease.

Make a *small* dog ear *excision* of any redundant skin and muscle at the medial canthus using the *Burow's triangle* technique .

The reformed skin crease should be measured to be symmetric. This is a good time to place the patient in a sitting position make a final check for symmetry in the skin fold, crease height, and contour. When you are satisfied, close the skin with a continuous 7-0 Vicryl suture. Alternative sutures for closure include 6-0 fast absorbing gut or 7-0 nylon.

TRANSCUTANEOUS LOWER EYELID BLEPHAROPLASTY (SEE PAGES 146-149)

There are two lower blepharoplasty procedures. The *transcutaneous lower blepharoplasty* is used to remove skin, muscle, and fat. This procedure is usually performed in older patients where there is excess skin on the lower eyelids. Most of these patients will require a lower lid tightening procedure as well. The *transconjunctival lower blepharoplasty* is used for patients who require fat removal only.

Transcutaneous lower eyelid blepharoplasty includes the following:

- Marking the skin
- Instilling local anesthesia

- Making a skin incision
- Dissecting a skin and muscle flap
- Opening the orbital septum, dissecting, and excising prolapsing orbital fat
- Consideration of a lateral canthoplasty
- Conservative skin and muscle excision
- Closing the skin

The steps of the transcutaneous lower eyelid blepharoplasty are the following:

Mark the skin: Mark a subciliary incision 2 to 3 mm below the lower lashes. Extend the mark from the punctum to the lateral canthus and bring it approximately 5 mm lateral to the lateral canthus in a wrinkle line.

Administer anesthesia.

Consider intravenous sedation.

Inject the lower eyelid anteriorly with a 30-gauge needle passing just beneath the skin (1.5 to 2 ml). Take care not to cause a hematoma.

Prep and drape the patient, leaving the entire face in the operating field.

Make a skin incision: Use a Colorado needle to cut along the subciliary incision. A no. 15 blade or CO_2 laser may be used.

Dissect a skin and muscle flap.

Dissect a *skin and muscle flap* inferiorly to the orbital rim.

As with upper lid blepharoplasty, "pull apart" the orbicularis and septum and you will see *small fibers stretching from the posterior surface of the orbicularis to the septum* that can be cut. In many patients, you will see one or two neurovascular bundles in the postorbicular fascia running perpendicular to the muscle fibers (as in the upper eyelid). These nerves are a subtle, but helpful, surgical landmark, indicating the depth of the septal plane.

Open the orbital septum and dissect the orbital fat.

You will identify the orbital septum as a thin fibrous layer covering the orbital fat. The septum has many thin layers to it. In older adults, the septum may be quite thin (which allows the orbital fat to prolapse).

Open the septum with Westcott scissors. Cut the septum overlying the fat to protect the underlying lower lid retractors.

The three fat compartments in the lower lid are the *nasal, central,* and *lateral fat pads.* Generally the nasal and central fat pads are easy to see. You have already opened the orbital septum so the individual fat compartments should be visualized. Open the thin fibrous fat capsule over each pad. There are small vessels in the capsule that may require some cautery. Dissect the capsule posteriorly to the white band of tissue, *the lower lid retractors.* As you con tinue to elevate the fat off the retractors inferiorly you will see a thicker horizontal band of fibrous tissue, Lockwood's ligament. Just posterior to *Lockwood's ligament,* within the retractors, lies the inferior oblique muscle.

Before fat excision, *inject some additional local anesthetic* into the fat. Use bipolar cautery at the base of the fat pads and *excise the fat at or just anterior to the inferior orbital rim.* It is much better to be conservative with fat excision than to be overaggressive. *Fat excision posterior to the inferior orbital rim will result in the patient having a hollow gaunt look, which is difficult to correct.* For your first few operations, be conservative and have the patient sit up after the fat excision to estimate if further excision is necessary. Generally, little bleeding results with fat excision. It is worth looking for fat in all three compartments.

Generally, the nasal and central fat pads are not difficult to identify, *but the lateral fat pad may be somewhat more hidden.* Remember it is not the amount of excision that needs to be symmetric, but rather that you *leave symmetric amounts of fat* in each orbit. Using the inferior orbital rim as a landmark is helpful. The fat excision should be guided by the preoperative evaluation.

There is a trend toward smaller amounts of fat excision in both the upper and lower eyelids. In particular, some patients benefit from "repositioning" of the orbital fat over the inferior rim to mask the descent of the malar fat that occurs with aging.

Consider a lateral canthoplasty.

Before skin and muscle excision consider a lateral canthoplasty or lower lid tightening. I use a *lateral tarsal strip-type* procedure (see Chapter 3). Make a canthotomy incision extending into the previously marked wrinkle line using Westcott scissors.

Perform a cantholysis using Westcott scissors. Make a strip of bare tarsus by dissecting the anterior lamella off the tarsus and denuding the lid margin and posterior aspect of the tarsus of the epithelium. Suture the strip onto the inner aspect of the lateral orbital rim with two 4-0 Vicryl sutures on a P2 1/2 circle needle. Use moderate tightness and slight superior placement of the lateral canthal tendon. You might have to try a double-armed 4-0 Mersilene suture

instead of the Vicryl. Remember the precautions about the patient with hemiproptosis, in whom lid tightening can exacerbate lid retraction.

There are several variations of the lateral canthoplasty procedure. Some surgeons plicate the tendon. When performing an upper lid blepharoplasty at the same time, you might try to pull the lateral canthal tendon superiorly through the upper lid incision and anchor it to the lateral orbital rim periosteum. This works well in younger patients who do not require much lid tightening. Some surgeons use permanent sutures.

Excise skin and muscle.

With the posterior lamella sutured into position, drape the skin and muscle over the edge of the lid margin. A conservative amount of skin and muscle should be excised (usually 2 to 3 mm). I use a marking pen to outline the excess skin at the lid margin. *Avoid the tendency to remove more skin laterally than medially*. This is a common cause for the temporal droop of the lower lid, or scleral show, seen in patients postoperatively. Again, remove a conservative amount of skin and muscle. Your skin excision can be slightly less conservative if you have tightened the lid. Once the skin and muscle have been removed, the skin should lie nicely in position. Some surgeons choose to have the patient sit up at this point to check if enough skin has been removed. This is a reasonable step to perform in your early experience.

Close the skin.

I usually place a *deep fixation suture* at the lateral canthus, giving further lift and support of the lateral lid tissue. I use the same 4-0 Vicryl suture and place a stitch through the orbital orbicularis muscle approximately 1 cm below the lateral canthus and pull this tissue up, attaching the muscle to the peri osteum of the lateral orbital rim. Try not to dimple the skin.

Next, place an interrupted 7-0 Vicryl suture to the edge of the skin and muscle flap directly to the most lateral edge of the tarsal strip to nicely reform the canthal angle. Use a running 7-0 Vicryl suture (or 5-0 fast absorbing suture) to close the skin only from the punctum into the lateral wrinkle line.

Place some topical antibiotic ointment on the wound and in the conjunctival cul de sac. As usual, ask your patient to use cold compresses placed over the eyes for the first 24 to 48 hours.

TRANSCONJUNCTIVAL LOWER EYELID BLEPHAROPLASTY (SEE PAGES 149-153)

This approach is *useful in younger patients with no excess skin and muscle.* The fat can be removed through a transconjunctival incision without placing any scars on the skin. In patients in whom lower eyelid laxity exists, a lateral

canthoplasty can be performed, but it generally is not necessary as the majority of these procedures are performed on younger patients.

The transconjunctival lower blepharoplasty includes the following:

- Marking
- Anesthesia
- Conjunctival incision
- Orbital fat exposure
- Excision of prolapsing fat
- Elective lower lid tightening
- Conjunctiva closure

The steps of the transconjunctival lower blepharoplasty are the following:

Mark the skin.

No formal marking is done on the conjunctiva. However, you may find it helpful to mark the bulging fat pads on the skin surface as a reminder to you.

Administer anesthesia.

Consider intravenous sedation.

Place topical anesthetic drops in the conjunctival cul-de-sacs.

Inject local anesthetic under the palpebral conjunctiva and again under the skin anteriorly.

Make a conjunctival incision.

Use two *4-0 silk sutures* through the lid margin as traction sutures. If lid tightening is not anticipated, evert the lower lid over a "shoehorn" (Jaeger retractor or a Desmarres retractor).

Use a no. 15 blade or a Colorado needle to make an incision at the inferior edge of the tarsus. Be extremely careful using the Colorado needle, especially if you are not using a corneal protector. This incision is through the conjunctiva and lower lid retractors to the level of orbicularis muscle.

If lid tightening is anticipated, the conjunctival incision is preceded by a small lateral canthotomy and cantholysis. The inferior conjunctival incision is then performed and extended into cantholysis. You will find that using the canthotomy/cantholysis approach makes it easier to see the fat.

Dissect a skin and muscle flap.

If you are used to doing only anterior approach lower lid surgery, these steps will seem somewhat unfamiliar initially. The goal of your dissection is to now elevate the orbicularis off the orbital septum and extend the dissection inferiorly to the orbital rim. Once dissection in this plane is started, it will become familiar to surgeons used to the anterior approach because the remainder of the dissection is essentially the same.

Pull the edges of the conjunctival wound apart, separating the orbital septum from the orbicularis muscle. Follow this plane inferiorly to the inferior orbital rim. You will see the preaponeurotic fat posterior to the orbital septum.

Expose the orbital fat.

The same technique of orbital fat dissection and removal is carried out through this incision. I find it helpful to place another suture at the edge of the conjunctival wound to retract this tissue superiorly. A Desmarres lid retractor or a Jaffe lid speculum is useful to retract the lid margin and tarsus away from the fat. If a lateral canthotomy and cantholysis have not been performed, it is somewhat difficult to get to the lateral fat pad, but your persistence and experience will allow this to be done.

Open the septum and elevate the fat off the retractors.

Inject additional local anesthetic into the fat. Open the fat capsules, exposing all three fat pads. Use bipolar cautery if necessary.

Excise the redundant orbital fat: Trim the fat off just anterior to the inferior orbital rim. Consider repositioning of the fat to "soften" the inferior rim.

Close the conjunctiva.

When no lid tightening procedure has been used, suture the conjunctiva with either interrupted or running sutures. Some surgeons only place one or two sutures. I tend to close the wound with a running 7-0 Vicryl suture. This is also a good place to use a 6-0 mild chromic or fast absorbing gut suture.

If lid tightening is necessary, close the medial two thirds of the wound and perform a tarsal strip type of canthoplasty. Place the canthus slightly high with appropriate lid tightening.

When only fat removal is anticipated, some surgeons will make the initial incision in the fornix through the conjunctiva and lower lid retractors going directly into the fat in the preaponeurotic area. In theory this approach is less likely to cause lower lid retraction, because the orbital septum is not opened at all. All fat excision is carried out from behind the intact orbital septum. I find the fornix incision technique somewhat more difficult and generally do not use it.

Evaluation and Treatment of the Patient With Ptosis

THE LEVATOR APONEUROSIS ADVANCEMENT OPERATION (SEE PAGES 173-178)

The levator aponeurosis advancement operation is one of the most common oculoplastic operations performed. *It is the procedure of choice for adults with involutional ptosis.*

The levator aponeurosis advancement operation includes the following:

- Patient preparation
- Skin incision
- Identification of the levator aponeurosis
- Dissection of the levator aponeurosis off Müller's muscle
- Levator aponeurosis advancement
- Intraoperative adjustments to height and contour
- Closure

The steps of the levator aponeurosis advancement operation are the following:

Prepare the patient.

Use light *intravenous sedation.* You don't want to make the patient too sleepy or adjustment later will not be possible.

Instill topical drops.

Mark an upper lid skin crease incision.

Elevate the brow with your finger until the lashes start to lift up. Ask the patient to look up and down. Watch where the crease forms. Mark symmetric creases from the lateral canthus to the punctum, usually at 6 to 8 mm for men and 8 to 10 mm for women.

Often, an incision for an upper lid blepharoplasty will be marked at the same time.

Inject local anesthetic with epinephrine under the skin.

Inject 0.1 ml into two spots. Apply light pressure. Wait 10 seconds.

Inject an additional *1 to 1.5 ml* of local anesthetic slowly across the proposed incision.

Take care not to cause a hematoma.

Prep and drape the patient.

Make a skin incision.

Place a 4-0 silk suture through the meibomian glands along the lid margin for a traction suture. Use a cutting needle (Ethicon 783 P-3 cutting needle).

Stretch the skin taut with your fingers.

Use a Colorado needle or a no. 15 blade to incise the skin. Try not to cut through the muscle.

You will need cautery at this point if you use a no. 15 blade.

Identify the levator aponeurosis.

Incise the orbicularis muscle across the wound.

Dissect the orbicularis off the orbital septum for about 5 mm. Look "through" the septum to see the yellow of the preaponeurotic fat. Looking through the tissues is helpful to see where you are. It takes a little practice. Sometimes light pressure on the eye will make the fat more visible.

Open the septum.

Use Westcott scissors in your dominant hand and Paufique forceps in your nondominant hand. (the Colorado needle causes pain posterior to the septum for most patients). You will be superior enough to avoid damage to the aponeurosis.

Ask your assistant to *lift the septum toward the* ceiling .

While you do the same, make a generous cut *through the septum* to see the preaponeurotic fat. You will be lifting the septum off the aponeurosis so don't worry about cutting it.

Slide the scissors into the wound and open the septum to the left and then to the right. *If you are unsure where you are ask the patient to look up and you can see the aponeurosis* move.

Dissect the septum off the preaponeurotic fat.

Dissect the preaponeurotic fat off the aponeurosis.

Dissect the levator aponeurosis off Müller's muscle.

Disinsert the levator aponeurosis from the anterior surface of the tarsus using either the Colorado needle or Westcott scissors, "baring" the superior margin of the tarsus.

Dissect the orbicularis muscle off the superior one third of the tarsus.

Dissect the aponeurosis free from Müller's muscle.

Pull the edge of the aponeurosis superiorly and inferiorly and start to dissect a plane between Müller's muscle and the posterior surface of the aponeurosis.

The assistant should put tension on Müller's muscle with a Q-tip.

You should see the peripheral arcade in Müller's muscle.

Müller's muscle is too sensitive to grasp with forceps.

Pull the aponeurosis away from Müller's muscle. You will see *thin adhesions* stretching between Müller's muscle and the posterior surface of the aponeurosis. Carefully cut these to safely free the aponeurosis without making Müller's muscle bleed.

Continue the dissection superiorly about 10 to 12 mm.

Advance the levator aponeurosis onto the tarsus.

Pass a double-armed 5-0 nylon suture (Ethicon 7731, S-24 spatula needle) into the tarsus.

Make the needle pass in a *lamellar fashion about 3 mm inferior* to the superior tarsal margin.

Make a *long needle pass* to include the *most medial 6 to 7 mm of* tarsus.

Pass the arms of the suture through the back of the aponeurosis about 10 mm superiorly, depending on how much lift you want.

Ask your assistant to pull the aponeurosis inferiorly against the tarsus as you tie a *temporary knot.* Make sure that the aponeurosis is against the tarsus.

Ask the patient to open both eyes. Check the *height and contour* with the patient in the reclining position.

Make intraoperative adjustments to height and contour.

Aim for a 1-mm overcorrection, leaving the lid at or just above the limbus.

If the lid is too high or too low, untie the knot and back the sutures out of the aponeurosis. Reposition the sutures at a higher or lower position in the aponeurosis.

If the lid peak (normally just nasal to the pupil) is not correct, you will have to reposition the tarsal bite.

When you are happy with the height and shape, *have the patient sit up* and make a final inspection before you close.

We use an operating table with pneumatic lifts that easily sits the patient up on the operating table--a must if you are doing many ptosis operations or blepharoplasties.

If you are not satisfied with the height or contour, readjust the position of the suture in the tarsus or aponeurosis.

When you are pleased with the final height and contour, *tie the suture permanently.*

Trim off the extra aponeurosis.

If there is a small amount of temporal droop you can place an additional suture temporally.

Close the skin.

Consider a *single suture to reform the skin crease.* Pass an absorbable suture from the skin edge to the aponeurosis at the superior margin of the tarsus to the opposite skin edge. If you are doing bilateral surgery, make sure this stitch is symmetric.

Use either 6-0 fast absorbing plain gut (Ethicon 1916, PC-1 needle) or 7-0 Vicryl (Ethicon J-546, TG 140-8 needle). Some surgeons prefer a permanent monofilament suture such as nylon or Prolene for skin crease closure.

Provide postoperative care.

Instill topical antibiotic ointment in the eye and on the wound three times per day.

