To achieve predictable and optimal results, the surgeon must adhere to sound diagnostic and therapeutic principles, be skilled in basic surgical techniques, and have available proper instrumentation. The principles, techniques, and instruments described in this chapter for pediatric ophthalmic plastic and reconstructive surgery should find immediate application in the ophthalmic surgeon’s practice and should minimize complications and the need for secondary procedures.

Preoperative Evaluation

When meeting with a child and his/her family, it is useful for the surgeon to mentally categorize each patient during the initial interview concerning the primary purpose of the desired surgery. Emotional stability of the pediatric patient and his/her parents may assume even greater importance if cosmetic surgery is requested. The pediatric patient often presents an interesting set of problems in this regard. While the teenager may express direct concerns about appearance, in younger children such concerns are usually expressed by parents and grandparents. These concerns may or may not be realistic, and it is important for the surgeon to be patient and not to dismiss the family’s distress. A careful explanation of surgical realities must be given, never promising more than doing one’s best within these surgical realities. Children who are about to enter school may experience heightened social traumas. Experience with major craniofacial deformities has demonstrated that families can often shelter and protect a child’s sense of self, keeping this very positive; but children can be quite direct and even cruel in their social interactions. The surgeon must always remember to think of the child as a whole person, not just a surgical problem to solve, and to consider the whole family constellation in this regard. Suggestions for genetic and psychological counseling, as well as for family support groups are important considerations, particularly for serious syndromes or deformities.

An appropriate systemic and ophthalmic history and examination is mandatory for each patient. This is important even when the diagnosis and indicated treatment appear obvious to the surgeon. Details for pediatric evaluation are covered in other chapters, but an awareness of the threat of amblyopia in addition to more obvious system and visual concerns must always be prominent in the surgeon’s mind. Taking a careful history will afford the doctor an opportunity to increase rapport with the patient and family before surgery. In obtaining a detailed history, the surgeon must not forget to obtain information on previous systemic conditions that may significantly influence the surgical outcome. Specified details about time, place, and accompanying circumstances are particularly important following trauma because a later preoccupation with secondary gain may distort the facts. Specific questions about which eye has always provided better vision, about previous eye surgery, and about any history of eye patching all provide valuable clues to preoperative visual impairment and should be noted in the patient’s record. Obtaining an accurate history regarding bleeding disorders, medications, and allergies is mandatory.

With young children, playful interaction will usually permit useful observation even without touching the patient. After a time, the child may relax and feel comfortable with more intimate contact.

Preoperative photographs are useful as a learning aid for the surgeon, as verification for insurance purposes, and in refreshing the memory about details of the patient during...
surgery. For easy comparison, preoperative and postoperative photographs should be taken at the same distance and from the same perspective. Older photographs of the patient are often helpful, along with previous operative notes and pathology reports.

With elective procedures, it is imperative that the patient and parents, not the surgeon, make the actual decision to proceed with surgery. The surgeon must make a recommendation based on an honest, objective view of the findings, but should resist the temptation to rush the patient's decision. It is often helpful after the initial interview to give the patient and family some time alone to think about what has been discussed. Sometimes that will mean a return visit to the office, while in other cases a few minutes alone in a quiet, private area will be sufficient. This time gives the patient and family the opportunity to weigh alternatives and bring matters to the surface that may have been difficult to express initially.

Serious complications can occur during any surgical procedure, so the surgeon, patient, and family should view all surgical procedures with an appropriate measure of caution and respect. An operative permit specifically mentioning the remote possibility of blindness during the course of surgery is particularly helpful in properly preparing the patient and family for surgery. Reading, understanding, and signing the operative permit should be completed in the relaxed atmosphere of the office when the surgery is scheduled, not left until the day of surgery. Taking care of this matter in the office also allows patients and families the opportunity to discuss with the surgeon any questions they may have regarding the permit or the procedure. Descriptive terms that might be used to put the patient and family at ease—such as “routine,” “simple,” and “minor”—should be avoided, because they imply a guarantee of success without any complications.

