Introduction

Ophthalmic plastic and reconstructive surgery combines the precision of ophthalmic microsurgery with plastic and reconstructive surgical principles, allowing for subspecialized care of the eyelid, orbital, and lacrimal system. A foundation in ophthalmology allows the oculoplastic surgeon the knowledge and skills to safely and successfully protect the globe while achieving functional and aesthetic results. Certain basic ophthalmic and plastic surgical considerations form the necessary framework for the successful practice of oculoplastic surgery.

Preparation of the Patient

Consistent surgical outcomes depend on optimal preoperative preparation and patient counseling. The patient’s oculoplastic, ophthalmic, psychological, and general physical condition must be evaluated and documented. The surgeon needs to understand the concerns that have caused the patient to seek consultation. Every patient deserves a discussion of the goals of treatment (medical or surgical), along with an honest appraisal of the expected outcomes and potential pitfalls that may prevent the patient from achieving the desired results.

The patient’s preoperative condition must be assessed and documented in a manner consistent with the risk and complexity of the proposed procedure. This may include a general physical examination, an ocular examination, and an ophthalmic plastic examination, as indicated. A typical preoperative oculoplastic evaluation includes a problem-specific examination of the eyes, eyelids, and adnexal structures. It may include specialized testing such as lacrimal probing and irrigation, ocular photography, or orbital imaging.

Laboratory and ancillary evaluation should adequately satisfy the patient’s needs and be consistent with the diagnosis and planned intervention. This may include complete blood count (CBC), electrolyte panel, prothrombin time (PT), partial thromboplastin time (PTT), chest radiograph, electrocardiography, magnetic resonance imaging (MRI), and/or orbital computed tomography (CT).

Many nonorbital oculoplastic procedures are now performed with local anesthetic and intravenous sedation as needed, with monitored anesthesia care provided by an anesthesiologist. These cases may not require any ancillary testing if the patients are under 40 years of age and without a history of diabetes, diuretic use, or coagulopathy. In some instances, a CBC and coagulation panel is performed, depending on the patient’s age and comorbidities and the proposed procedure. Patients who are diabetics require measurement of their glucose level. Patients on a diuretic need measurement of their potassium level. A recent electrocardiogram is usually necessary for patients older than 40 years. The same procedure performed in the office setting with local anesthesia and oral sedation usually does not require any laboratory evaluation.

When possible, medications that decrease clotting should be stopped before oculoplastic surgery. Ideally the patient is given a list of all aspirin-containing medications, both prescription over the counter and homeopathic, and instructed...
not to use these for 1 or 2 weeks before surgery. However, for patients with certain medical conditions, such as a mechanical heart valve or cardiac stent, it is not always advisable to stop anticoagulation. Working in coordination with the patient’s primary care doctor or cardiologist will allow an individualized decision based upon the cardiac history and the surgical risk of bleeding [1]. When abnormal bleeding cannot be avoided during surgery, the surgeon and the patient need to reevaluate the relative necessity of the surgery and the inherent risks involved.

All patients with periocular or remote trauma need to have their tetanus immunization status evaluated. Any patient who has been previously immunized for tetanus but was last immunized over 5 years ago needs to have a booster for tetanus toxoid. Any patient with a contaminated wound and no prior tetanus immunization needs to have a tetanus immune globulin injection immediately followed by a complete tetanus vaccination sequence.

**Perioperative Antibiotics**

Perioperative antibiotics have limited usefulness in most oculoplastic procedures. Infection is very unlikely following oculoplastic surgery, and preoperative antibiotics have not been demonstrated to reduce the incidence of postoperative infection in most oculoplastic procedures [2, 3]. Although there is no consensus, antibiotics may be useful in cases of trauma, particularly bite wounds (with anerobic coverage needed), and in cases of preoperative infection. Antibiotic selection should be directed to the most likely category of bacterial contamination, such as gram-positive organisms from the skin and anaerobes from the sinuses. When deemed appropriate and if the patient is not allergic to penicillins or cephalosporins, 1 g of cefazolin covers the most common pathogens.