THE FRONTALIS SLING OPERATION (SEE PAGES 179-182)

The most common indication for the frontalis sling operation is simple congenital ptosis with poor levator function, but the operation is used for any type of ptosis with poor levator function. Any of a variety of suspension materials can be used to "sling" the lid open. The most common material is fascia lata from the thigh. Originally, fascia was harvested from the patient. More commonly now, tissue bank fascia is used. Some surgeons prefer using alloplastic materials. Regardless of the material the technique is nearly the same.

The frontalis sling operation includes the following:

- Patient preparation
- Skin incisions
- Suturing of the fascia to tarsus
- Passing the fascia to the brow
- Skin crease closure
- Adjustment of height and contour
- Closure of forehead incisions

The steps of the frontalis sling operation are the following:

Prepare the patient.

The operation is usually performed under *general anesthesia in children,* but can be performed under *local anesthesia in adults.*

Mark an *upper lid skin crease* incision and *2-3 mm blepharoplasty.*

Mark *three 4-mm incisions on the forehead.* Place an incision above the brow hairs just medial to the lateral canthus and just lateral to the medial canthus. Mark a third incision 1-2 cm above the brow in line with the pupil.

Inject local anesthetic with epinephrine into the proposed incision site.

Prepare and drape the patient.

Make the skin incisions.

Use a 4-0 silk suture as a traction suture through the lid margin (Ethicon 783 P-3 cutting needle).

Use a no. 15 blade to *cut the brow incisions* down to the periosteum.

Try not to cut the supraorbital neurovascular bundle.

Spread the wound open with a hemostat. You will need to "seat" the knot of the fascia in this wound later.

You will see some bleeding that usually stops with pressure.

Incise the skin crease with a no. 15 blade or a Colorado needle.

Identify the levator using the same technique as that in the levator advancement procedure.

Suture the fascia to the tarsus.

"Bare" the superior half of the tarsus by dissecting the orbicularis off the tarsus.

Suture the fascia to the tarsus. You will need two strips of fascia for each eyelid (5-0 polyester, Davis and Geck 2828-23 D-1 spatula needle).

Suture the middle of the length of the first strip of fascia to the upper third of the tarsus at the peak of the lid.

Suture the same piece of fascia to the tarsus at the *medial* limbus.

Repeat with the second strip of fascia, sewing it next to the first suture and then at the *lateral* limbus.

Pass the fascia.

Thread the fascia onto a *Mayo trocar* (this is a thick needle used for general surgical closures, made by Richard Allen Medical (800-253-7900), 1/2 circle, Style 217003).

You will pass the fascia through the skin crease incision under the orbital septum and out the brow wounds using a Webster needle holder.

Place a *Jaeger lid plate* in the superior conjunctival fornix to protect the eye.

Skim the periosteum at the superior orbital rim to make sure that the tracer is posterior to the septum (don't pass the needle into the periosteum or the fascia will not move).

Pass the *medial fascia strip ends* out the medial brow incision.

Pass the *lateral fascia strip ends* out the lateral brow incision.

This pattern makes two small triangles from the tarsus to the brow (the Crawford technique).

Inspect the lid contour.

Pull the fascia superiorly through the brow incisions and look at the contour of the lid margin.

If necessary move the tarsal sutures to give a natural lid contour.

Close the skin crease. Use interrupted 7-0 Vicryl sutures (Ethicon J-546) to form the skin crease (remember that poor levator function means no natural crease). Pass the suture through the skin edge to the top of the tarsus and then out the opposite skin edge. Follow with a ranning suture.

Adjust the height and contour.

Pull the fascia superiorly again to adjust the height. *Tie the fascia so that the lid margin is at the limbus.*

Use a square knot tied over a piece of 5-0 Vicryl suture. Tie the Vicryl suture over the square knot so it will not slip.

Cut one end of fascia off 1 cm past the knot.

Pass the long end of each piece of fascia out the central incision using the Mayo trocar.

Tie the knot in the same way. Trim the ends of the fascia.

Use a forceps to slip the ends of the fascia under the frontalis muscle.

Close the forehead incisions using the same 7-0 suture with interrupted passes.

Provide postoperative care.

Place a 4-0 silk suture through the lower lid margin and tape to the forehead (Frost suture) to avoid postoperative exposure.

Remove the Frost suture on the first postoperative day.

Use frequent doses of *lubricating ointment* for the first week and taper as tolerated.

Use *topical and oral antibiotics* for 1 week.

The frontalis sling operation is easier than the levator aponeurosis operation. The anatomic structure is simpler, and the adjustment is less subjective. Passing the fascia is somewhat intimidating initially, but it is safe if you control the needle.

ABNORMAL MOVEMENTS OF THE FACE

ADMINISTRATION OF BOTULINUM TOXIN FOR HEMIFACIAL SPASM (SEE PAGE 199)

Botox is reconstituted with sterile saline, making a concentration of *5 units per 0.01 ml.* Some surgeons use a more concentrated solution of 10 units per 0.01 ml, with the idea that the medication will diffuse less, resulting in fewer side effects. The Botox is administered just beneath the skin in the sites shown in Fig. 8-8 on page 199.

ADMINISTRATION OF BOTULINUM TOXIN FOR ESSENTIAL BLEPHAROSPASM (SEE PAGES 199-200)

Using the same concentrations as are used for hemifacial spasm, the Botox is administered in the sites shown in Fig. 8-9 on page 199. The sites and amounts of injection can be individualized in rare situations. Avoid injections close to the mouth, because an annoying paresthesis of the lip will occur. Similar injections can be given for symptomatic aberrant regeneration of the facial nerve. Remember that exposure problems are more likely in these patients.

TEMPORARY SUTURE TARSORRHAPHY

(see pages 202-203)

If you anticipate improvement over a few weeks, a temporary tarsorrhaphy is appropriate. The simplest temporary tarsorrhaphy uses a suture to close a portion of the eyelids. Usually the lateral one third of the lids is closed.

A temporary suture tarsorrhaphy includes the following:

Instill topical anesthetic and inject local anesthetic into the eyelids.

Cut two 5-mm pieces of a ***narrow red rubber catheter*** to use as bolster material.

Pass one arm of a 5-0 nylon suture.

Through the bolster material,

Then into the lower lid skin 5 mm below the lid margin, emerging through the meibomian glands,

Into the opposite lid margin,

Out the skin 5 mm below the upper lid margin, and

Through the second bolster.

Repeat this procedure with the other arm of the suture.

Tie a slip knot over the bolster.

The temporary suture tarsorrhaphy can be placed anywhere along the lid margins. The suture tarsorrhaphy can be opened to inspect the cornea by untying the slip knot. The nylon suture can be left in place for 2 weeks. When corneal healing has occurred, the suture can be removed and the lids will open naturally.

BOTULINUM TEMPORARY TARSORRHAPHY (SEE PAGE 205)

Botox can be used to close the eyelids. *Five to* ten units of Botox are injected through the central aspect of the eyelid 2 cm into the orbit. After 48 hours, the upper lid rests closed and remains so for a period of several weeks to several months. The results of botulinum toxin tarsorrhaphy, however, are somewhat unpredictable.

PERMANENT LATERAL TARSORRHAPHY (SEE PAGE 205)

A more permanent lateral tarsorrhaphy can be made by splitting the anterior and posterior lamella of the lid margin, deepithelializing the eyelid margin and sewing the layers together.

The steps of the permanent lateral tarsorrhaphy are the following:

Administer topical and local anesthetics.

Split the lateral one third of the upper and lower lid margins.

Use a no. 15 blade to incise the lid margins along the gray line for the lateral one third of the upper and lower eyelids. Keep the plane of the incision parallel to the posterior surface of the tarsus.

Use Westcott scissors to separate the anterior and posterior lamellae 4 mm proximal to the lid margins.

Some bleeding may occur. Use bipolar cautery, if necessary.

De-epithelialize the margins of the posterior lamella.

Sew the upper and lower posterior lamellae together; use three interrupted 5-0 Vicryl sutures.

Sew the upper and lower anterior lamellae together.

Use interrupted absorbable sutures.

Evert the eyelashes with the closure.

This is a very effective way to make a permanent tarsorrhaphy. No bolsters are used, and no suture removal is required. At a later date, the lids can be opened, but some lid margin deformity may follow, so use this procedure only if you are sure that you want a strong long-term tarsorrhaphy.

MEDIAL TARSORRHAPHY (SEE PAGE 205)

One of the most useful but little-known tarsorrhaphies is the *medial tarsorrhaphy.* In this operation the canalicular portions of the eyelids are sewn together. The medial tarsorrhaphy technique is modified from the usual tarsorrhaphy because the lid margin cannot be split in the area of the canaliculus.

The steps of the medial tarsorrhaphy are the following:

Prepare the patient.

Administer topical anesthetic.

Mark a V -*shaped incision* just peripheral to the canaliculi to the upper and lower lid.

Inject local anesthetic.

Make small myocutaneous flaps at the canthus.

Place a *Bowman probe* into the canaliculus.

Use a no. 15 blade, Westcott scissors, or a Colorado needle to cut through the skin and muscle adjacent to the canaliculus. Repeat this on the opposite lid, taking care not to cut the canaliculus itself. Connect the arms to form a "V".

Dissect a small skin and muscle flap away from the canaliculi. Be careful not to damage the canaliculi.

Suture the medial portion of the lids together.

Use three interrupted 5-0 Vicryl sutures in the muscle to close the tarsorrhaphy.

You will notice that the canaliculi are inverted.

Use a 5-0 fast absorbing gut or 7-0 Vicryl suture to close the skin.

The medial tarsorrhaphy gives a horizontal and vertical narrowing of the palpebral fissure without interfering with the vision or dramatically changing the appearance of the eyelids. Medial tarsorrhaphy can be used with other procedures such as lateral tarsorrhaphy, gold weight implantation, or elevation of the lower eyelid.

GOLD WEIGHT IMPLANTATION (SEE PAGE 207)

Gold weights can be implanted into the upper lid to improve eyelid closure. Preoperatively test weights are applied to the eyelid with benzoin solution to select the correct size weight. I put in the most weight possible creating about 1 mm of eyelid ptosis. You will find that most patients do well with two 0.8-g weights.

The steps of gold weight implantation into the upper eyelid are the following:

Prepare the patient.

Use a topical anesthetic.

Mark an upper eyelid skin crease 1 to 2 mm higher than normal.

Inject a local anesthetic.

Dissect a pretarsal pocket.

Place a 4-0 silk suture in the upper lid margin for traction.

Make a skin crease incision with either a no. 15 blade or a Colorado needle.

Dissect the skin and muscle off the tarsus inferiorly, stopping 2 to 3 mm above the eyelashes. You will *create a pretarsal pocket.*

Sew the weights into position.

Sew the weights onto the tarsus with 5-0 Dacron sutures.

Make sure that there is *no stress on the skin* overlying the weight.

The upper edge of the gold weight usually sits at the top edge of the tarsal plate.

Close the wound.

Close the orbicularis muscle with interrupted 5-0 Vicryl sutures.

Close the skin with a running 7-0 Vicryl or 5-0 fast absorbing gut suture.

Gold weights can be used with other procedures such as a medial tarsorrhaphy or lower eyelid elevation. The combination of weight implantation and lower eyelid elevation has almost eliminated the use of permanent large lateral tar sorrhaphies.

DIRECT BROWPLASTY (SEE PAGES 210-212)

The most commonly performed browplasty for facial nerve palsy is the *direct browplasty.* The direct browplasty is a simple and straightforward technique to raise the brow above the visual axis. An ellipse of skin and muscle is removed directly above the eyebrow. The wound is closed with attachment of the subcutaneous tissues to the periosteum.

The steps of the direct browplasty are the following:

Prepare the patient.

Mark the area of proposed tissue excision above the eyebrow.

The *lower incision line* is drawn 1 mm above the eyebrow hairs. This line starts at the head of the brow and extends beyond the tail of the brow in an upward direction for about 1 cm.

The *vertical height* of the tissue resection is determined with the patient in the sitting position with the brow manually elevated to its normal position.

A ruler is placed at the brow and the brow is allowed to relax. The millimeters of brow drop are multiplied by 1.5 to determine the vertical height of tissue to be excised. The excision ranges from 10 to 15 mm in most elderly patients. This allows for a slight overcorrection of the brow.

The *upper incision line* is marked accordingly.

Administer topical and local anesthetics.

Excise skin and muscle.

Use a no. 15 blade or Colorado needle to incise through the skin and subcutaneous tissue down to the underlying frontalis and orbicularis muscles. I don't attempt to bevel the wound parallel to the brow hairs, as suggested by some surgeons.

Apply cautery as needed, but *try to avoid damaging the hair* follicles.

Medially, remove only skin and subcutaneous tissue to avoid damage to the supraorbital nerve.

Centrally and laterally, excise the muscle down to the periosteum with Stevens scissors. In patients without facial nerve palsy, avoid muscle resection lateral to the brow to avoid damage to the frontal nerve.

Close the wound.

Suture the muscle layer to the underlying periosteum with interrupted 4-0 Vicryl or Prolene sutures to maintain the position of the elevated brow, *if the brow ptosis is* paralytic.

Close the *subcutaneous layer* with interrupted *4-0 Vicryl* sutures .

Close the *skin* with a *running 5-0 Prolene suture.* The blue color of the Prolene suture contrasts with the brow hairs, facilitating suturing and eventual suture removal.

DIAGNOSIS AND MANAGEMENT OF THE PATIENT WITH TEARING

THREE-SNIP PUNCTOPLASTY OPERATION (SEE PAGE 225)

In this operation, a small triangle of the posterior wall of the vertical and horizontal portion of the canaliculus is excised.

The steps of the *three-snip punctoplasty* are the following:

Vertical cut of punctum: "snip 1": Place a Westcott scissors in the vertical portion of the canaliculus and cut inferiorly.

Horizontal cut of the canaliculus: "snip 2"

Turn the scissors 90 degrees and slide one tip in the horizontal portion of the canaliculus.

The scissors will be parallel to the lid margin.

Make a 2-mm cut slightly posterior to the lid margin. It is important to place this horizontal cut posteriorly; otherwise you will disturb the normal appearance of the lid margin.

Diagonal cut of the canaliculus: "snip 3"

Grasp the cut corner and make a diagonal cut, removing a posterior triangle of canaliculus.

The excised area should not be visible when looking at the lid margin.

The mucosa of the inside of the canaliculus should be visible from the posterior aspect of the eyelid.

THE MEDIAL SPINDLE OPERATION (SEE PAGES 226-227)

The medial spindle operation is simple to perform and quite effective. It is a combination of a posterior lamellar shortening procedure and a mechanical inversion of the lid margin with an absorbable suture (see Chapter 3).

The *medial spindle operation* includes the following:

- Patient preparation
- Excision of a diamond of conjunctiva
- Closure of the conjunctiva to invert the punctum
- A lateral tarsal strip operation (usually)

The steps of the *medial spindle operation* are the following:

Prepare the patient.

Instill topical anesthetic drops.

Inject local anesthetic into the inferior fornix of the medial conjunctiva.

Inject local anesthetic under the skin at the orbital rim inferior to the punctum.

Excise a diamond of conjunctiva.

Place a no. 1 Bowman probe into the canaliculus and evert the lid margin.

Excise a "diamond" of conjunctiva (and theoretically lower eyelid retractors) inferior to the punctum and the tarsal plate (3 to 4 mm by 3 to 4 mm).

Make the diamond-shaped excision by grasping the conjunctiva with a Paufique forceps and using Westcott scissors to excise a V of conjunctiva inferiorly. Cut a similar V of conjunctiva superiorly so the two incisions form into a diamond. The excised area of conjunctiva will be closed vertically, shortening the posterior lamella and turning the punctum inward.

Take care not to cut the vertical portion of the canaliculus when performing the excision.

Close the conjunctiva to invert the punctum.

Use a double-armed *5-0 chromic suture* (Ethicon 793 G-3 needle) to close the diamond, incorporating a pass through the lower lid retractors in the center of the diamond excision. (You will not always be able to recognize retractors.)

Next pass the two arms of the suture backhanded through the apex of the diamond adjacent to the punctum. This part of the operation theoretically advances the lower lid retractors to the top of the diamond.

The remainder of the closure involves collapsing the diamond and passing the sutures out through the eyelid. Pass each suture arm through the inferior apex of the diamond and continue the full-thickness pass through the lid, exiting at the junction of the eyelid and cheek skin. The suture pass can be visualized as a *spiral* if viewed laterally. The conjunctival suture passes close the posterior lamellar, resulting in a posterior lamellar shortening. The full-thickness pass of the suture through the eyelid, emerging inferiorly, causes a mechanical inversion of the punctum. A significant mechanical inversion of the punctum will occur when the sutures are pulled tightly on the skin side of the eyelid.