Pediatric ophthalmic plastic surgery requires not only planning, but also flexibility. The surgeon should begin each operation with a basic plan and with alternative plans should circumstances during surgery so dictate. The ultimate purpose of this planning is to bring about the best possible result in the most efficient manner. Preoperative planning minimizes operating time, tissue exposure, and anesthesia time, which in turn helps to minimize the overall risk to the patient. The preoperative evaluation, surgical indications, recommendations, and discussion of risks and alternative treatment should be clearly documented in the patient’s record.

**Incision**

Faulty placement or execution of an incision may result in a functional success but cosmetic disaster. Incisions in adults are usually planned preoperatively to follow the relaxed skin tension lines (RSTL), which correspond to the directional pull existing in relaxed skin. The RSTL fall in the normal skin creases and folds, often enabling planned incisions to be hidden or camouflaged (Figure 4.1). In children the surgeon may have to imagine where these lines will be in later life, as they have not yet formed. However, some lines are formed by deeper skin attachment to facial muscles so that a crease or dimple may be seen with smiling or other forms of expression. Polaroid or digital pictures can help to remind the surgeon of the location of such lines and the possible use of these for surgical incision.

Incision lines should be marked prior to injecting local anesthesia to avoid blurring anatomic landmarks and misplacing the incision. If the marks are to be drawn prior to skin preparation, the skin should be gently wiped with an alcohol swab and dried. This permits the ink to penetrate the scrub will not remove it. A plastic protective shell lubricated with ointment may be placed on the globe both for protection and to keep the operating room light from bothering the patient under local anesthesia.

A variety of scalpel blades and super-sharp blades are available. It is helpful to begin cutting at the lowest part of the incision to keep blood from obscuring the advancing incision line. With rare exceptions (i.e., incisions within the eyebrow), incisions should be made perpendicular to the skin’s surface, keeping the skin taut to avoid beveling the incision and subsequent poor wound closure secondary to overlapping wound edges. The skin incision should be made through the epidermis and dermis. The depth of the incision can be judged by looking at the cut edges. They will begin to spread once the full thickness of the dermis is cut in taut skin.

To minimize tissue trauma, either skin hooks or fine-toothed forceps should be used to handle the wound edges. If forceps are used, the finest instrument that will accomplish the task is usually chosen. This applies mostly to final
skin closure. When working with larger or heavier flaps a larger, toothed forceps is useful to avoid tearing tissue from the weight or tension created by pulling or supporting such flaps. Brow tissue, for example, may require heavier forceps, whereas fine 0.5-mm Castroviejo forceps may be more appropriate for delicate eyelid skin. Nontoothed forceps crush tissue, retarding wound healing and making histologic examination difficult. Therefore, their use in oculoplastic surgery should be confined to tying sutures.

Traction sutures are helpful during eyelid surgery to facilitate stretching and stabilization of tissues. The plane of the gray line is utilized. A 4-0 black silk suture with a reverse-cutting needle is introduced into the gray line in a vertical direction, while the lid is kept on stretch horizontally. After the needle penetrates 2 mm, it is turned so that the curvature of the needle is followed until the point of the needle emerges in the gray line. This works well for both the upper and the lower lid. This suture can be left in place and used postoperatively as a Frost suture, if indicated.

A variety of scissors (spring and direct-action) are useful in ophthalmic plastic surgery and should be immediately available on the instrument tray. In general, gently curved, sharp-pointed scissors are most satisfactory in completing a curved incision. The curve of the instrument should correspond to the direction of the curve of the incision. Blunt-tipped, curved scissors are of particular value in undermining. The blunt tip allows the surgeon to push into the tissue plane and spread the blades with minimal risk of “buttonholing” the overlying eyelid skin. Delicate, sharply pointed, fine-tipped scissors are especially useful in surgery close to or involving the lacrimal apparatus. Scissors, like all instruments, must be carefully maintained to avoid tissue damage. They should be inspected routinely by the surgeon and serviced or replaced as needed. (See the section on instruments later in this chapter for more detailed information.)