Do a lateral tarsal strip operation (usually).

Cut the needles of the spindle suture off and clamp the suture ends out of the way. If a lateral tarsal strip operation is also being done (as is usually the case), it should be performed at this point.

The medial spindle suture should be tied after the strip is sewn into position. The amount of inversion can be titrated by tying the suture with more or less tension. At the conclusion of the medial spindle procedure, a slight overcorrection (inversion) is desired.

The chromic suture will fall out on its own in approximately 7 to 10 days. The overcorrection will reduce spontaneously, leaving the punctum in its normal position. Remember that the medial spindle operation must be performed before the eyelid is tightened with a lateral tarsal strip operation. Once the lateral tarsal strip sutures are tied, the medial eyelid cannot be everted to perform the medial spindle operation.

NASOLACRIMAL DUCT PROBING PROCEDURE (SEE PAGES 228-231)

In most cases, this procedure is performed under general anesthesia in an outpatient setting.

Nasolacrimal duct probing includes the following:

- Patient preparation
- Infracture of the inferior turbinate
- Dilation of the punctum
- "Hard stop" pass into the sac

- Passage of the probe into the nasolacrimal duct
- Confirmation that the probe is in the nose

The steps for nasolacrimal duct probing are the following:

Prepare the patient.

Spray a vasoconstricting agent in the nose: Like all other lacrimal operations, it is important to prepare the nose with a vasoconstricting agent so you will minimize bleeding and maximize vi su al iza tion in the nose. In the preoperative holding area, spray the involved side of the nose with a nasal decongestant spray such as oxymetazoline hydrochloride 0.05% (Afrin) twice, ten minutes apart.

Pack the nose. After induction of general anesthesia, pack the inferior turbinate with either a small piece of cotton or a small neurosurgical cottonoid dampened with oxymetazoline hydrochloride. You may need to cut the cottonoid so that it is narrow enough to slide under the inferior turbinate easily. You should use a *fiberoptic headlight and a pediatric nasal speculum* to visualize the inside of the nose. *Bayonet forceps* are useful to place the pack in the nose. You will get the best decongestion and intraoperative view if you pack medially and laterally to the inferior turbinate. Remember, lateral to the inferior turbinate means that the pack is under the inferior turbinate. When you perform a DCR, you will be packing the area around and under the *middle* turbinate. No local anesthetic is necessary. Clear any discharge off the patient's eyelids, but no formal prep is necessary. Remove the nasal packing.

Infracture the inferior turbinate.

Look inside the nose again to see how much space there is in the inferior meatus. I place a Freer elevator under the turbinate and rotate it. If there is resistance to this rotation, I perform an *inferior turbinate infracture.* This is easy to do.

With the elevator under the turbinate held in your dominant hand and the nasal bridge in your nondominant hand, push the turbinate toward the nasal septum. You will feel the turbinate "give" a bit or sometimes crack. I am not aware of any study that has definitely proven that turbinate infracture is a helpful procedure, but it is a common practice.

Dilate the punctum.

Next proceed with careful punctal dilation. *You must avoid creating a false* passageway .

Sit at the head of the bed and stabilize the lower eyelid with your index finger and thumb of your nondominant hand. Place the punctal dilator into the *vertical portion* of the lower punctum.

Carefully rotate the punctal dilator to a position parallel with the lid margin. Give slight lateral traction on the eyelid. Gently pass the probe toward the medial canthus into the *horizontal portion* of the canaliculus. If you meet any resistance to the probe, you should stop to avoid creating a false passageway. It is not necessary to push the probe very far into the canaliculus.

I perform probings through the lower punctum only. Dilation and passage of the probe into the canaliculus are easier in the lower eyelid than in the upper eyelid.

Make a ***hard stop*** pass through the canaliculus.

The nasolacrimal duct probing is best done with a larger probe such as a *no. 1 Bowman probe.* Place the probe into the *vertical portion* of the canaliculus while stabilizing the lid with the same lateral traction you used for dilation of the punctum.

Turn the probe 90 degrees and pass it along the *horizontal portion* of the canaliculus. Give lateral traction on the eyelid.

If you see the *lid move* as you pass the probe, you are running into a soft tissue obstruction, a *soft stop.* You should not advance the probe any further. Reorient the probe and try again. In an unobstructed canaliculus, the probe should pass easily into the sac and hit the medial wall of the lacrimal sac fossa resulting in a *hard stop.* Make sure that you understand the concepts of soft and hard stops discussed here and earlier in this chapter.

Pass the probe into the nasolacrimal duct.

You will not be able to see inside the sac so *you need to visualize in your mind what is happening.* The goal is to pass the probe atraumatically down the duct into the inferior meatus. The orientation of the duct lies in the coronal plane of the face, perhaps somewhat more posterior and slightly lateral. Think about where you placed the pack under the inferior meatus. That is where you are aiming. In your mind, visualize the tip of the probe in the sac.

Without moving the tip of the probe off the medial wall of the sac, rotate the probe into the coronal plane. Imagine that you are sliding the probe down into the neck of a funnel as the probe passes from the sac into the duct. Continue to pass the probe down the duct. The nasolacrimal duct is shorter than you think, usually less than 15 mm (sometime you might find it helpful to place the probe on the outside of the patient and actually see how short the duct is).

It won't be long before you feel a *small "pop"* as you penetrate the membrane of the duct. If you cannot advance the probe you are probably hitting the floor of the nose. You will not always feel a definitive "pop."

Sometimes it is difficult to get the proper orientation of the probe if the brow is prominent. I find it helpful to hold the probe against the medial canthus and bend the probe in a *curved fashion* so that it can pass easily into the nose.

Confirm that the probe is in the nose.

You must confirm that the probe has passed into the inferior turbinate. This can be done either by *direct vi* su al iza tion or by *irrigation of fluorescein-tinged solution* into the nose.

Direct vi su al iza tion: Over the years, as I have gotten more proficient in looking in the nose, I often choose the direct vi su al iza tion route. Again, using a headlight and nasal speculum, it is usually possible to look under the inferior turbinate and see the metal probe in position. Most times you can see the probe in the nose by direct view, especially if you use a Freer elevator to push the turbinate away and place a suction tip in the inferior meatus.

This is a good time to recheck the position of the inferior turbinate. If the inferior meatus is too narrow, it is reasonable to perform an infracture of the turbinate as described above.

If you are interested in using a *nasal endoscope,* this is an easy way to see the probe in the nose.

Fluorescein irrigation: An alternative to direct vi su al iza tion is irrigation using fluorescein-tinged fluid. An irrigation syringe is passed through the lower punctum into the canaliculus. With a suction tip in the inferior turbinate, irrigate fluorescein-stained saline down the nasolacrimal duct (put some fluorescein strips in saline to make the irrigation fluid yellow). The yellow fluid will easily be seen in the tubing of the suction. Remember children usually don't have a cuffed endotracheal tube so don't irrigate more than you have to and suction out as much of the irrigation fluid as you can.

Apply antibiotic ointment. *At the conclusion of the procedure, put some topical antibiotic ointment into the conjunctival cul-de-sac. Tell the parents* to use the ointment three or four times a day for 1 week.

Follow-up.

Explain to the parents that a *bloody tear or small amount of blood from the nose* is not unexpected.

I usually see the patients 1 month postoperatively. The majority of patients will be symptom free.

NASOLACRIMAL DUCT INTUBATION WITH SILICONE STENTS (PAGES 231-234)

The technique of passing stents through the nasolacrimal system is similar to that of passing a Bowman probe down the tear duct. One stent is placed in each canaliculus, and the stents are retrieved and brought out through the nose. They are tied in a knot, forming a loop through the nasolacrimal system.

The *nasolacrimal duct intubation procedure* includes the following:

- Patient preparation
- Dilation of the punctum
- Passage of the stents into the canaliculus and NLD
- Retrieval of the stents
- Tying the stents

The steps of the *nasolacrimal duct intubation procedure* are the following:

Prepare the patient.

Use general anesthesia in an outpatient setting.

The preparation of the nose is the same as that for nasolacrimal probing. During the preparation, you should determine whether the inferior turbinate needs to be infractured.

Dilate the punctum. Slightly more aggressive punctal dilation is necessary to allow the entrance of the olive tip of the Crawford stent. You must be careful not to create a false passage with the dilator.

Pass the stents into the canaliculus and NLD.

I often pass a no. 1 Bowman probe through the duct before positioning the stents. This gives me information about the anatomy of the system more easily than with the metal probe on the stents, which are thinner and less malleable. They are somewhat more difficult to pass than the no. 1 Bowman probe.

Repeat the probing technique with one arm of the stent.

Retrieve the stents.

Once the stent is in the nose, the olive tip on the end of the stent can be retrieved with either a

Crawford hook (C106 from Roger Klein, Palmer, Puerto Rico).

Tse-Anderson grooved director (special order from Hansen Laboratories, Iowa City, IA).

A small *hemostat* .

My preference is to use the Tse-Anderson grooved director. This is a very atraumatic way to retrieve the stents. A slotted hood on the end of a grooved director is used to hook the olive tip of the Crawford stent.

The Crawford hook is a simpler, but more traumatic, way to retrieve the stent.

Some surgeons prefer the use of a hemostat.

If you are able to use an endoscope easily, visu al iza tion of the stent makes retrieval much easier.

Consider these tips for retrieval of the stent.

Unless you are using an endoscope or can see the stent directly, *retrieval of the stent is all by* touch .

You must first make sure that you are actually in the inferior turbinate. When an instrument is placed in the inferior turbinate, it extends out the nose perpendicular to the plane of the operating table. The inferior meatus is very narrow so that the instrument will hold securely in place.

Once the *Tse-Anderson grooved director* is in position, you must locate the metal olive tip of the stent.

In most cases, the tip is against the lateral wall of the nose inferior to where the duct opens.

Push the grooved director against the lateral wall of the nose and slide it anteriorly and posteriorly a few millimeters to see if you can feel the stent.

If you can feel the stent or see the stent move in the punctum above, push the grooved director against the lateral wall of the nose and retract the stent from above a few millimeters.

Confirm that the grooved director is against the lateral wall of the nose and advance the stent inferiorly again.

Pull the grooved director anteriorly, and the tip should catch in the slot.

Once the olive tip is engaged, offer some general resistance on the stent at the punctum above to "set" the olive tip in the grooved director. Advance the grooved director out of the nose, and the stent will follow. Be careful to pull the stent out slowly.

The *Crawford hook* can be used in a similar fashion.

Make sure that you know where the open side of the hook is facing. A flat area on the handle of the hook is opposite to the open end of the hook. Place your index finger on this marked area on the handle.

Place the Crawford hook in the nose as you would the grooved director. Turn the closed side of the hook against the lateral wall of the nose and see if you can palpate the probe. If you can palpate the stent, advance the hook a few millimeters and rotate the open end of the hook against the lateral wall of the nose. Pull the hook anteriorly, and you should be able to hook the olive tip of the stent.

If the hook doesn't come out of the nose easily, it may have attached itself to the nasal mucosa so try to carefully loosen the hook rather than pull harder.

Both the grooved director and Crawford hook techniques take some practice. *If you can't find the stent, make sure that it is not placed too far down the duct into the nose. Perhaps the biggest mistake is that the stent has been advanced too far into the nose and has turned posteriorly, parallel to the floor of the nose toward the nasopharynx.* If you don't

find either of these stent retrieval techniques easy, you may want to try the Ritling intubation system (which may make retrieval easier).

Tie the stents.

After the upper and lower canalicular stents have been passed out the nose, spread the eyelids open to properly position the stent in the canthus.

With a small needle holder reach into the nostril and grasp both stents anterior to the tip of the inferior turbinate. Withdraw the stents from the nose and tie a 1-1-1 square knot on the needle holder. Release the needle holder and let the knot retract into the nose.

Cut the ends of the stent so that they hang out from under the turbinate, but not outside the nose.

Remember not to tie the stents under traction or the knot will retract up in the duct.

Some surgeons prefer to suture the stents to the lateral wall of the nose or to secure a sleeve or piece of silicone around the knot to prevent prolapse. I have found this generally unnecessary. If you do choose to secure any material to the stent to prevent prolapse, be aware that excessive tension on the stents will cause punctal erosion and eventual unroofing of the canaliculi.

Use antibiotic ointment three times per day for 1 week.

Follow-up.

Leave stents in place for 6 months.

A small amount of tearing will often remain with the stents in place, especially when the child has a cold. No discharge should be seen, however.

Remind the parents that tears do not flow through the stents and that any residual tearing usually resolves when the stents are removed.

PREOPERATIVE NASAL PREPARATION FOR DCR (SEE PAGES 237-238)

In this section we will discuss decongestion of the nose and anesthetic injection for DCR.

Gather equipment and medications.

You will need some special equipment before you perform a DCR. Have at hand an *atomizer, fiberoptic headlight, bayonet forceps, nasal speculum,* and *neurosurgical* cottonoids .

You will also need *0.05% oxymetazoline hydrochloride* (*Afrin) spray and 2% lidocaine (Xylocaine) with 1 mX100,000 epinephrine mixed with 0.5% bupivacaine* (Marcaine) .

Perform preoperative decongestion of the nose.

The first step to successful lacrimal surgery is excellent nasal decongestion. Without thorough nasal decongestion, vi su al iza tion in the nose and hemostasis will be difficult and surgery will be long and "painful" for you.

Begin decongestant therapy with oxymetazoline hydrochloride nasal spray in the preoperative area 15 minutes ahead of surgery. In the operating room, spray the nose once again.

Use general or local anesthesia.

I suggest that you perform your first few DCRs with patients under general anesthesia. When you are confident of your ability to control bleeding easily and do the surgery quickly, local anesthesia is preferred.

If you are using local anesthesia, you must provide both nasal decongestion and anesthesia. Spray the nose with the lidocaine containing epinephrine using the atomizer.

Mark the skin incision.

If you are using the external approach, mark a skin incision on the nose halfway between the nasal bridge and medial canthus as the nose spray takes effect.

Start at the level of the medial canthus and draw the incision inferiolaterally toward the lateral alae of the nose for 12 mm. You should palpate the anterior lacrimal crest and in some patients, move the incision somewhat closer to the crest.

Inject local anesthetic: In any patient undergoing DCR, either with the external or internal approach, you should *inject 2% lidocaine with* epinephrine into

The tissue around the incision site.

The sac.

The skin around the canaliculi.

The mucosa of the lateral nasal wall adjacent to the anterior tip of the middle turbinate.

The mucosa of the middle turbinate.

Pack the nose.

After injection of local anesthetic, *pack* the nose with cottonoids dampened with oxymetazoline hydrochloride. One-half inch by 3-inch neurosurgical cottonoids are good for this. The packing should be placed in the middle meatus against the lateral wall of the nose.

Cocaine 5% is an excellent topical anesthetic and vasoconstrictor. However, it should be used with caution, especially in elderly patients or in any patient undergoing general anesthesia, because many of the inhalation agents sensitize the heart to arrhythmia, making a combination of cocaine and any injection containing epinephrine dangerous.

Position the patient.

Before starting the surgery, place the patient in the *reverse Trendelenburg position* (with the head up 10 to 15 degrees).

Check the height of your operating stool.

Prep and drape the patient.

If your patient is under general anesthesia, include the eye to be operated on and ipsilateral nostril in the surgical field.

If the patient is under local anesthesia, it is best to include the whole face in the field.

Scrub while the decongestants are working. Remember to put a headlight on if you are using an external approach. On your way out to scrub, discuss with the nursing staff the orientation of the operating table and video unit (for endoscopic approaches), if you haven't done so already.

THE EXTERNAL DCR (SEE PAGES 238-243)

Before performing an external DCR, you should follow the steps outlined above for nasal preparation. After you have injected anesthetic and packed the nose of the patient, scrub while the nursing staff prepares and drapes the patient. When you return to the operating room sit by the side of the head to be operated on.

The procedure can be broken down into these steps:

- Expose the sac.
- Create the osteotomy.
- Form the flaps, suture the posterior flaps, intubate the system, and close the anterior flaps.
- Close the incision.

Expose the sac.

You will find that *exposure of the sac* is important because vi su al iza tion of the tissues in the ostium is difficult for the novice surgeon.

Make the skin incision *using a no. 15 blade* or Colorado needle. Try to cut through the thick nasal skin, but not into the underlying muscle.

Using a Stevens scissors in your dominant hand, *spread the orbicularis muscle* parallel to the muscle fibers. Continue spreading deeply until you see the white periosteum.

Pass two 4-0 silk *traction sutures* on each side of the wound for exposure.

Pass the sutures into the orbicularis muscle, but not through the skin.