Hemostasis

Meticulous hemostasis permits accurate wound closure, tissue identification, and dissection; eliminates the need for elaborate dressings; and promotes optimum wound healing. Blood clots trapped in a wound can retard healing, increase scarring, and serve as a nidus for microorganism growth. Use of a local anesthetic containing epinephrine (1:100,000 to 1:200,000), even when the patient is under general anesthesia, is a worthwhile first step in achieving good hemostasis. The anesthesiologist should be consulted prior to its use so that cardiac and blood pressure changes can be anticipated.

Digital pressure is frequently sufficient to obtain hemostasis from pinpoint bleeding sources during eyelid surgery. Most bleeding in the eyelids is adequately handled with a disposable thermal cautery unit or monopolar or bipolar electrocoagulation. The Colorado needle (Colorado Biomedical, Evergreen, CO 80439) is particularly useful. It is a very fine, reusable, monopolar cautery tip that can be used in modes for cutting and cautery.

When working deep within a cavity, such as when performing a dacryocystorhinostomy, the ophthalmic surgeon should consider using the combined suction–electrocautery unit popular with neurosurgeons. Chemical adjuncts such as a cotton pledget soaked in 1:10,000 epinephrine solution or a 1:1 mixture of 4% cocaine and oxymetazoline, an absorbable gelatin sponge soaked in thrombin, or microfibrillar collagen hemostat powder (Avitene) are occasionally useful.

Patients should be asked not to use aspirin products 2 weeks prior to surgery because aspirin tends to inhibit platelet activity.

Wound Closure

If a wound is contaminated, cleansing should be the first step in management. This is usually done by thoroughly irrigating the wound with sterile saline or antibiotic solutions. In addition, the wound must be carefully searched for foreign bodies that could interfere with wound healing and give rise to a draining fistula tract. Foreign bodies or dirt trapped in the subcutaneous tissue or skin may leave tattoo marks that are most difficult to manage satisfactorily once healing has occurred.

While extensive debridement in the eyelids should be avoided, necrotic tissue should be carefully trimmed prior to suturing. Any trimming of the wound edges, however, should be done with extreme care, especially if the wound crosses the relaxed skin tension lines. A straight scar from a wound that has been carelessly trimmed may ultimately be more disfiguring than the scar from a carefully closed jagged, irregular laceration.

“Dead space” in the recesses of the wound may serve as a reservoir for hematoma and microorganisms, prevent accurate wound closure, and impair wound healing. For deep closure, absorbable sutures are popular (e.g., 4-0 or 5-0 chromic gut or Vicryl (polygalactin) (Ethicon, Inc., Somerville, NJ) on a spatulated needle or reverse cutting needle). The knots of the subcutaneous sutures are usually buried to avoid interference with skin closure and postoperative erosion of the knot through the wound (Figure 4.2). To ensure that the knot does in fact assume the desired buried position in the depths of the wound, the surgeon must be sure that both ends of the suture are on the same side of the loop before tying the suture and must then pull the ends of the suture in a direction along the length of the incision while tightening the knot. A specific exception to burying the knot of a subcutaneous suture is a tarsal suture because erosion through the conjunctiva may cause corneal ulceration. Properly placed deep sutures should not only eliminate dead space in the depths of the wound but also relieve tension of the cutaneous suture line, thereby minimizing postoperative spread of the wound with a wide scar.

Closure of some types of wounds requires special tension-relieving sutures, such as the vertical and horizontal
The vertical mattress suture lies perpendicular to the wound edges and is most useful in the heavier tissues of the eyebrow, cheek, and temple or when closing the donor site for a dermis fat graft taken from the buttock. This suture can be used to reduce the number of buried subcutaneous sutures and therefore help minimize “suture reaction.” To eliminate inturning of the wound edges, the vertical mattress suture should not be used to bring the skin edges completely together; rather, an interrupted or running suture should be used for this purpose after the vertical mattress sutures have been placed. The horizontal mattress suture finds specific application in closing the tips of triangular flaps and in closing unequal wound edges. The near/far–far/near suture is occasionally useful in relieving tension on snug eyelid margin closures.

While there is room for personal preference regarding the type of skin suture (silk, nylon, fast-absorbing gut, etc.) and the method of suturing (interrupted, running, subcuticular, etc.), to minimize the final scar, it is essential that the surgeon use the smallest caliber suture that will accomplish the specific task. Size 6-0 or 7-0 sutures are commonly used for skin closure on atraumatic cutting or reverse-cutting needles. Although nonabsorbable materials are usually used for skin closure in adults (silk, nylon, polypropylene), absorbable sutures placed either subcuticularly or interrupted eliminate the need for suture removal in children.

A rapidly dissolving 6-0 plain gut suture is available for suturing skin (Ethicon 1916G). This rarely causes epithelialized suture tracts or skin inflammation, which can result from the use of regular gut sutures. Use of the rapidly dissolving gut suture eliminates the need for suture removal, which is desirable for pediatric patients and is appreciated by adult patients. It allows more flexibility in the timing of postoperative visits. Because the rapidly dissolving gut suture has less tensile strength than other sutures of the same caliber, it must be used only for skin alignment and not for closing wounds under tension. Additional throws may be placed on the knots since the decreased tensile strength may prevent the knot from being cinched as tightly as stronger sutures. Beige-colored Vicryl or Dexon (Davis & Geck, Inc., Manati, Puerto Rico) can be effective in supporting skin closure. The 7-0 Dexon gauge can be used as an interrupted stitch for skin closure to supplement a running fast-absorbing gut. It is also very useful for small flaps and Z-plasties as in epicanthal fold repairs.

In suturing skin, the edge opposite or facing the surgeon should be grasped with either fine-toothed forceps (e.g., Bishop-Harmon, Manhattan, Castroviejo) or a skin hook directly in line with the suture needle. Lining up the forceps with the needle in this manner prevents rolling of the edge, which causes faulty needle placement. The curve of the needle should be followed as it is passed through the tissue, and the surgeon should choose a needle holder that is appropriate to the size of the needle.

Proper placement of the skin sutures and proper tension on the knots of the sutures will promote eversion of the wound edges, which is essential in preventing late depression of the resulting scar. This is especially important in the thicker skin of the brow and cheek. In cross section, the sutures should assume a trapezoid configuration where slightly more deep tissue is included in the suture, thereby forcing the wound edges outward when the knot is tied. Faulty suture placement may cause overlapping wound edges, inverted incision lines, local necrosis, or epithelial inclusion cysts. Faulty suture tension can give rise to necrosis of the
wound edges if the sutures are tied too tightly; an unsightly wide scar may result if they are tied too loosely.

In tying sutures, the surgeon can obtain the desired tension with an initial “double throw,” or two wraps, of the suture material. Additional single wrap throws are then placed as square knots to secure this tension. Usually two additional throws are sufficient with monofilament sutures, particularly if there is any weight or tension. Occasionally, an initial triple throw is useful to avoid slippage when the closure is under tension. The surgeon should resist the common tendency to increase suture tension with the second throw, as this can result in distortion of the wound edges and subsequent unnecessary scarring. To prevent a bothersome loop of suture in the attempt to tie a knot, it is helpful to pull the suture far enough through the wound so that the end of the suture can be grasped with the needle holder or tying forceps. This also saves suture material. Another valuable point is to work with an appropriate length of suture. Although one wishes not to waste material, 18 inches of suture only gets in the way of efficiency. One should trim the excess as needed.