Broad bites of the orbicularis muscle will help with hemostasis.

If the angular artery is visualized, be careful not to pass the needle through it.

Have the scrub nurse load the needles forehanded for the edge of the wound closest to the eye, and backhanded for the edge of the wound away from the eye.

Clamp the sutures to the drapes using hemostats.

Elevate the periosteum

Take a *Freer elevator* in your dominant hand and a small *Baron suction tube* (5 FR, Storz N0610) in your nondominant hand. Use the suction tube to retract the sides of the wound open and use the Freer elevator to clean any remaining muscle off the periosteum.

Incise the periosteum parallel to the incision with the sharp edge of the elevator. Reflect the periosteum toward the anterior lacrimal crest using the Freer elevator.

You will probably encounter some bleeding from the *innominate suture* 2 or 3 mm anterior to the anterior lacrimal crest. You may want to use bone wax applied with a cotton-tipped applicator to stop this bleeding.

Carefully elevate the periosteum from the edge of the anterior lacrimal crest and lift the entire contents of the lacrimal sac fossa off the bone.

Create the osteotomy.

Once you have elevated the lacrimal sac from the underlying bone, use the suction tube in your nondominant hand to *retract the sac tissue* so you can see the floor of the lacrimal sac fossa clearly.

Identify the suture line between the thinner lacrimal bone and thicker maxilla. This occurs slightly more than half way back in the lacrimal sac fossa.

Use your Freer elevator to gently break open the suture line. Be careful not to disturb the underlying nasal mucosa.

Next use a Hardy sella punch (90 degree) to start the ostium.

Place the punch in the hole. Use the blunt end of the punch to push the nasal mucosa away from the bone. Then close the blades to cut the bone. Retract the punch to clean the bone from the punch jaws.

Move anteriorly to enlarge the ostium. Put the sella punch in the ostium as though you are placing a key in a lock. Remember the end of the punch is designed to push the soft tissues off the back of the bone. Once against the mucosa, *rotate* the punch *(like turning the key)* under intact bone to enlarge the ostium.

Enlarge the osteotomy with Kerrison rongeurs.

As the size of the ostium is enlarged, use consecutively larger Kerrison rongeurs (Storz N1951, N1952, and N1953) to complete the bone removal. The Kerrison rongeurs are much stronger than the sella punch and will make allow quick removal of the thicker maxillary bone anteriorly.

The ostium is completed when the entire lacrimal sac mucosa is adjacent to nasal mucosa. The ostium size is approximately 15 mm by 15 mm, but varies from patient to patient. The important point is to remove enough bone to easily connect the mucosal flaps.

Remove *a small spine of bone* often present at the neck of the sac. This bone is best removed with a rongeur that looks like a pliers, known as a Belz lacrimal sac rongeur (Bausch and Lomb Surgical, Storz, #E4590).

Form the flaps, suture the posterior flaps, intubate the system, and close the flaps.

Use a no. 1 Bowman probe passed through the canaliculus into the sac. Look inside the ostium to see the probe tent up the sac.

Cut the anterior sac flap.

Use a *no. 66 Beaver blade or crescent blade* to make an incision along the long axis of the sac (toward the duct).

Turn the blade 90 degrees to cut the anterior lacrimal sac flap at both ends of the sac incision.

Cut the opposite anterior nasal mucosa flap.

Incise the nasal mucosa using the same No. 66 blade, cutting parallel to the initial sac incision.

Again, turn the blade 90 degrees to cut the nasal mucosa at each end of the incision, completing the anterior nasal mucosal flap (you haven't put the blade down yet).

Cut the posterior flaps.

Exchange the blade for a Westcott scissors to cut the *posterior sac flap* and *posterior nasal* flap.

Use the scissors to cut perpendicular to the initial long axis cuts to form the posterior sac and nasal flaps.

At this point, you will have made four flaps of mucosa. You will notice that the pos terior flaps are apposed. You will soon pass sutures through these flaps to connect them.

The nasal packing should be visible and can be removed through the nose.

Suture the posterior flaps.

You will now be connecting the lacrimal sac mucosa to the nasal mucosa. This is a difficult concept in the beginning, but in essence *you are making a tunnel of mucosa from the sac into the nose.* The posterior flaps form the back wall of this tunnel.

Use a 4-0 chromic gut suture on a short 1/2 circle needle (the Ethicon 798 G-2 micropoint cutting needle is essential) to suture these flaps together.

Usually two sutures are best. When you look in the wound, you will now see the back wall of what will be a mucosal tunnel between the sac and the nose.

Pass the Crawford stents through the canaliculi into the ostium and pull them out the nose.

Either an open grooved director or a hemostat will help you to retrieve the stents out of the nose.

At this point, I cut off a 3-inch piece of one of the 4-0 silk traction sutures and tie it around the stent in the ostium. *This will prevent postoperative stent prolapse.* To do this, reach through the incision with an empty needle holder and grasp the two arms of the silicone stent inferior to the ostium. Pull the stents out from the wound and tie the silk suture around them, cutting the ends of the suture short. Let the stent retract back into the wound. The silk suture will shorten the loop of the stent, preventing prolapse.

Tie the ends of the stent together in the nose.

After you have tied the silk suture, reach through the nostril and grasp the stents with the empty needle holder where you would like the knot to be.

Retract the stents out of the nostril. Pull the wire probes off the stent and tie the stents together at the needle holder.

Remove the needle holder and allow the stent to retract in the nose. Cut the ends of the stent.

Close the anterior flaps.

Use the same P-2 needle. Sometimes it is easier to use a backhanded pass of the needle. Pass the suture through the sac flap first and then use the needle to hook the anterior nasal mucosal flap from underneath.

Use two sutures to close the anterior flaps.

Close the incision.

The remainder of the closure is simple. Remove the 4-0 silk traction sutures. Sometimes there will be some additional bleeding at this point that requires cautery.

Use two or three interrupted *5-0 Vicryl sutures to close the muscle* layer.

Try using an *absorbable skin suture for the skin layer.* A running stitch is fine as suturing in this area leaves little scarring.

Provide postoperative care.

Put topical *antibiotic ointment* in the conjunctival cul-de-sac and on the wound.

I like to give a 1-week course of *cephalexin (Keflex)* to reduce the already low wound infection rate to zero postoperatively. I see the patient 1 week postoperatively.

Remove the stent in 6 months. It is easy to cut the stent in the canthus and pull the stent out of the nostril.

Prolapse of the stent rarely occurs if you tie a suture around the stents as described above.

THE ENDONASAL DCR (SEE PAGES 244-248)

The indications for endonasal DCR are the same as those for an external DCR. As with other DCR operations, I suggest that you perform your first endonasal procedures with patients under general anesthesia until you become comfortable with the anatomic structures and hemostasis. Eventually you should perform both endonasal and external DCR under local anesthesia. When doing the endonasal approach, pay special attention to the preparation of the nose because any bleeding makes this procedure much more difficult. Put the patient in the reverse Trendelenburg position, elevating the head of the bed 10 to 15 degrees. Use the same nasal spray and liberal injection of local anesthetic with epinephrine followed by nasal packing as for the external DCR. Have the nurses prep and drape the patient while you scrub. If the patient is under local anesthesia, remember to leave both eyes, nose, and mouth in the surgical field.

You should sit on the patient's right side, placing the video monitor off the patient's left shoulder. Your position is the same for both left and right eyes if you are right-handed. If you are left-handed, you should operate from the patient's left side.

Before you start the procedure, *connect and check all the equipment.* This includes the endoscope light and video unit, the light pipe (which you will insert into the canaliculus), the suction tubing, and the bipolar cautery tool. You will also need an antifogging agent to apply to the tip of the endoscope.

You need to become familiar with how the endoscope works. It is best to hold the endoscope in your nondominant hand. Cradle it from below. Aim the endoscope at a familiar object so that you can orient the camera to make the picture on the video monitor upright. Some endoscopes have a focusing ring, which will require some adjustment when the scope is in the nose.

Remove the nasal packing. Next inspect the nasal cavity with the endoscope light on near-maximum intensity. Use your nondominant hand to insert the endoscope into the nose so that the scope rests against the anterior edge of the nostril. Look at the patient and aim the scope toward the medial canthus. Now look at the monitor for the familiar landmarks inside the nose, including the inferior and middle turbinate. Keep the scope resting against the anterior part of the nostril. This will allow you to place other instruments into the nose posteriorly to the scope.

Now have the circulating nurse turn the endoscope light on standby while your assistant passes the light pipe into the superior canaliculus until a hard stop is obtained. Aim the endoscope in the nose (illumination is off) to see the light pipe shining through the sac wall and floor of the fossa. Move the light pipe in all directions to get an estimate of the position of the entire sac. With the endoscope light back on, use a Freer elevator to infracture the middle turbinate, if necessary, to get a good view of the lateral wall of the nose. Be gentle when moving the middle turbinate, because it is connected at the cribriform plate. Theoretically, vigorous fracture could cause a cerebrospinal fluid leak. At this point you should know where the sac is and have a good view of the nasal mucosa directly lateral to it. This is important as the next step is to incise and remove this nasal mucosa.

There are fewer steps for the endonasal DCR than the external DCR. The endonasal approach is easier than the external approach once you master using the endoscope. The endonasal DCR includes the following:

- Removing the nasal mucosa
- Forming the osteotomy
- Placing the stents

The steps of the endonasal DCR are the following:

Remove the nasal mucosa.

Locate the position of the sac by visualizing the glow of the light pipe with the endoscope light off.

Use a *crescent blade* (Alcon 6600 crescent blade or Beaver angled 55 degree 373807) from a cataract instrument set to perform an elliptical incision of the nasal mucosa that roughly outlines the sac. If a crescent blade is not available a no. 66 Beaver blade will work well.

Usually this incision is made with the endoscope light on, but you may want to experiment with the light off so you can see the position of the sac.

As you learn to do this operation with the endoscope you may find that you are losing track of the blade as you pass it into the nose. Try this: before you put any instrument into the nose, pull the endoscope back to get a broad view of the nasal cavity. You will quickly be able to see the other instrument as it enters the nose and can then advance the scope and the blade (or any other instrument) together with the scope, "watching" the instrument advance forward.

Next *use a Freer periosteal elevator to elevate this mucosa* off the nasal wall. A pediatric front biting ethmoid forceps (Struempel ear forceps, Storz N0962) can be used to tear the mucosa away once it is elevated.

Form the osteotomy.

Use the *Freer elevator to penetrate the thin bone of the fossa,* being careful not to damage the underlying sac. Sometimes you can see the *suture line between the thin lacrimal bone and the maxillary bone.* If not, feel for the thin bone.

As you would with an external DCR, *use a right angle Hardy sella punch to remove the anterior portion of the fossa.*

Switch to a small Kerrison rongeur when room allows.

Remove the bone anteriorly until the sac is exposed.

You can move the light pipe around in the sac to point to any bone that requires removal.

In contrast to the external DCR, *no formal flaps are made.* The remainder of the procedure involves opening the medial wall of the sac into the nose and placing stents.

Tent up the sac using the light pipe. Using the crescent blade again, cut a posterior incision along the vertical axis of the sac. The light pipe should present itself through this incision.

If you can make a similar incision anteriorly, the flap can removed. It is often easier to take the small forceps (Struempel ear forceps) and tear the sac flap away, because it is difficult to make the second cut. This will open the interior of the sac to t he nose.

Place the stents.

Use Crawford stents passed into the nose as with an external DCR.

Under endoscopic view use an open-ended grooved director or hemostat to retrieve the stents.

It is not possible to tie a suture around the stents as you do in an external DCR.

Instead, you can slip a no. 270 silicone sleeve (Labtician Ophthalmics, Inc., Oakville, Ontario, Canada), cut to a 3-mm length, onto the stents and slide it up near the ostium. This will effectively shorten the loop of the stents and prevent prolapse.

After the sleeve is positioned, cut and tie the stents as you would for an external procedure.

Provide postoperative care and follow-up.

Place topical antibiotic ointment into the conjunctiva. No oral antibiotics are required.

The stents are removed at 6 months. You must remove the stents through the nostril as you cannot pull the sleeve out through the canaliculus above.

CANALICULAR RECONSTRUCTION (SEE PAGE 249)

Canalicular obstruction can be repaired if the obstructed area is localized. A small obstruction can be excised and the canaliculus repaired over stents as is done for canalicular lacerations (see Chapter 12). Localized obstruction may occur after trauma, but it is rare after viral infection or chemotherapy use. For these latter patients, canalicular reconstruction is usually not possible and Jones tube placement is necessary.

DCR WITH JONES TUBE PLACEMENT

(see pages 249-253)

If the canalicular system is occluded and there is no hope of reconstruction, a Jones tube is required. This is a Pyrex tube that carries the tears from the conjunctival cul-de-sac through a DCR ostium into the nose, bypassing the obstructed canaliculi. The Jones tube can be placed in conjunction with a standard external or endonasal DCR. In some situations, the Jones tube is added after a DCR. In my experience, the Jones tube is never quite as good as the natural tear drainage system, but for most patients it is far better than having epiphora.

The critical factor in the success of a Jones tube is proper positioning during insertion. There is not much space between the lateral wall of the nose and the septum in most patients. Examine the nose preoperatively. If there is not enough room for the tube to protrude into the nose without pushing against the septum, a septoplasty should be considered. In some patients removal of the anterior portion of the turbinate will be required to make space for the intranasal end of the tube.

Jones tube placement includes the following:

- DCR
- Determining the tube position and length

- Placing the tube
- Suturing the tube in position

The steps of Jones tube placement are the following:

Perform a DCR.

An ostium is required to pass the Jones tube into the nose. Either an external or endonasal DCR can be used.

The Jones tube is usually placed at the time of the DCR, but can be positioned later if a DCR has been performed in the past.

Determine the tube position and length.

Both the conjunctival and the nasal ends of the tube should be positioned accurately.

The tube should *enter the conjunctiva between the plica and the caruncle* slightly inferior to the lower lid margin.

The tube should be *angled slightly inferiorly* into the nose, *emerging through the ostium anterior to the tip of the middle* turbinate .

The position and length of the Jones tube can be determined by placing a 20-gauge needle attached to a 5-ml syringe through the conjunctiva into the nose. The intranasal position of the needle should be checked to see if the tube opening is obstructed. If so, the needle should be redirected until the appropriate position, free of obstruction, is obtained. If the middle turbinate prevents the tube from projecting into the nose, *the anterior part of the middle turbinate can be excised using a rongeur.* Inject the turbinate with local anesthetic with epinephrine before excision. Disturbance of the air flow in the nose can result, so do this only when necessary. Postoperative bleeding can be a problem in some patients, so excise a conservative amount.

After the ideal position has been determined with the needle, determine the appropriate length of the tube. Place a hemostat on the needle at the medial canthus and withdraw the needle. *The distance from the needle tip to the hemostat will be a good guide for choosing the proper length of Jones tube.* Usually a 4-mm flange, 17-mm length tube is ap propriate.

Place the tube.

Placing the tube is easy using a technique described by Jon Dutton.

Direct a *14-gauge intravenous catheter needle and sleeve* along the same path as the previously placed 20-gauge needle.

If the intranasal position of the needle is in good position, *withdraw the needle, but leave the sleeve in place.* The sleeve will be used to pull a Jones tube into the nose.

You will need a suture to secure the conjunctival end of the tube, so wind a double-armed 6-0 Vicryl suture (Ethicon J-570) around the tube near the flange on the end of the tube. Tie this suture onto itself, leaving the needles on the suture.

Push the Jones tube into the conjunctival end of the catheter sleeve. You will need to stretch the opening of the catheter some using a Stevens scissors as a dilator.

Pull the sleeve out the nose with a hemostat, bringing the Jones tube into position. Remove the sleeve.

The Jones tube should ideally protrude into the nose 3 mm or more with a slight inferior tilt. The nasal end of the tube should not be obstructed by the septum or turbinate. If you are not satisfied with the placement of the tube, change it. *It is nearly impossible to change the position of a Jones tube after healing has occurred, so this is the best chance to get a good functioning* tube.

Suture the tube in position.

After the proper position and length of the tube are confirmed, pass the Vicryl sutures through the surrounding conjunctival tissue to pull the tissue snugly around the tube. Tie the suture to secure the tube in position.

If too much conjunctival tissue pulls around the neck of the tube, you may want to trim some conjunctiva or some of the caruncle before tying the suture.

Provide postoperative care and follow-up.

Instill a *topical antibiotic*. Use an *oral* antibiotic if a DCR has been performed simultaneously.

There is little maintenance required for the typical Jones tube. The tube should remain in position for the remainder of the patient's life. Occasionally the tube will be become clogged. If the tube gets obstructed, it is easy to exchange a Jones tube using the plastic guide provided in the Jones tube set.

Other operations are rarely needed.

EYELID RECONSTRUCTION

PRIMARY CLOSURE WITH UNDERMINING (SEE PAGES 286-287)

Primary closure with undermining is commonly used to close lesions away from the eyelid margin. Keep the following concepts in mind:

- Level of undermining

You must know the level to undermine in order to mobilize tissue, preserve blood supply, and avoid nerve damage.

Be especially careful when undermining any tissue in the path of the seventh nerve extending from the tragus of the ear to the tail of the eyebrow.

The facial nerve is superficial where it crosses over the zygomatic arch.

Do enough undermining to minimize tension on the skin closure.

· Wound closure

When closing a wound, always *orient the closure to minimize tissue distortion and maximize scar camouflage.*

When reconstructing the lower lid, *minimize any* vertical traction on the eyelid by closing wounds to leave a vertical scar.

Use deep *anchoring sutures* to the underlying periosteum to support the deep tissues and take tension off of the subcutaneous skin closure.

When tension is off the edges of the wound, use an interrupted *deep layer* closure with an absorbable suture:

3-0 Vicryl in the scalp

4-0 Vicryl in the cheek

5-0 Vicryl in the orbicularis

Interrupted sutures provide the best wound alignment and eversion.

Continuous, or *running, sutures* can be used when you anticipate that the scar will fall within a natural skin crease.

ANTERIOR LAMELLAR REPAIR WITH FULL-THICKNESS SKIN GRAFT (SEE PAGES 287-288)

The steps of anterior lamellar repair include the following:

· Consider a lateral tarsal strip

· Make a template

· Harvest the FTSG

· Suture the FTSG in place

The steps of anterior lamellar repair using a Full-Thickness Skin Graft are as follows:

Consider a lateral tarsal strip.

Most patients requiring lid reconstruction with FTSG techniques are older and have an element of lower lid laxity.

Horizontal lid tightening will help to prevent the lid from developing ectropion again, because the skin graft shrinks with healing.

Remember to reattach the strip to the lateral orbital rim slightly high, overcorrecting the height at the lateral canthus.

Make a template.

Draw a *template* indicating the size of the defect to be repaired.

The template can be made by tracing the area onto a piece of the clear plastic surgical drape.

A clever alternative method is to use a piece of gelfoam pressed into the surgical defect. Blood in the defect stains the gelfoam in the precise size and shape of the defect.

The template is then cut and its outline is transferred onto the skin of the preauricular area or other donor site.

The graft should be slightly oversized. By tracing the proposed graft size on the outside of the template, some oversizing is accomplished.

Harvest a FTSG.

Use a *no. 15 blade to cut full thickness through the skin* along the mark of the template.

Use a *Westcott scissors to separate the subcutaneous fat from the dermis* of the skin. Try to leave as little "yellow" on the dermis as possible.

Close the donor bed using subcutaneous interrupted 4-0 Vicryl sutures. Generally, little or no undermining is required.

Close the skin with a running 5-0 Prolene suture.

Suture the FTSG in place.

Next, perform a *lateral tarsal strip procedure.*

This will help to prevent the lid from developing ectropion again as the skin graft shrinks with healing.

Remember to reattach the strip to the lateral orbital rim slightly high, overcorrecting the height at the lateral canthus.

TIPS FOR MYOCUTANEOUS ADVANCEMENT FLAPS (SEE PAGE 291)

Some specific tips will help you when creating myocutaneous flaps for reconstruction:

- Choose natural skin creases to hide the incision lines.
- Know the planes to move into when you advance peripheral to the orbital rims.
- Create horizontal tension rather than vertical tension on the lower eyelid.
- Develop the flap so that there is little tension on the final closure.
- Use anchoring sutures to reduce tension on the skin and to provide vertical support.
- Always overcorrect the position of the flap.
- Consider tightening the lower eyelid if you are concerned about retraction or you have shortened the anterior lamella.

LID MARGIN REPAIR (SEE PAGE 293)

Follow these guidelines for lower or upper eyelid margin repair:

- Attempt *primary closure.* If the closure is under too much tension or the lower lid retracts inferiorly under the globe,
- Do a *canthotomy and cantholysis.* If there is still too much tension,
- Perform a *Tenzel flap procedure,* advancing tissue from the temple to form a new lid margin.
- If the defect involves most of the lower eyelid you should start with a *Hughes flap* procedure.
- If the defect involves most of the eyelid you should start with a *Cutler-Beard procedure* (an advanced technique).

PRIMARY LID MARGIN REPAIR (SEE PAGES 293-295)

The eyelid margin repair begins with *identifying the appropriate anatomic landmarks* of the eyelid, especially the landmarks of lid margin. You may want to review the section, "Fundamentals of Eyelid Anatomy," in this chapter if you don't know this anatomy well. The *strength of the closure is in sutures placed in the tarsal plate. Eyelid wound margin eversion* is necessary to prevent lid notching.

Eyelid margin repair includes the following:

- Injecting local anesthetic
- Aligning the lid margin
- Suturing the tarsal plate
- Suturing the lid margin
- Closing the skin

The steps of eyelid margin repair are the following:

Inject local anesthetic: Instill topical anesthetic drops, and inject local anesthetic with epinephrine into the wound.

Align the lid margin: Use a 7-0 Vicryl vertical mattress suture passed through the meibomian gland orifices to align and evert the lid margin. Keep this suture long for traction on the eyelid.

Suture the tarsal plate: Use two or three interrupted 5-0 Vicryl sutures passed in a lamellar fashion to align the tarsal plate. The initial lid margin suture will help with the positioning of your tarsal sutures.

Suture the lid margin.

Go back to the lid margin and place a 7-0 Vicryl *vertical mattress* suture anterior to the gray line. This suture should align the eyelashes and provide *eversion* of the lid margin.

If you are unhappy with the alignment of the lid, replace the suture.

An additional suture may be used to help improve the alignment of the eyelashes.

I prefer to use *7-0 Vicryl sutures for the eyelid margin.* Traditional teaching suggests the use of 6-0 or 8-0 silk sutures, which are left long and require removal later. The 7-0 Vicryl sutures can be cut short and allowed to absorb.

Close the skin.

The skin can be closed with an interrupted simple or vertical suture using permanent or absorbable sutures.

If the wound seems under tension, you may want to place 5-0 Vicryl sutures through the orbicularis muscle before closing the skin.

Repair of Full-Thickness Eyelid Defects of 25% to 50%: Canthotomy, Cantholysis, and Eyelid Margin Closure (see pages 295-297)

The canthotomy and cantholysis are used to release the lateral aspect of the lid to allow the lid margin to be closed under less tension. You will find that these are very useful procedures, and when you know how to use them, you will add this step to many primary lid margin repairs. We will discuss the canthotomy and cantholysis in detail in Chapter 12, but I will introduce them here for you. When you perform a canthotomy and cantholysis you will be advancing a small amount of skin over the lateral orbital rim medially. The skin will become a portion of the lateral lid margin. Perform the canthotomy in the usual way, but *angle the canthotomy incision slightly superiorly.* Next, strum the deep tissues and sharply incise the crus of the lateral canthal tendon. Some cautery will be necessary. If additional relaxation is necessary, cut the tissues that are fixing the lid to the rim. You may not recognize these tissues

anatomically, but they are portions of the septum and lower lid retractors as they fuse at the lateral canthus. If you are unable to perform the eyelid margin closure without tension, you should extend the canthotomy incision to perform the Tenzel flap procedure described below. You will see in the next section why it is important to angle the canthotomy superiorly.

REPAIR OF LID DEFECTS OF 50% TO 75%: THE TENZEL FLAP (SEE PAGES 298-299)

The Tenzel flap pro cedure does not require a second stage. If 50% of the upper or lower lid is missing, a Tenzel flap will work well.

The Tenzel flap procedure includes the following:

- Injecting local anesthetic
- Performing canthotomy and cantholysis
- Forming the flap
- Mobilizing the flap
- Repairing the margin

The steps of the Tenzel flap for reconstruction of the lower eyelid are the following:

Inject local anesthetic.

Draw an *arched line* extending superiorly from the lateral canthus in a curve. Extend the canthotomy incision along the marked incision with a no. 15 blade or Colorado needle.

Most lid reconstructions can be performed on a cooperative patient with local anesthesia and sedation.

As usual, you will be using local anesthetic with epinephrine added.

Perform canthotomy and cantholysis.

Perform the canthotomy and cantholysis as described above.

Remember to *angle the canthotomy superiorly* as the canthotomy incision will continue as the Tenzel flap.

Perform a *lower cantholysis.*

Form and mobilize the Tenzel flap.

Dissect a myocutaneous flap posterior to the orbicularis muscle (in the preseptal plane). You will see that you will be able to mobilize the skin and muscle medially.

The originally described Tenzel flap was a small (dime-shaped) flap that did not extend beyond the lateral orbital rim. Using this small flap is possible if you know that a minimal amount of mobilization will be necessary. I prefer to

make the longer arched incision to allow as much mobilization as necessary. You will see that the arched incision is the beginning of as a larger rotational flap called the Mustarde cheek rotation.

Keep in mind that the frontal nerve passes from the tragus to the tail of the brow. If you have to extend the myocutaneous advancement flap lateral to the lateral orbital rim, you will need to keep your incision superficial to *avoid damage to the frontal branch of the facial* nerve.

As you create the flap, check to see that the margin can be opposed without tension. After you have achieved satisfactory mobilization of the tissue, place one or two 4-0 Vicryl sutures to *anchor the flap* medially on the lateral canthal rim periosteum. Place the anchoring sutures so that the lateral canthus is slightly overcorrected superiorly. Place the suture on the inner aspect of the rim to pull the lateral canthus posteriorly toward its natural insertion on the inner aspect of the rim.

Repair the lid margin.

Repair the lid margin in the usual way, supporting the tension of closure on the tarsus using 5-0 Vicryl sutures.

Sew the lid margin with everting mattress sutures using 7-0 Vicryl.

Give postoperative care.

Instill topical antibiotics and place a patch over the wound for 24 hours.

You will notice that the lateral portion of the eyelid margin is created by the advancement flap. Some patients will have a small amount of notching where the canthotomy was made (especially if you have not angled the canthotomy incision superiorly). *If an irregularity in the lid margin is present, you may want to repair this with one or two 7-0 Vicryl* sutures.

Intraoperatively, I am always concerned that the final result look good. Postoperatively, I am pleasantly surprised with the final outcome. This is a useful operation that you should learn to do well for lower and upper eyelid reconstruction.

REPAIR OF LOWER LID DEFECTS OF 75% OR GREATER: THE HUGHES PROCEDURE (SEE PAGES 300-304)

If you know how to do a Hughes procedure, you can fix almost all large lower eyelid defects. The Hughes procedure is used to reconstruct the posterior lamella of a full-thickness lower eyelid defect that is too wide for the use of a Tenzel flap. You must provide an anterior lamella using a myocutaneous advancement flap or full-thickness skin

graft. You should learn this procedure because it will give you the flexibility and confidence to take care of larger lower eyelid skin cancers.

The Hughes flap procedure includes the following:

- Injecting local anesthetic
- Measuring the lower eyelid defect
- Forming the tarsoconjunctival flap
- Suturing the flap into the lower lid defect
- Completing anterior lamellar repair
- Postoperative care

The steps of the Hughes flap procedure are the following:

Inject local anesthetic.

The Hughes flap procedure can easily be performed with local anesthesia. As always, use local anesthetic with the addition of epinephrine. Infiltrate the superior and inferior conjunctival cul de sacs.

Infiltrate the skin of the upper lid. Infiltrate the wound edges of the lower lid.

Measure the lower eyelid defect.

Examine the edges of the lower eyelid wound. Identify any remaining posterior lamella at the medial and lateral edges of the wound.

Pull the edges of the wound together with slight to moderate tension. Use a caliper to measure the defect.

In most patients, you can harvest up to a 20-mm width of tarsus from a normal upper lid. If more length is needed, you can extend the tarsal graft to include conjunctiva on the medial and lateral edges of the graft.

Form the tarsoconjunctival flap.

Place a 4-0 silk suture in the lid margin and evert the lid over a Jaeger lid speculum (shoehorn).

Use a caliper to place a mark parallel and 3 mm superior to the upper lid margin. You need to leave 3 mm of intact lid margin to prevent upper lid entropion.

Use a Colorado needle or a no. 15 blade for this incision.

Use Westcott scissors to develop a plane in the pretarsal space superiorly to the top edge of tarsus.

You have the option of creating a flap of conjunctiva alone or conjunctiva and Müller's muscle. In most patients, you can dissect a plane between Müller's muscle and conjunctiva, bringing only conjunctiva down with the tarsus.

Dissect high into the fornix. This will help to avoid upper lid retraction postoperatively. If you are finding that your patients have upper lid retraction postoperatively, dissect between Müller's muscle and the conjunctiva more superiorly to avoid advancing the Müller's muscle and the levator aponeurosis when you bring the flap into the defect.

Make vertical cuts into the conjunctiva to complete the formation of the flap.

Suture the flap into the lower lid defect.

Identify the inferior margin of conjunctiva and lower lid retractors.

Use 5-0 Vicryl sutures with a spatula needle (Ethicon J571 S-14 needle) to attach the flap to the edges of the remaining posterior lamella of the lower eyelid.

Make sure that the superior edge of the tarsus is at or slightly above what will be the new lower lid margin.

Suture the inferior aspect of the tarsal graft to the remaining conjunctiva.

Complete the anterior lamellar repair.

To determine if you will be able to use a myocutaneous advancement flap from the cheek, dissect the edges of the remaining skin andmuscle free and pull up toward the upper lid. If there is a moderate amount of redundancy, you will probably be able to use a myocutaneous advancement flap. If not, a full-thickness skin graft will be required.

If there is not adequate skin to drape over the tarsoconjunctival flap, place a full-thickness skin graft harvested from the preauricular area over the tarsoconjunctival flap.

Place the skin graft slightly superior to the edge of the tarsal graft.

Use a running suture on the periphery of the graft to secure its position.

You may want to use mattress sutures from the tarsal graft through the skin graft.

If there is enough redundant skin and muscle in the remaining lower lid and cheek, you can develop a myocutaneous flap to cover the defect. Use the technique that you are already familiar with to elevate the flap.

When you get to the inferior orbital rim, advance into the subcutaneous fat plane and use anchoring sutures to elevate the cheek if necessary.

Suture the flap into position over the newly reconstructed posterior lamella.

Because the tarsoconjunctival flap is supported superiorly, you can advance lower eyelid and cheek tissues with slightly more vertical tension than you would otherwise consider. A Hughes flap will not support a poorly constructed flap with significant vertical tension, however.

Give postoperative care.

Place topical antibiotic ointment on the wound and tape a patch into position for 1 week.

The Hughes flap should be allowed to *heal for* 3 to 4 weeks before you undertake the second stage of the operation.

During this time, the *eyelid will look closed,* which should be comfortable for the patient.

The opening of the upper lid, the *second stage of* the Hughes flap procedure, can be performed under local anesthesia. The injection will be somewhat more painful than normal because there will be some scar tissue in the lid. Inject both the upper lid and the superior edge of the flap. Use Westcott scissors to sharply incise the flap, creating a new lid margin. As you would expect, it is better to make this initial cut too high. You can trim more if necessary. I prefer to angle the scissors slightly inferiorly toward the anterior edge of the lid margin. The bevel of the lid margin incision plays a role in where the mucocutaneous junction will form. In some patients, conjunctiva will heal slightly over the edge of the new lid margin, which can create erythema as a result of drying of the conjunctiva.

After the lower lid is separated, excise the remaining tarsoconjunctival flap at the tarsal plate of the upper lid. Some cautery may be required to stop a small amount of bleeding there. A patch is usually not necessary, unless oozing is present.

You will find the Hughes flap procedure to be very helpful and worth your efforts to learn. Although the Hughes procedure is a two-stage operation and there will be no lashes on the lower eyelid, the results are very good. Most patients will have a functioning lower eyelid that appears normal.

FREE TARSAL GRAFT (SEE PAGE 304)

A free tarsal graft can be harvested from the contralateral upper lid to be used as a posterior lamellar replacement for lower eyelid defects. This is an alternative to the Hughes flap or Tenzel-type flaps. The disadvantage of a free tarsal graft is that it does not have a blood supply, so it must be covered with a myocutaneous advancement flap.