It is important that nonabsorbable sutures be removed correctly to avoid risking contamination of the wound by dragging externalized portions of the suture through the wound. To minimize scarring, skin sutures that have little or no tension on them should be removed in 3–5 days. The wound edges can then be reinforced with 1/8-inch or 1/4-inch Steristrips (3M Medical-Surgical Division, St. Paul, MN) for an additional 3–5 days. If vertical mattress sutures have been used in closing the wound, they are removed in 7 days. Lid-margin sutures are usually removed in 8–12 days.

Traction sutures placed through the gray line of the lids may be useful to ensure corneal protection and/or to keep lid tissues on stretch. A Frost suture can be used to stretch one lid (Figure 4.4A). An intermarginal suture brings both lids together, but limits visualization of the ocular surface (Figure 4.4B). The serpentine intermarginal suture brings both lids together and can be loosened to permit inspection of the ocular surface (Figure 4.4C).

**Dressing**

Patches are unnecessary after many ophthalmic plastic surgical cases, and particularly in the pediatric patient. They may, however, be helpful after surgery of anophthalmic sockets, some orbital cases, and lid reconstructive cases with skin grafts. Meticulous attention to hemostasis and wound closure results in sutured incisions that usually need no other dressing. Steristrips can be used in older children, but in younger children they may become an annoyance that leads to more picking and manipulating of the wound by the child. The use of elbow restraints is often very useful in pediatric patients. These allow the child to play, but not be able to reach hands to face. Masking of signs and symptoms, injury to delicate eyelid tissue, and blindness have been reported following the use of “pressure” patches, so their use should be monitored appropriately.

The patient may be asked to wear a protective metal or plastic shield to bed to avoid injury to the operated area during sleep. Cold packs are usually prescribed to be used intermittently for a total of 15 min out of each waking hour the day of surgery for their vasoconstrictive effect in minimizing postoperative edema. Warm packs for 10 min every 3 h may be started 24 h after surgery to promote vasodilation and absorption of the edema that has occurred.

The family should be specifically instructed on how to keep the area clean (e.g., gentle, twice-daily wiping with a clean, moist cloth or cotton ball, followed by the application of a small amount of antibiotic or steroid–antibiotic ointment). Some patients have difficulty attending to this wound hygiene because of their fear of “hurting something.” Prolonged soaking of the wound disrupts the healing process. Excessive straining, which may cause venous congestion, increased swelling, and bleeding, should be avoided. Tegaderm dressings are particularly useful for buttock wounds, providing protection in children wearing diapers. Instructions regarding baths or showers must be individualized.

**Wound Healing**

Wound healing is a continuum initiated by a traumatic or surgical event that may continue for years. This process can be divided into four overlapping phases: inflammatory,
fibroblastic, wound contraction, and scar maturation. This is covered in detail in Chapter 3.

1. **Inflammatory phase** In uncontaminated wounds, the inflammatory phase may last 4–6 days. This phase is initiated by vasoconstriction and deposition of fibrin platelet clots that help control bleeding. Vasodilation follows and is accompanied by the release of chemotactic substances that attract leukocytes and macrophages to the wound. These cells cleanse the wound of debris. Epithelial cells also migrate into the wound to bridge the edges and serve as a barrier to infection. Proper wound hygiene, along with careful tissue handling, can shorten the inflammatory phase of wound healing. In contaminated wounds with retained foreign bodies, the inflammatory phase will be prolonged and may result in a chronic inflammatory reaction. A good tension-relieving subcutaneous suture closure is all the more important in light of the fact that skin sutures are usually removed during the inflammatory phase of wound healing when little actual wound strength has been formed.

2. **Fibroblastic phase** Toward the end of the inflammatory phase and continuing for 2–4 weeks, fibroblasts that have migrated into the wound begin laying down collagen fibrils in a rather disorganized manner. Initially, an excessive amount of collagen is produced, accounting for the prominent scars patients sometime exhibit during this period. In most patients, however, an equilibrium is soon established between collagen production and collagenolysis.