The advantage of a free tarsal graft is that it is a *one-stage procedure* and gives a result very similar to that of the Hughes procedure. The free tarsal graft is harvested similarly to the initial steps of forming the Hughes flap. When the dissection in the pretarsal space reaches the superior margin of the tarsus, the conjunctiva is cut, freeing the graft. No suturing of the upper lid donor site is required. Usually there are no problems with the donor site. If the upper lid of the donor site is lax, a small "kink" of the upper lid margin can occur as the donor bed contracts during healing. Remember to leave 3 mm of tarsus along the lid margin to prevent upper lid entropion.

You should consider using a free tarsal graft as a posterior lamellar replacement for upper or lower lid defects when you are certain there is adequate anterior lamella to cover the free tarsal graft.

COMBINATION PROCEDURES (SEE PAGE 304)

Using the techniques discussed thus far, you will be able to repair most lower and many upper lid defects after removal of cutaneous malignancies. As your surgical experience increases, you will learn to put the various techniques together in combinations that you have not used before. For example, you may encounter a lower lid defect that involves considerably more anterior lamella than posterior lamella. You can apply the technique of primary lid margin repair to the posterior lamella alone, closing the tarsal defect and lid margin. You then have the option of using a myocutaneous advancement flap or a skin graft over the reconstructed posterior lamella. You will find the combination of procedures available to be limited only by sound surgical principles, good technique, and your creativity.

SPECIALIZED PROCEDURES

The following procedures are discussed in detail on pages 305-309. Learn these procedures after you have mastered the other operations in Chapter 11.

- Anterior lamella repair

Mustarde cheek rotation

Median forehead flap

Glabellar flap

- Full-thickness upper lid repair

Cutler Beard procedure

Eyelid and Orbital Trauma

ANTERIOR LAMELLAR REPAIR

Simple Laceration Repair

Before repair of any laceration, explore the depths of the wound to ensure that deeper injury has not occurred. *Any visible orbital fat means that the orbital septum has been violated.* Make sure that you are not dealing with a potentially more serious injury involving damage to the orbital contents or brain. If the laceration occurs perpendicular to the orbicularis fibers and the wound is pulled open, placement of deep absorbable sutures in the muscle may approximate the wound edges without tension on the skin closure. Lacerations parallel to the orbicularis muscle do not

require closure of the muscle layer. Placement of interrupted permanent skin sutures that bisect the wound in successive halves prevent formation of a "dog ear" (redundant tissue on one side of the wound noted at the completion of closure). A running suture can be used for longer straight lacerations, but this does not permit individual removal of sutures if any infection should occur. Suitable sutures for eyelid skin closure include 6-0 and 7-0 nylon using a reverse cutting needle. Lacerations of the brow in thicker skin can be closed with 4-0 or 5-0 nylon sutures. Blue 5-0 Prolene sutures are especially useful in the brow, where black sutures can easily be confused with eyebrow hairs. A layered closure can be used in the dermis or subcutaneous tissues to remove tension off the skin edges.

COMPLEX LACERATION REPAIR (SEE PAGE 317)

Complex lacerations have many jagged edges and extend into deeper tissue layers. Repair of a complex laceration is like building a jigsaw puzzle. First, you start with pieces of the puzzle that you can identify, the edges and corners, and put them together. Then you fill in the missing areas in the center of the puzzle, looking for less obvious details to guide you.

The steps of complex laceration repair are the following:

Clean and inspect the wound.

Rule out deep injury.

Remove any foreign material.

Do not debride any tissue. You will be surprised how well this tissue survives.

Repair the deep layer.

To begin the laceration repair, *identify anatomic landmarks* such as the eyebrow, the lid margin, and the canthus.

Place deep sutures to reposition the anatomic landmarks in proper alignment.

In some cases, temporary "tacking" *sutures* of large caliber (2-0, 3-0, or 4.0) can be placed full thickness through the skin to help with the orientation of tissues and take tension off the wound while deep layers are being closed. These temporary sutures are removed as the wound comes together.

Start with the deepest layers of closure first, including any posterior lamellar repair of conjunctiva, tarsus, canthal tendons, or levator aponeurosis.

Close the subcutaneous layer with buried absorbable long-lasting sutures such as 4-0 and 5-0 Vicryl. In large lacerations extending on the scalp, 3-0 Vicryl sutures are appropriate. Use a reverse cutting needle for these closures. If

you are unhappy with the position of a deep suture, replace it. *The final skin closure cannot compensate for poor deep closure* alignment .

Complete the deep closure before starting closure of the superficial layer.

Close the superficial layer.

Approximate the edges of the skin with interrupted sutures.

Most commonly, 6-0 and 7-0 nylon sutures are used on the eyelids, and 4-0 and 5-0 nylon sutures are used in the thicker periocular skin.

You can use absorbable sutures such as gut or chromic gut for the final skin closure. Vicryl sutures are not designed for the skin, but I like using 7-0 Vicryl sutures because of the ease of manipulating the suture. I have not found needle tracking or reaction to sutures to be much of a problem, but the sutures persist in the skin for 4 to 6 weeks after repair.

Use a *topical antibiotic ointment* such as erythromycin, placed over the wound.

Dressings are not necessary.

EYELID MARGIN REPAIR (SEE PAGES 319-320)

Eyelid margin repair includes the following:

- Injecting local anesthetic
- Aligning the lid margin
- Suturing the tarsal plate
- Suturing the lid margin
- Closing the skin

The steps of eyelid margin repair are the following:

Inject local anesthetic.

Repair can be done with local or general anesthesia.

Instill topical anesthetic drops and inject local anesthetic with epinephrine into the wound.

Align the lid margin: Use a 7-0 Vicryl vertical mattress suture passed through meibomian gland orifices to align the lid margin. Keep this suture long for traction.

Suture the tarsal plate: Use two or three interrupted 5-0 Vicryl sutures passed in a lamellar fashion to align the tarsal plate. Traction on the initial lid margin suture will help with the positioning of your tarsal sutures.

Suture the lid margin.

Go back to the lid margin and place an additional 7-0 Vicryl *vertical mattress* suture anterior to the gray line. The vertical mattress sutures should provide *eversion* of the lid margin wound.

If you are unhappy with the alignment of the lid margin, replace the sutures.

An additional anterior suture may be used to help the alignment of the eyelashes.

I prefer to use *7-0 Vicryl sutures for the* eyelid margin. Traditional teaching suggests the use of 6-0 or 8-0 silk sutures, which should be left long and require removal later. The 7-0 Vicryl sutures can be cut on the knot and allowed to absorb.

Don't tie the margin sutures very tightly because the tissue may die, resulting in a lid margin notch.

Close the skin.

The skin can be closed with an interrupted simple or vertical suture using permanent or absorbable sutures.

If the wound seems to be under tension, you may want to place 5-0 Vicryl sutures through the orbicularis muscle before closing the skin.

Postoperative care is routine. Occasionally the sutures will rub against the cornea and require removal.

CANALICULAR LACERATION REPAIR WITH CRAWFORD STENTS (SEE PAGE 322)

Canalicular repair using Crawford stents includes the following:

- Identifying cut ends of the canaliculus
- Passing the stent through the torn canaliculus
- Passing the stent into the nasolacrimal duct
- Suturing the pericanalicular tissue
- Passing the other stent through the nose

The steps of *canalicular laceration repair using Crawford stents* are the following:

Identify the cut ends of the canaliculus: It is easy to identify the cut ends of the canaliculus if the lid margin itself has been directly cut. The mucosa of the canaliculus is visible as a white or pink ring of mucosa. It is much more difficult to identify the cut end of the canaliculus if it has been avulsed at the lacrimal sac. A microscope is helpful in all canalicular laceration repairs, but especially for avulsions because the laceration is deep in the medial canthus.

Pass the stent through the canaliculus.

Thread the stent through the punctum and out the distal end of the lacerated canaliculus.

Next, thread the stent to the proximal end of the canaliculus.

Pass the stent down the nasolacrimal duct.

This step is similar in all nasolacrimal duct probings. If you are intubating an adult, it helpful to *bend the probe* of the stent into a curve to maneuver around a prominent brow. Intubation of adults requires somewhat more manipulation than intubation of children.

Retrieve the stent and pull it out of the nose (use either a Tse-Anderson grooved director or a Crawford hook; see the Chapter "Evaluation and Management of the Tearing Patient" for tips on this technique).

Repeat for the opposite canaliculus.

Suture the pericanalicular tissue around the stent.

If the laceration is at the junction of the canaliculus and the sac, it is worth *using additional 4-0 Vicryl sutures to reinforce the medial canthal tendon* before suturing the pericanalicular tissues.

Ideally the mucosal edges of the cut canaliculus should be apposed with suturing. It is not necessary to sew the mucosal edges together, but you should suture the pericanalicular tissue, bringing the mucosal edges together as much as possible. Two or three 7-0 Vicryl sutures are used for this purpose. The difficult part of the procedure is over at this point.

Tie the stents.

Tie the stent in the nose. Be careful not to tie the knot too high so that it retracts into the nasolacrimal duct.

Be careful not to tie the stent too low so that the knot hangs out of the nose.

Suture the skin: The skin can be sutured with either an absorbable or permanent suture, usually 6-0 or 7-0 in size.

Apply topical antibiotic ointment.

CANALICULAR LACERATION REPAIR USING THE PIGTAIL PROBE (SEE PAGES 322-325)

The pigtail probe technique has been useful for me in many patients. Initially the technique is somewhat more complex than nasolacrimal duct intubation. Remember that you do not need to use general anesthesia because you do not intubate the nasolacrimal duct.

Canalicular laceration repair using a pigtail probe includes the following:

- Passing the pigtail probe
- Threading a 6-0 nylon suture through the canalicular system
- Passing the stent through the canalicular system

- Suturing the pericanalicular tissue
- Tying the nylon suture
- Suturing the skin

The steps of the *canalicular laceration repair using a pigtail probe* are the following:

Pass the pigtail probe.

Use the pigtail probe with a *closed needle eye,* not an open hook as used several decades ago.

Choose the end of the pigtail probe that corresponds to the direction of rotation required. The curves on the ends of the pigtail probe are opposite in direction.

Place the tip of the pigtail probe through the intact punctum and rotate it through the normal canaliculus to the medial canthus. At this point, the handle of the probe should be oriented vertically perpendicular to the coronal plane of the patient.

At the medial canthus, *the probe should go posterior to the medial canthal tendon.* You will know that you are in the correct position if you lift the probe toward the ceiling of the operating room and meet resistance at the canthus.

Use *gentle pressure* to guide the pigtail probe through the common canaliculus. The probe should emerge through the cut proximal end of the canaliculus without exerting much pressure.

If the probe does not pass easily, try threading the probe through the cut proximal end of the other canaliculus (you lose the advantage of not having to find the canaliculus). If this doesn't work, switch to Crawford stents. You have encountered one of the few patients who does not have a common canaliculus.

Thread a suture through the canalicular system.

Thread a 6-0 nylon suture (no needle) *through the eye of the probe* and rotate the probe out of the intact canaliculus.

Pass the pigtail probe into the punctum of the torn canaliculus and out the distal end of the cut canaliculus. Thread the suture through the eye of the needle and rotate the probe out the punctum.

At this point, the 6-0 nylon suture will be through the upper and lower canaliculus.

Pass the stent through the canalicular system.

Cut a piece of silicone tubing *25 mm in length.* This tubing either can be from a Crawford stent or can be ordered separately (less expensive). The silicone stent measures 0.125 (inner diameter) by 0.250 mm (outer diameter).

Use your fingers and a smooth forceps to thread the piece of stent over the nylon suture.

You will now pull the suture and the stent through the canaliculus. *To do so grasp the silicone stent tightly with a smooth forceps, squeezing the suture within the* stent.

Pull the opposite end of the 6-0 nylon suture and guide the piece of stent material into the punctum of the intact canaliculus. As you pull the suture, the stent will travel through the canalicular system and out the cut canaliculus.

Again, guide the stent through the cut end of the canaliculus and out the punctum. The canaliculi are now intubated.

Suture the pericanalicular tissue: Use the same technique as that described above for suturing the pericanalicular tissue to appose the mucosa of the cut canaliculus. You may want to place a small hemostat or "bulldog" clamp on the ends of the nylon suture to secure it while you repair the canaliculus.

Tie the nylon suture.

Tie the 6-0 nylon suture with *three single throws* tight enough to pull the knot into the stent, but not so tight as to kink the circle of stent that you have created. Cut the tails of the knot short so they retract in the tubing.

Rotate the tube moving the knot out of the palpebral fissure into the canaliculus.

Suture the skin: Use a technique similar to that above to suture the skin.

Apply antibiotic ointment.

Postoperative care of the repaired canaliculus is routine. Apply topical antibiotic ointment for 1 week. Remove the stent in approximately 6 months. If the stent prolapses after nasolacrimal intubation with Crawford stents, removal of the stent will probably be necessary. A stent placed with a pigtail probe cannot prolapse. To remove a stent placed with a pigtail probe, rotate the knot between the lids and cut the knot. Pull the stent and suture out together. You will be pleased at how well the tissues heal. The majority of patients will not have tearing after your repair using one of these two techniques.

CANTHOTOMY AND CANTHOLYSIS

(see page 326)

If vision is decreased or if there is an afferent pupillary defect in the presence of increased orbital pressure as a result of hemorrhage consider doing a *canthotomy* and *cantholysis.* Check the intraocular pressure and look at the arterial circulation of the optic nerve. Pressure higher than 35 to 40 mm Hg or decreased arterial flow (no flow or pulsing retinal arteries) should make your decision easy.

The canthotomy and cantholysis should be performed as an emergency procedure at the bedside or in the exam chair with local anesthesia.

The steps of the canthotomy and cantholysis are the following:

Inject local anesthetic.

Inject a generous amount of local anesthetic with epinephrine under the skin of the lateral canthus and subconjunctivally.

Perform a canthotomy.

Use Westcott or Stevens scissors to open the lateral canthus for 1 cm.

The canthotomy makes the Y of the lateral canthus into a V .

This will not decrease the orbital pressure.

Perform a cantholysis.

Pull the lid under tension toward the ceiling of the room (away from the patient's face). With the scissors turned 90 degrees to the eyelid margin, "strum" *the deep tissue to find the crus.* Cut this tissue until the lid releases from the rim.

The first cantholysis cuts one arm off the V .

You must cut the upper and lower crus of the lateral canthal tendon, *cutting both arms off the* V.

Hold pressure on the wound. Cauterize as necessary.

Recheck the intraocular pressure and retinal blood flow.

Don't close any wounds.

ORBITAL FLOOR BLOWOUT FRACTURE REPAIR (SEE PAGES 334-337)

Orbital floor blowout fracture repair includes the following:

- Preparation in the operating room
- Dissection in the preseptal plane to the inferior orbital rim
- Elevating the periosteum off the floor
- Freeing the entrapped tissue
- Positioning the implant
- Closing the wound

The steps of orbital floor blowout fracture repair are the following:

Prepare the patient in the operating room.

Inject local anesthetic with epinephrine in the conjunctival cul de sac and under the skin adjacent to the inferior orbital rim.

Prepare and drape *both eyes* in the surgical field.

Before making any incision, *repeat the forced duction* test.

Dissect in the preseptal plane to the inferior orbi tal rim.

Place a 4-0 silk traction suture in the lower lid. Use a reverse cutting needle.

Place a 4-0 silk suture through the conjunctiva under the insertion of the inferior rectus. Use a taper needle.

The *swinging eyelid approach* to the orbital floor begins with a canthotomy and cantholysis.

Evert the lid margin over a Jaeger lid plate (shoehorn) and make a transconjunctival incision at the inferior margin of the tarsus from the punctum to the lateral canthal incision.

Pull the orbital septum and orbicularis muscle apart with two pairs of Paufique forceps and continue a preseptal dissection to the inferior orbital rim. You will know that you are getting close to the rim when the dissection turns 90 degrees from the plane of the operating table posteriorly toward the orbital rim.

Palpate the orbital rim and use a Freer elevator to dissect cheek fat away from the periosteum of the rim.

Elevate the periosteum off the floor.

Place a *Jaffe lid speculum* in the wound and clamp it to the drape.

You can use a *Desmarres vein retractor* for additional retraction.

You will need to wear a *headlight* for this portion of the operation. *Dim the operating room lights* to make your headlight illumination more effective.

Cut the periosteum along the inferior orbital rim with a no. 15 blade or the Colorado needle.

Elevate the periosteum off the inferior orbital rim with a Freer elevator in your dominant hand and a Frazier suction tube in your nondominant hand.

Continue the dissection of the periorbita off the orbital floor until you reach the front edge of the fracture.

Free the entrapped tissue.

Most blowout fractures occur medial to the infraorbital canal.

Tease the periorbita off the anterior edge of the fracture. Extend this dissection posteriorly *around the perimeter* of the fracture site.