3. **Wound contraction phase** Wound contraction is a normal phase of wound healing that occurs along with the fibroblastic phase. In anticipation of this contraction, it is important to strive for everted wound edges at the time of suturing to avoid depressed scars in the late postoperative period. Free grafts should be approximately one-third larger than their recipient beds, also in anticipation of this normal contraction. Steroids can inhibit wound contraction, but they can also interfere with the proliferation of fibroblasts and collagen synthesis, thereby decreasing the strength of the wound.

4. **Scar maturation phase** The scar maturation phase begins about 1 month following the trauma or surgery and may continue for years. During the early part of the phase, fibroblasts begin leaving the area. Thereafter, organization and dehydration of the collagen fibrils occur, serving to strengthen and refine the wound.

**Hypertrophic Scars and Keloids**

Hypertrophic scars involve only the tissue of the wound, and these scars usually become paler, softer, and less visible with the passage of time. Keloids are tumor-like overgrowths that invade surrounding tissue and may take years to reach their maximum size. Both hypertrophic scars and keloids are characterized by tissue responses that exceed the physiologic needs of the wound. Both have a predilection for dark-skinned children and young adults.

Treatment of hypertrophic scars includes massage, steroid ointment, and steroid injections into the scar. A 30-gauge needle on a 1-mL syringe is used to inject 1/10 mL of triamcinolone diacetate (Kenalog 10 mg/mL: Apothecan–Bristol Meyers, Squibb, Princeton, NJ) directly into the scar. The injections can be repeated every 2 weeks as needed. Atrophy and depigmentation may result if more concentrated suspensions are used or if the steroid is injected intradermally. Radiation, cryotherapy, surgical excision, and other modalities (e.g., vitamin E oil applied topically or taken orally) have been used with limited success in the treatment of keloids. Prolonged patching with silicone sheets may also help.

**Scar Revision**

Scars can be minimized by planning incisions carefully, closing wounds accurately, understanding the principles of wound healing, and monitoring postoperative progress attentively. However, many other factors influence scar formation over which the surgeon often has little control, including the following:

- Relationship of the wound to the relaxed skin tension lines
- Cause of the wound, i.e., elective incision vs. dogbite
- Region involved, i.e., lid with thin dermis vs. brow with thick dermis
- Depth of the wound
- Length of the wound
- Shape of the wound, e.g., trapdoor, stellate
- Tissue loss
- Individual factors, e.g., age, race, scar history, general health
- Previous treatment, e.g., surgery, radiation

Scars are never exactly the same; therefore, every scar deserves careful analysis and every scar revision deserves careful planning before the patient is taken to surgery. Factors that may significantly influence the result of scar revision must be discussed in detail preoperatively, and often the surgeon must spend considerable time dispelling common misconceptions. For example, it is not unusual for the patient to regard “plastic surgery” to remove a scar as a magical removal or erasure of a scar; whereas scar revision is in fact an attempt to substitute a more desirable scar for a less desirable scar. The optimal appearance of a scar may take years to achieve. The patient must have a realistic notion of what can and cannot be accomplished by the recommended treatment. The patient must understand that, even with the most carefully executed surgery, the best possible result may not be entirely satisfactory.

Relaxed skin tension lines correspond to the directional pull existing in relaxed skin. This directional pull is determined by underlying structures such as muscle and bone. Incisions that parallel the RSTL tend to remain narrow.
cisions perpendicular to the RSTL are referred to as antitension line (ATL) incisions. These tend to gape and result in more prominent scarring. Generally, the closer the incision or wound follows the RSTL, the better the cosmetic and functional result. In the pediatric patient, the skin has greater elasticity or resistance to stretch. This makes skin closure or scar revision more difficult.

The relationship of a scar to the RSTL must be evaluated preoperatively, along with the other factors listed above, so that the surgeon can effectively plan the operation and can give the patient a general prognosis regarding the chance of success and the need for additional procedures. In this way, misunderstandings and postoperative disappointment can be minimized.

Revisions of scars in which there has been no tissue loss can usually be improved by one or more of three linear scar-revision techniques: fusiform excision, Z-plasty, or W-plasty. Which technique or combination of techniques the surgeon uses to deal with a particular scar is again based on knowledge of the RSTL. The fusiform excision is the most useful for revision of scars that follow the RSTL. W-plasty finds its greatest application in ATL scars of the eyebrow, forehead, temples, and cheeks; but single or multiple Z-plasties are usually preferred for all other ATL scars. In lengthy irregular scars, it is not uncommon to combine all of these techniques during a single procedure. The overall objective in scar revision is to hide or camouflage the scar. The linear scar-revision techniques accomplish this objective by breaking scars into smaller segments and redirecting the original scar into a more favorable relationship with RSTL.

The fusiform excision involves resection of tissue that includes the scar paralleling the RSTL (Figure 4.5). This places the tension on the ends of the wound, which tends to promote closure of the wound. If the fusiform excision is perpendicular to the RSTL, the tissue tension would be at the center and would pull on the incision line, resulting in a broader scar. The angles of the fusiform excision should be 30° or less to ensure smooth closure. Once the fusiform strip is removed, the wound edges are undermined, creating two sliding flaps that are moved in to cover the defect. The subcutaneous tissue is closed to achieve skin approximation without tension.

A Z-plasty utilizes two adjoining triangular flaps created by a Z-shaped incision. The central limb of the Z should be placed along the line of contracture. A transverse diagonal line drawn perpendicular to the central limb then allows the surgeon to consider two sets of triangles (Figure 4.6A). One pair of triangles is usually more suitable as determined by assessment of the surrounding tissues and the relationship of the final incision lines to the RSTL. Once the configuration of the Z is determined, each flap is incised, undermined, elevated, and transposed into its partner's bed (Figures 4.6B,C). If there is cutaneous scar over the line of contracture, it can be removed in a fusiform excision along the central limb (Figure 4.6D).

The amount of lengthening achieved by a Z-plasty depends on the angles of the flaps and the length of the arms. Except in unusual circumstances, the angles should be between 50 and 60°. Smaller angles progressively lessen the amount of lengthening achieved, while angles greater than 60° become increasingly difficult to transpose.

The surgeon must remember to completely incise or excise the subcutaneous traction bands once the flaps of the Z-plasty are elevated. Failure to do this compromises the effect of the revision. Keeping the flaps of sufficient thickness and the flap angles between 50 and 60° helps avoid ischemic necrosis of the tips of the flaps. This complication is most likely to occur if the base of the flap is too narrow, if the flap is constructed in scar tissue, or if the sutures are placed in such a way as to cut off the blood supply to the tips of the flaps. The surgeon should consider using the previously described horizontal mattress suture to avoid compromising the vascular supply to the tips of the flaps.

A variation or extension of the Z-plasty, the W-plasty, is a zigzag incision using short, acutely angulated incisions that are closed by advancement without rotation of tissue. The W-plasty finds its greatest use in ATL scars in the eyebrow, forehead, temple, and cheek areas. Some tissue must necessarily be sacrificed in using the W-plasty, so the pro-

![Figure 4.5. Z-Plasty. (A) The central limb of the Z overlies the contraction line and allows the construction of two sets of flaps: one using a and b as arms and the other using the dotted lines as arms. (B) Any subcutaneous traction band must be released. (C) The flaps are transposed. (D) Example of a fusiform excision combined with a Z-plasty. (Adapted from Cahill and Carroll [1])]
A simple variation of the W-plasty can occasionally be used in upper eyelid blepharoplasty and in closing elliptical incisions. Ancillary measures such as eyeglasses, cosmetics, shave excisions, and dermabrasions should also be considered in planning scar revisions and camouflage. Newer techniques, such as injectable collagen, appear to provide only temporary improvement when used to change skin contour. Injectable collagen has been avoided in the eyelids because of a report of visual loss from retinal artery occlusion following eyelid treatment.