You will need to retract the orbital contents with a *Sewall* or *malleable retractor* in your nondominant hand. Use a Freer elevator in your dominant hand. If there is bleeding, have your assistant do the retraction and use the suction tube in your nondominant hand.

When the entire perimeter of the fracture has been exposed, try to elevate the entrapped orbital tissue from the broken orbital floor or maxillary sinus mucosa. As this dissection continues you will be able to *gently pry the tissue out* of the fracture site.

At this point, *the entire perimeter of the fracture should be visible.*

There is no need to elevate the broken bone fragments.

Repeat the forced duction testing at this point. Results should be normal.

Position the implant.

There are many materials available to use for implants. I prefer thin *Supramid (SupraFOIL) sheets measuring 0.4 mm in thickness.* These implants are easy to work with and inexpensive. Thin *MEDPOR implants* work well also. *MEDPOR* channel implants are useful if there is no posterior edge to rest an implant on. Cut the implant to the size and shape that you feel is necessary. Usually a typical *guitar pick shape* is used.

Elevate the tissue and place the implant into position with a hemostat. The implant should cover the entire floor defect with the anterior and posterior edges of the implant resting on solid bone. Some trimming of the implant may be required to get the perfect fit.

If you are having trouble with orbital fat prolapsing around your retractors, cut a second piece of Supramid to use as a retractor against the orbital fat. Use your Sewall retractors on the floor side of the retracting implant, and you will have much better exposure to position the floor implant. Remove the retracting implant after you are happy with the shape and position of the floor implant.

When the floor implant is in good position, elevate the implant with your retractor and make sure that there is no tissue prolapsing around the implant.

Screw the implant into position with *two 3 mm microscrews* at the inferior orbital rim. Be careful not to screw into the infraorbital nerve.

Repeat forced duction tests. If results are positive, the implant may have entrapped tissue. The implant will require some adjustment if this is the case.

Close the wound.

Close the periosteum with a 4-0 Vicryl suture on a P-2 needle, if possible. Make sure that you do not sew the septum to the periosteum (causes lid retraction).

Close the conjunctiva with interrupted 6-0 plain or 7-0 Vicryl sutures.

Reattach the lateral canthal tendon with the same 4-0 Vicryl suture.

Close the canthotomy with the same absorbable suture.

Postoperative care generally includes one night of hospitalization. Visual acuity should be checked on a routine basis. Oral steroids can be given to reduce postoperative swelling. Antibiotics should accompany steroid use. The patient should rest with the head of the bed elevated and ice in place. Activity may be resumed over 48 hours. Implant infection or extrusion is rare.

Surgical Approaches to the Orbit

UPPER EYELID SKIN CREASE APPROACH

(see pages 397-399)

The upper eyelid skin crease approach to anterior orbitotomy includes the following:

- Marking the skin
- Injecting local anesthetic
- Making the skin incision
- Performing the orbital dissection
- Obtaining the biopsy specimen
- Closing the skin

The steps of the upper eyelid skin crease approach to anterior orbitotomy are the following:

Mark the skin.

Mark an upper eyelid skin crease incision from the punctum to the lateral canthus.

Extend the mark laterally in a "laugh line."

Inject local anesthetic: Inject a local anesthetic mixture of 2% lidocaine (Xylocaine) with l:100,000 epinephrine in combination with 0.5% bupivacaine (Marcaine) directly under the skin.

Make the skin incision.

Prepare and drape the patient.

Place a 4-0 silk suture through the upper lid margin for traction.

Use a No. 15 blade or Colorado needle to make a skin incision.

Continue the incision through the orbicularis muscle using Westcott scissors or the Colorado needle.

Perform the orbital dissection.

Identify the orbital septum and open it using Westcott scissors.

If the mass is not visible, palpate the wound to locate the mass.

Separate the orbital fat from the mass with blunt dissection, *pulling* the tissues apart.

Obtain the biopsy specimen.

Obtain either an incisional or excisional biopsy specimen using the principles outlined earlier under "Handling Biopsy Specimens."

Obtain hemostasis with bipolar cautery before closing.

Close the skin.

Do not close the orbital septum.

Close the skin with a running 7-0 Vicryl or 7-0 nylon suture.

Apply topical antibiotic ointment to the wound.

Routine postoperative care is required. Use topical antibiotic ointment three or four times a day for 1 week. Use ice packs for 24 to 48 hours. No oral antibiotics are necessary. Restrict activity in the first 24 hours.

LOWER EYELID TRANSCUTANEOUS APPROACH (SEE PAGES 399-400)

The inferior anterior orbitotomy using the lower eyelid transcutaneous approach includes the following:

- Marking the skin
- Injecting local anesthetic
- Making the skin incision
- Performing the orbital dissection
- Obtaining the biopsy specimen
- Closing the skin

The steps of the inferior anterior orbitotomy using the lower eyelid transcutaneous approach are the following:

Mark the skin.

Mark a subciliary incision 2 mm below the lash line from the punctum to the lateral canthus.

Extend the mark superiorly in a laugh line.

Inject local anesthetic.

Inject a local anesthetic mixture of 2% lidocaine with l:100,000 epinephrine in combination with 0.5% bupivacaine directly under the skin.

Make the skin incision.

Place a 4-0 silk suture through the lid margin for superior traction on the lower eyelid.

Use a Colorado needle or no. 15 blade to incise the skin.

Use a Westcott scissors to cut the orbicularis muscle.

Cauterize as needed.

Form a skin muscle flap inferiorly to the orbital rim, attempting to keep the orbital septum intact.

If the mass is not visible, palpate the orbit to locate the mass.

Perform the orbital dissection.

Open the orbital septum.

Dissect the mass free from surrounding orbital tissues.

Obtain the biopsy specimen.

Obtain either an incisional or excisional biopsy specimen using the principles outlined earlier under "Handling Biopsy Specimens."

Obtain hemostasis with bipolar cautery in the orbit.

Close the skin.

Do not close the orbital septum.

Close the skin with a running 7-0 Vicryl or 7-0 nylon suture.

Apply topical antibiotic ointment.

Routine postoperative care is required. Use topical antibiotic ointment three or four times a day. No oral antibiotics are necessary.

LOWER EYELID TRANSCONJUNCTIVAL APPROACH (SEE PAGES 400-402)

The lower eyelid transconjunctival approach to inferior orbitotomy includes the following:

- Injecting local anesthetic
- Performing a canthotomy and lower cantholysis
- Making a transconjunctival incision

- Performing the orbital dissection and obtaining the biopsy specimen
- Closing the wounds

The steps of the lower eyelid transconjunctival approach to inferior anterior orbitotomy are the following:

Inject local anesthetic.

Inject lidocaine and epinephrine into the inferior and lateral conjunctival cul de sacs.

Inject additional local anesthetic under the skin inferior to the lashes and at the lateral canthus.

Perform a canthotomy and lower cantholysis.

Place a 4-0 silk suture through the lower lid margin.

Perform a canthotomy using Westcott scissors, a No. 15 blade, or a Colorado needle.

Perform a lower cantholysis, detaching the lateral portion of the lower lid from the orbital rim.

Make a transconjunctival incision.

Evert the eyelid over a Jaeger lid plate ("shoehorn").

Make a transconjunctival incision with a no. 15 blade. Be extremely careful if you use a Colorado needle, because the eye is not protected well. Consider using a corneal shield.

Dissect a plane between the orbicularis muscle and orbital septum to the inferior or bital rim.

You can facilitate this by placing a suture through the lower lid retractors to lift the conjunctiva, the retractors, and the septum superiorly and away from the orbicularis muscle.

A Desmarres retractor or Jaffe eyelid speculum can be used for retraction of the lid margin and anterior lamella.

Perform the orbital dissection and obtain the biopsy specimen.

Open the orbital septum or periorbita.

If the mass is not visible, palpate the orbital tissues to locate the mass.

Dissect the mass away from the normal surrounding tissue.

Obtain the biopsy specimen using the principles outlined earlier under "Handling Biopsy Specimens."

Cauterize as needed.

Close the wounds.

Close the conjunctival wound with either interrupted or running absorbable sutures of 7-0 Vicryl or 6-0 chromic.

Reattach the lateral edge of the eyelid to the periosteum on the inner aspect of the lateral orbital rim using 4-0 Vicryl on a P-2 needle.

Close the canthotomy with two interrupted absorbable sutures.

Place topical antibiotic in the conjunctival cul de sac and on the lateral canthal wound.

Postoperative care is routine. Apply a topical antibiotic three times daily. No oral antibiotics are necessary.

TRANSCONJUNCTIVAL MEDIAL ANTERIOR ORBITOTOMY (SEE PAGE 403)

The orbitotomy is performed under general anesthesia. A 180-degree conjunctival peritomy is performed at the medial limbus. Radial relaxing incisions of the bulbar conjunctiva can be made to improve exposure. Tenon's capsule is bluntly separated from the sclera with Stevens scissors. Sewall and 1/4-inch malleable retractors are used to spread through Tenon's capsule to enter the intraconal space. In a young patient, careful sharp dissection through Tenon' s capsule can speed up the dissection. Palpation of the base of the wound is not possible. If a deep intraconal dissection is anticipated, the medial rectus should be disinserted from the eye to improve exposure.

The operating microscope is used for magnification and illumination. After the abnormal anatomy is found, neurosurgical cottonoids are used to pack the wound open. If exposure is limited, a lateral orbitotomy can be combined to provide more room medially (see below). Once the biopsy is complete, the medial rectus is sewn back on the globe and the conjunctiva is closed with absorbable sutures. This approach provides good exposure of medial orbital tumors in the anterior half of the intraconal space. Apical medial intraconal tumors are usually better approached using a transcranial orbitotomy.

VERTICAL UPPER LID SPLIT ANTERIOR ORBITOTOMY (SEE PAGE 403)

A vertical incision line is marked on the upper eyelid at the junction of the medial one third and the lateral two thirds of the lid. A scalpel blade is used to incise the margin, and a Stevens scissors is used to extend the wound full thickness through the eyelid. The cut extends above the tarsus, dividing the levator aponeurosis, Müller's muscle, and the conjunctiva. The upper portion of the sclera is usually visible. Dissection into the intraconal space is possible using standard dissection techniques. This technique is particularly well suited for removal of intraconal cavernous hemangiomas. The posterior one third of the medial intraconal space cannot be reached easily using this technique.

TRANSCARUNCULAR ANTERIOR ORBITOTOMY (SEE PAGE 405)

The orbitotomy is performed under general anesthesia. An injection of local anesthetic with epinephrine is given in the medial bulbar conjunctiva and plica. A Westcott scissors is used to cut between the plica and the caruncle. Stevens scissors are used to bluntly dissect a plane to the medial orbital wall, and 4-0 silk retractor sutures can be used

on each side of the wound. Additional retraction is required with a Desmarres vein retractor and a narrow Sewall retractor. In most patients, the goal of the orbitotomy is to gain access to the bony medial wall, so the periorbita is cut and elevated with a Freer elevator. While the assistant holds the retractors, the surgeon uses a suction tube in the nondominant hand and a Freer elevator in the dominant hand to expose the bone.

A fracture may be repaired, an ethmoidectomy performed, or a hematoma drained. The closure does not require periorbital sutures. Only one or two absorbable conjunctival sutures are required. Drainage of medial subperiosteal abscesses secondary to ethmoid infections is usually performed by a transcutaneous frontoethmoidal anterior orbitotomy approach to leave a drain in position.

TRANSCUTANEOUS FRONTOETHMOIDAL ANTERIOR ORBITOTOMY (SEE PAGES 405-407)

The orbitotomy is performed under general anesthesia. An arched incision is placed midway from the medial canthal angle to the bridge of the nose, extending from the inferior to the superior orbital rim in the concavity of the medial canthus. Local anesthetic with epinephrine is injected. A skin incision is made. The subcutaneous tissues are incised with a Colorado needle or other cutting cautery tool. The periosteum of the inferior and medial orbit is reflected. With this reflection the lacrimal sac is elevated. Suture retractors in the subcutaneous tissues and Sewall retractors in the orbit allow a clear view of the medial orbital wall. The anterior and posterior ethmoidal vessels can be cauterized or clipped and cut, if necessary, to provide additional exposure of the subperiosteal and extraconal spaces of the orbital roof.

LATERAL ORBITOTOMY WITH REMOVAL OF THE LATERAL ORBITAL WALL (SEE PAGES 407-410)

The lateral orbitotomy with bone removal includes the following:

- Anesthesia and room preparation
- Exposing the lateral orbital rim
- Making the bone cuts
- Drilling holes to reposition the bone
- Out-fracture and removal of bone
- Performing the intraorbital dissection
- Replacing the lateral orbital wall
- Closing the soft tissues in layers

The steps of the lateral orbitotomy with bone removal are the following:

Administer anesthesia and prepare the operating room.

Lateral orbitotomy is performed with *general anesthesia.* Place the patient in 10 degrees of a reverse Trendelenburg position. Turn the head slightly to the side with the lateral orbit facing toward the ceiling.

While the patient is being prepared for general anesthesia, you should ready the room and balance the operating microscope.

After the patient is asleep, *mark an upper lid skin crease incision with an extension laterally into a lateral canthal skin crease.*

Inject local anesthetic with epinephrine into the wound. Inject additional local anesthetic into the lateral conjunctival cul de sac to the periosteum. Inject and additional 2 ml of local anesthetic into the temporalis muscle posterior to the lateral orbital rim.

Expose the lateral orbital rim.

Wear a headlight and surgical loupes for this portion of the procedure.

Place a *4-0 silk suture* through the lateral rectus muscle for traction.

Make a skin incision with a No. 15 scalpel blade or Colorado needle. Cut through the orbicularis muscle down to the orbital septum in the lid. At the lateral canthus incise the soft tissues overlying the lateral rim.

Expose the periosteum of the lateral orbital rim with blunt dissection using a Dean periosteal elevator. Place 4-0 silk traction sutures in the subcutaneous layer to provide exposure to the lateral or bital rim.

To *elevate the periosteum off the external side of the lateral orbital rim incise the periosteum* 2 mm posterior to the lateral orbital rim and dissect it off the rim posteriorly toward the temporalis fascia. Open *the temporalis fascia* posteriorly for 1 or 2 cm to allow access to the temporalis fossa. Now *elevate the temporalis muscle out of the temporalis fossa* with a Dean periosteal elevator. Stay close to the bone as you direct the elevator around the posterior edge of the lateral rim to get between the temporalis muscle and the bone. This elevation requires some effort. As you elevate the muscle, pack two 2-inch gauze sponges between the temporalis muscle and the bone of the temporalis fossa to help with hemostasis and prevent injury to the muscle when you perform the bone cuts. The external aspect of the lateral orbital wall is now exposed.

To elevate the periorbita on the inner aspect of the orbit, turn the head slightly toward you to see along the lateral wall. Elevate the periorbita using a Freer elevator in your dominant hand and a Sewall retractor or suction in your

nondominant hand. You may need bipolar cautery and bone wax at the sites of bleeding corresponding to the zygomaticotemporal and zygomaticofacial vessels.

Make the bone cuts.

Next choose sites for your bone cuts. *Plan on removing a 3- to 4-cm piece of bone.* The exact position of the bone cuts depends on the goal of the procedure. *Generally, the superior bone cut is at or above the frontozygomatic suture and the inferior bone cut is at the junction of the zygomatic arch to the lateral orbital rim.* You will need to use a power saw such as a Hall microsagittal saw.

To make sure that you *don't enter the anterior cranial vault* during the superior bone cut, look on both the inside and outside of the lateral orbital wall to judge the thickness of the bone you are about to cut. You will be able to tell where the bone expands superiorly to become the floor of the anterior cranial fossa. While your assistant protects the periorbita with a Sewall or malleable retractor, make the superior bone cut using the power saw. Stop when the saw blade reaches the thicker sphenoid bone posteriorly.

Make the inferior cut at the junction of the lateral orbital rim and the zygomatic arch. You may need to work quickly because you are likely to see some bleeding during the bone cuts that is difficult to control until the bone is out.

Drill holes to reposition the bone: Use a *Bien drill or Hall Surgairtome* to drill 1-mm holes through the rim on both sides of your bone incisions. You will use these holes to pass sutures to secure the bone back into position. Alternatively if you are planning to reposition the rim with a microplate you can use the plate to predrill the screw holes at this time. My preference has been to use sutures to secure the bone because they are much less expensive than the microplates. The microplates are more secure, however.

Out-fracture and remove the bone.

Out-fracture the bone with a Leksell laminectomy rongeur. The bone will break free, and you can then remove it and place it in a saline-soaked gauze pad.