**Grafts**

Autologous grafts (e.g., skin, fascia lata, ear cartilage, mucous membrane, dermis fat, hard palate mucosa), and homologous grafts (e.g., sclera, fascia lata) have found wide-
spread application in ophthalmic plastic surgery. Autologous grafts can be conveniently divided into free grafts and flaps. A free graft is completely detached from its donor site and therefore has no blood supply of its own. In contrast, a flap remains partly attached to its donor site by a pedicle, thereby maintaining a blood supply.

**Skin Grafts**

Skin grafts may be either full thickness or split thickness, depending on whether all or only part of the dermis is included in the graft. Contraction of split thickness grafts and poor color match often preclude their use in eyelid surgery. Full thickness skin grafts are frequently used for scar revisions, repair of cicatricial ectropion, and eyelid reconstruction. While skin from the contralateral upper eyelid is the best choice for repair of an upper eyelid defect, this source may be inadequate (except in older patients with dermatochalasis). Furthermore, the surgeon must consider the asymmetric postoperative appearance that may result when this donor site is used. Postauricular skin is a desirable donor site for lower eyelid defects and in practice is also a common donor site for repair of upper eyelid defects (Figure 4.7).

Proper preparation of the recipient bed; meticulous technique in obtaining, sizing, placing, and suturing the donor graft; and attentive postoperative care are essential in assuring optimal functional and cosmetic results. The basic steps in obtaining and placing a full-thickness postauricular skin graft are as follows:

1. All scar tissue is incised or excised as appropriate in the recipient area.
2. The recipient bed must be free of blood and other debris that may interfere with vascularization of the graft.
3. The size of the defect is measured; a template may be helpful.
4. To obtain the grafts, the head is turned and the external ear is brought forward toward the cheek with a 4-0 silk traction suture.
5. The proposed donor site is inspected to ensure that it is hairless.
6. A marking pen is used to outline the proposed graft so that it is at least one-third larger than the previously measured recipient bed. This is most important because the reflection of the external ear places the retroauricular skin on stretch. The proposed graft is positioned so that half of it is on the posterior aspect of the ear and half overlies bone.
7. Lidocaine 1 or 2% with epinephrine is injected subdermally for hemostasis and separation of tissue planes.
8. The marked incision line is incised with a scalpel.
9. The graft is then removed using a combination of sharp and blunt scissors dissection.
10. The graft is placed in saline-moistened gauze.
11. The donor area is sutured with a running suture (e.g., 4-0 silk, nylon, chromic catgut) or with simple or mattress interrupted sutures. It is helpful to leave the traction suture in place until the running postauricular suture has been completely threaded. After the traction suture is released, the running postauricular suture is pulled up and tied.
12. All subcutaneous tissue is meticulously removed from the graft to eliminate this potential barrier to vascularization of the graft. This is most easily performed with Westcott scissors while the graft is on a saline-moistened 4 × 4-inch gauze stretched over the index finger of the surgeon’s nondominant hand.
13. The graft is then placed in the recipient bed and sutured using multiple interrupted 6-0 silk sutures. It is helpful to suture one edge in place before making any final modifications in the shape or size of the graft. At least four of the interrupted sutures are left long. A running suture of fast-absorbing 6-0 plain gut and/or 7-0 Dexon can be used to maintain alignment of the skin edges between the silk sutures. It is useful to engage the graft first with the needle/suture and then the recipient bed, to pull the graft toward the recipient bed in the process of passing the suture.
14. A piece of Telfa is cut to the shape of the graft and placed over the graft. A moistened cotton roll is used to form a pledge, which is placed over the Telfa. This stent is secured with the long ends of the interrupted 6-0 sutures and kept in place 5–7 days.
15. In some cases, a lid-margin suture is also used to keep the operated area flat and immobile during the initial postoperative period. Amblyopia is a concern with prolonged patching.