Remove *the remaining posterior portion of the lateral orbital wall* with a Leksell laminectomy rongeur. Stop removing the bone when you reach bleeding points in the cancellous bone of the sphenoid wing. Pack small pieces of bone wax to stop the bleeding at the rongeur and bone saw sites.

Perform the intraorbital dissection.

Next, open the periorbita in a T -shaped incision with the leg of the T parallel to the lateral rectus muscle. You will see the lacrimal gland and the extraconal fat.

If you are planning an optic nerve biopsy or superior intraconal space operation, enter the intraconal space between the lacrimal gland and lateral rectus. If you are planning a dissection of a more inferior mass, enter between the lateral and inferior rectus muscles.

Use blunt dissection with Sewall retractors or a Freer elevator to spread or *pull* the tissues apart.

Before proceeding more deeply, *palpate the orbit using your finger* to identify the orbital mass, optic nerve, or other landmarks to get your positioning.

Move the operating microscope in for the necessary illumination and magnification of the deep dissection. The coaxial view provided by the microscope will be necessary to allow you and your surgeon to simultaneously see in the operating site.

You will need to *follow surgical landmarks to navigate within the orbit* (review the section above, "Exposure and Intraorbital Dissection"), for example, to find the optic nerve.

In older patients, you will be able to move through the orbit using *blunt dissection* only. In a younger patient, *occasional sharp dissection* through a tissue plane will be necessary.

Gently spread or *pull* the layers apart using the retractors. After the orbital mass is identified, use neurosurgical cottonoids to prevent the orbital fat from slipping around the retractors. When removing an orbital mass, a *cryoprobe* can be attached to the mass for traction.

Once the mass is removed, be sure to *obtain adequate hemostasis before closing.*

Replace the lateral orbital wall.

You do not need to close the periorbita.

Place the bone into position. *Use two pieces of 3-0 Prolene suture* without a needle to secure the bone into position. Alternatively, you can use microplates as described above.

Close the soft tissues in layers.

Close the periosteum over the bone using 4-0 Vicryl sutures.

Close the subcutaneous tissues with 5-0 Vicryl sutures.

Close the skin using a running 6-0 nylon suture.

Apply topical antibiotic ointment in the eye and on the suture line.

Give patients undergoing lateral orbitotomy 60 mg of prednisone 1 day before the operation. Use an intraoperative intravenous dose of 10 mg of dexamethasone (Decadron) and 1 g of cephalexin (Keflex). Patients are

hospitalized on the first postoperative night with frequent vision checks. Prescribe 5 days of 60 mg of prednisone and 7 days of cephalexin postoperatively.

Complications are rare. Discomfort with chewing is common postoperatively due to contusion of the lateral rectus muscle. Lateral rectus palsy is not uncommon initially. Skin sutures are removed 1 week postoperatively.

TRANSCRANIAL ORBITOTOMY

(see pages 411-414)

The transcranial orbitotomy is required to reach the orbital apex safely. A transcutaneous anterior orbitotomy provides exposure to the anterior half of the superior orbit only. The lateral orbitotomy provides exposure to the anterior two thirds of the lateral orbit, but the superior orbital fissure prevents access to the apex. The trans caruncular and frontoethmoidal approaches provide a limited view of the orbital apex even with removal of the ethmoid bone and air cells. During the transcranial orbitotomy, a frontal bone flap, created by a neurosurgeon, is removed. The superior orbital rim and the anterior portion of the orbital roof are broken free with the flap exposing the periorbita of the superior orbit. The frontal lobe of the brain is elevated and the posterior portion of the orbital roof is removed to the optic canal with a rongeur. This approach can be used for the following:

- Deep orbital tumors, especially those medial to the optic nerve
- Removal of the optic nerve in conjunction with optic canal unroofing and exploration of the chiasm for meningioma and glioma
- Optic canal decompression for traumatic optic neuropathy
- Debulking of a sphenoid wing meningioma
- Dissection at the superior orbital fissure

Orbital tumors can be removed by opening the thin periorbita without opening the dura (an extradural approach). Orbitocranial tumors (primarily optic nerve and sphenoid wing meningiomas) are explored by opening the periorbita and the dura (intradural approach).

An important anatomic consideration in deep orbital dissections is the position of the superior orbital fissure. Because the cranial nerves enter the orbit lateral to the optic nerve, it is safest to enter the orbital apex medial to the optic nerve. When the optic nerve is being removed, any damage to the trochlear nerve (along the medial orbital roof) resulting in torsional movement deficit will be relatively inapparent. You can see that excellent exposure of the

superior, lateral, and medial apex is obtained with the transcranial orbitotomy. Rare tumors of the inferior portion of the orbital apex must be approached from a temporal craniotomy approach, often combined with a lateral orbitotomy.

After the surgery the bone flap is returned to its natural position, repairing the orbital roof. Early postoperative ptosis and extraocular muscle paresis are usually seen, but they generally resolve. Enophthalmos, globe ptosis, pulsations of the globe, and temporalis wasting can be permanent.

LATERAL AND MEDIAL ORBITOTOMIES (SEE PAGE 414)

As we saw earlier with lid reconstruction procedures, as your familiarity with individual orbital approaches grows you will learn to combine procedures for additional or safer exposure to involved areas of the orbit. An example of a combination of orbitotomies is the addition of a modified lateral orbitotomy to the transconjunctival medial orbitotomy procedure. The lateral wall is exposed in the usual manner, and the lateral wall is cut and out-fractured but not removed. This provides space for the orbital contents to shift laterally, making exposure in the medial orbit much better.

ORBITAL DECOMPRESSION FOR THYROID EYE DISEASE (SEE PAGES 414-416)

A combined lateral and medial orbitotomy is used as the technique of choice for orbital decompression to relieve optic neuropathy or decrease proptosis resulting from thyroid eye disease. The orbital volume is expanded by the following:

- A transcaruncular medial orbitotomy for ethmoid ectomy
- A lateral orbitotomy with out-fracture of the lateral orbital wall
- Burring away of the body of the sphenoid wing

The lateral wall is held in an "out-fractured" position using microscrews to prevent the bone from rotating back into normal position. The outer cortex and cancellous bone of the sphenoid wing are burred away through the lateral orbitotomy incision. This approach reduces proptosis by 2 to 4 mm. This so-called "balanced" two-wall decompression is not associated with the high rates of postoperative diplopia that often resulted after decompression by removal of the orbital floor and medial wall. Globe ptosis and infraorbital nerve hypesthesia are eliminated with this operation. If additional reduction of proptosis is desired, the orbital floor can be removed at a later operation, creating a three-wall decompression.

MEDIAL AND INFERIOR ORBITOTOMIES FOR FRACTURE REPAIR (SEE PAGES 417-418)

Fractures involving both the medial orbital wall and the orbital floor can be approached with combined anterior orbitotomies using transcaruncular and inferior transconjunctival incisions. Imagine each approach individually with the subperiosteal space of the floor exposed through the lower lid and the subperiosteal space of the medial wall exposed through the transcaruncular incision. With these combined incisions, it is possible to slide a large MEDPOR or SupraFOIL implant into position, covering the floor and extending up on the medial orbital wall. Even better exposure is obtained if you connect the conjunctival incisions and elevate the inferior oblique muscle with the periosteum of the rim and periorbita of the floor. This gives the same orbital wall exposure as the frontoethmoid anterior orbitotomy, but without a visible scar.

Enucleation Evisceration, and Extenteration: The Care of the Eye Socket

ENUCLEATION PROCEDURE

(see pages 423-427)

Enucleation of the eye is most commonly performed under general anesthesia. In selected patients, the procedure can be performed using local anesthetic and sedation.

The enucleation procedure using a MEDPOR spherical implant wrapped in human sclera includes the following:

- Patient preparation
- Detaching the extraocular muscles
- Severing of the optic nerve
- Preparing the implant
- Attaching the muscles to the implant
- Closing in layers

The steps of the enucleation operation with placement of a scleral-wrapped MEDPOR spherical implant are the following:

Prepare the patient.

Develop a preoperative routine ensuring that you will remove the correct eye.

Unless the eye is obviously abnormal, leave preoperative instructions to *dilate the eye to be* removed .

Before surgery, *visit with the patient* to make sure you know which eye will be operated on.

In the operating room, *ask the nurses* to confirm which eye will be operated on.

And lastly, *look into the dilated eye* to ensure that there is a pathologic process present.

This may seem like a lot of trouble, but you must be sure in every case. Figure out the system that will work for you.

Administer anesthesia.

The majority of patients will be under *general* anesthesia .

Inject local anesthetic with epinephrine under the conjunctiva for hemostasis before you scrub.

Detach the extraocular muscles.

Begin the procedure with a *360-degree peritomy* using Westcott scissors.

Dissect Tenon's capsule away from the eye using curved Stevens scissors, spreading in each quadrant between the rectus muscles.

Hook the extraocular muscles using a smooth von Graefe muscle hook followed by a *Green muscle hook* from the opposite direction to make sure that you have hooked the entire muscle.

Pass the typical von Pirquet suture through the muscle insertion. I use 5-0 Vicryl on a spatula needle (Ethicon J571, S-14 needle). I find the traditional strabismus technique in which the surgeon holds the muscle hook in one hand and the needle holder in the other hand to be cumbersome. This technique may be important for a strabismus surgeon where the muscle is sutured and cut in a precise position, but is not important for enucleation surgery. I would suggest you try one of two options. Either (1) hold the muscle hook yourself and have your assistant load the second arm of the needle backhanded for you on an additional needle holder; or (2) have your assistant hold the muscle hook, leaving you two free hands to load the needle and manipulate the tissues.

Now *cut the muscle off the eye,* leaving a bit of muscle tendon on the eye, especially at the horizontal rectus muscle insertions so you place traction sutures at the horizontal muscle insertions later.

Detach all four rectus muscles in the same way.

Tape the sutures to the drape as you proceed.

Hook the oblique muscles and cut them from the eye (not at the eye). Hook the inferior oblique muscle in the inferior and temporal quadrants with the tip of the muscle sweeping from posterior to anterior toward the muscle as it leaves the lower lid retractors heading for the eye. Cauterize the inferior oblique muscle before cutting it.

Place *traction sutures at the muscle insertions of the medial and lateral rectus muscles.* If you have left some muscle at the insertion, this is quite easy. By all means do not penetrate the eye with a needle if you are removing a choroidal melanoma.

Sever the optic nerve.

Give traction on the globe, prolapsing it out of the conjunctiva.

Use Sewall retractors to retract the posterior Tenon's capsule away from the globe, exposing the optic nerve. Wearing a headlight is essential for this portion of the procedure.

Use a long hemostat to clamp the optic nerve approximately 1 cm posterior to the eye.

To apply the clamp, insert the hemostat with the blades closed. Tap the optic nerve from the inferior side. Next, tap the optic nerve from the superior side. Open the blades to surround the nerve and tap each side of the nerve with the open blade. Once you are sure that you are around the nerve, *close the hemostat.*

Cutting the optic nerve can be done in the same way.

Tap the nerve from below and above. Open the blades and tap the nerve from above and below again.

As you apply upward traction on the eye, push the scissors posteriorly and cut the nerve.

If the clamp is in the proper position, there will be no bleeding.

Any soft tissues clinging to the back of the eye can be cut with the enucleation scissors.

Before releasing the clamp, retract the tissues around the optic nerve with the Sewall retractors and *visualize the cut end of the optic nerve* in the clamp.

Use a Bayonet bipolar cautery to cauterize the optic nerve.

Slowly release the clamp. In most patients there will be no bleeding.

Put a damp 4 inch by 4 inch gauze pad into the wound while you prepare the implant.

Prepare the implant.

Most patients will require *20-mm spherical MEDPOR* implant .

Place the implant in the scleral wrap.

You will need relaxing incisions to do so. Trim the sclera with a no. 15 blade so that the posterior half of the implant is exposed. Use 5-0 Vicryl or Dacron sutures to tighten the wrap around the implant.

You might find it helpful to *cut the windows* of the scleral wrap to include the point in the sclera where the optic nerve entered the eye. In many donor eyes, this point in the sclera will be weak, not covering the implant well. This requires eccentric placement of the wrap.

Cut four windows in the scleral wrap.

The windows should measure 5 mm by 2 mm and be in the approximate anatomic position of the rectus muscles. Use a no. 15 scalpel blade to cut the sclera initially. Then use a pointed-tip Stores 3397 scissors to complete the window. You will be impressed by how tough the sclera is.

Attach the muscles to the implant.

Place two pieces of plastic drape material (cut 1 inch by 6 inches) into the socket lengthwise overlapping by about 1 inch.

Place the implant into Tenon's space onto the plastic drapes and push the implant into the socket.

The drapes will prevent the implant from sticking to the tissue. Slide the drapes out slowly.

Suture each of the rectus muscles to the anterior edge of each window created.

Close Tenon's capsule and the conjunctiva.

Close anterior Tenon's capsule using the same 5-0 Vicryl suture from the muscle sutures. Use interrupted sutures.

Close the conjunctiva using a running locking 7-0 Vicryl suture (Ethicon TG140-8).

Inject local anesthetic with bupivacaine (Marcaine) into the retrobulbar space for postoperative pain relief.

Provide postoperative care.

Place topical ointment and a *conformer* in the conjunctival fornix.

Tape a pressure patch over the eye. I usually leave the patch on for the entire first postoperative week, mainly to get the patient used to having only one eye. The patch is helpful to decrease swelling for 48 hours, if you don't want to use it for the entire week.

Inpatient care and parenteral pain medications are appropriate for 24 hours.

The patient should return in 1 week for inspection of the socket. You will have to explain what the conformer is and that it may rarely come out. Offer to "fog" the patient's lens with 2-inch translucent tape to cover the socket without drawing the attention of a pirate patch.

A custom-fit prosthesis should be made when the swelling has totally subsided, usually 6 weeks after surgery. Sometimes it is helpful to have the patient and family visit the prosthetic lab at this time, so they know what to expect.

EVISCERATION (SEE PAGES 428-430)

The evisceration operation has gained popularity in recent years. Two standard types of evisceration are performed:

- Evisceration with the cornea left in place
- Evisceration with keratectomy

If the cornea is healthy, it may be preserved. In these patients, the superior rectus is cut off the eye and an incision through the sclera is made posterior to the superior rectus insertion. After the intraocular contents are removed, an implant is placed into the eye and the scleral wound is closed.

The superior rectus is reattached.

The more common type of evisceration operation begins with a complete keratectomy for access to the intraocular contents.

The evisceration with keratectomy includes the following:

- Patient preparation
- Conjunctival peritomy
- Keratectomy
- Removal of the intraocular contents
- Placement of an implant
- Closure in layers

The steps of evisceration with keratectomy are the following:

Prepare the patient.

Most procedures are performed under general anesthesia. Evisceration can be performed with retrobulbar anesthesia alone, if necessary.

Take the same precautions mentioned earlier to correctly identify the eye to be removed.

Perform conjunctival peritomy.

Do a *conjunctival peritomy* using Westcott scissors. You should dissect only a few millimeters posterior to the limbus.

Complete a keratectomy.

Make a *stab wound through the cornea* at the limbus.

Use the Westcott scissors to make a full-thickness cut through the cornea for 360 degrees.

Remove the cornea with a toothed forceps.

Remove the intraocular contents.

Use an *evisceration spoon* to remove the internal contents of the eye.

Place the spoon between the choroid and the sclera and deliver the contents of the eye.

Place an implant.

Your implant of choice can be placed.

PMMA, MEDPOR, and hydroxyapatite implants can be used.

I usually place a *16-mm PMMA sphere* if I am not planning to integrate the implant and prosthesis.

An *18-mm or 20-mm spherical implant* can be placed if you open the sclera posteriorly using four radial incisions that allow the implant to move into the retrobulbar space.

To put the implant in the eye you will need to make *anterior radial relaxing incisions* from the limbus posteriorly.

Push the implant into the sclera.

Close in three layers.

Overlap the edges of the sclera and close with permanent sutures such as 5-0 Dacron or polyester (5-0 polyester, Davis and Geck 2828-23 D-1 spatula needle).

Pull the edges of Tenon's capsule together and close with interrupted 5-0 Vicryl sutures.

Close the conjunctiva with a running locking 7-0 Vicryl sutures.

Inject local anesthetic with bupivacaine into the retrobulbar space for postoperative pain relief.

Provide postoperative care.

Place *topical ointment* and a *conformer* in the conjunctival fornix.

Tape a *pressure patch* over the eye as with enucleation.

Inpatient care and parenteral pain medications are appropriate for 24 hours.

The patient should return in 1 week for inspection of the socket. Remember to discuss the role of the conformer and offer to "fog" the lens. Fit for a prosthesis in 6 to 8 weeks.