**Tissue Manipulation**

Instruments for oculoplastic surgery are larger and sturdier than instruments for eye surgery but are generally smaller and more delicate than instruments for general plastic surgery. Appropriately sized instruments allow the surgeon to hold the tissue without damaging it. The carbon dioxide laser can be used to incise skin and dissect tissues as well. See Chap. 3 for additional details on instrumentation in ophthalmic plastic surgery.

**Wound Closure**

Closure of incisions in the periocular area usually requires sutures. Staples and tissue adhesives are generally poor choices for the eyelids and surrounding areas owing to the great mobility of the skin and surrounding structures. Great care must be taken with suture placement and suture tension. A tight suture can cheese-wire (pull) through thin eyelid skin and can cause necrosis, especially in association with significant edema (Fig. 2.1). Attention must be paid to needle type and size, suture type and thickness, and suture placement and tension. All of these factors have a significant effect on the surgical result.

**Suture Needles**

The choice of needles is critical in eyelid surgery. The type of needle determines the ease with which the needle penetrates the tissue. The size and shape of the needle influence the amount of trauma induced by passing the suture. Cutting or reverse cutting needle configurations are the most useful in ophthalmic plastic surgery. Spatulated needles are helpful.
for lamellar passes through tissues such as sclera and tarsus (Fig. 2.2). Round or tapered needles, often used in vascular surgery, have a limited role in ophthalmic plastic surgery, but can be used to decrease bruising in certain procedures, such as temporary eyelid closure (tarsorrhaphy).

The size and curvature of the needle is also important. Slightly curved needles are helpful for suturing eyelid skin and tarsus. Highly curved (semicircle) needles are helpful for tight spaces such as the medial or lateral canthus or deeper suture passes in dacryocystorhinostomy surgery.

**Suture Placement**

Sutures should be used when clearly indicated. For skin closures, correctly placed sutures slightly pucker the wound edges.

A simple, interrupted suture is a single rectangular to trapezoid-shaped loop that can approximate tissue well when there is little tension on the wound. The base of the loop should be wider than the top to ensure skin edge eversion (Fig. 2.3). A vertical mattress suture creates a U-shaped loop
with the outer limits placed deep and the inner limits placed superficially through the skin alone. The vertical mattress suture is used to ensure an approximated and everted skin edge for a wound where there is significant tension (Fig. 2.4). A figure-of-eight suture is a variant of the vertical mattress suture (Fig. 2.5). A horizontal mattress suture is created by tying two connected simple sutures together (Fig. 2.6). A horizontal mattress suture is commonly used to reattach the lateral canthal tendon to the inner aspect of the lateral orbital rim during lower eyelid tightening. The horizontal mattress suture, like a continuous, locking, running suture, is a means of reducing the number of knots and the time required to tie them (Fig. 2.7). Subcuticular sutures form an S-shaped chain linking the dermis. Such sutures, largely buried, suit a skin closure with little tension in which the surgeon wishes to reduce the effect of suture materials on epidermal scarring. The subcuticular sutures are exteriorized at the wound ends and left free, and tied or sutured to skin at the ends (Fig. 2.8).

**Suture Materials**

Both absorbable and nonabsorbable sutures are useful, depending on the desired effect. The sizes for ophthalmic plastic surgery are usually between 4–0 (largest) and 8–0 (smallest). The naturally occurring materials such as catgut and collagen are usually monofilaments and are degraded by enzymatic action that is somewhat variable between individual patients (Table 2.1). Therefore the effectiveness of these suture materials is somewhat unpredictable, but they are shorter acting than the synthetic materials. The synthetic materials such as polyglactin are usually braided and are degraded by hydrolysis, which is more predictable but takes longer to complete. The braided sutures make the most effective knots but also have spaces between the braids that are too small for white cells to enter while allowing bacterial proliferation. Sutures that inhibit bacterial colonization by impregnation with triclosan are now available (Ethicon plus sutures, Ethicon, Somerville, NJ).

Nonabsorbable sutures usually last at least for several years or longer. When externalized, they are frequently
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removed after several days to weeks. They tend to cause less inflammation than absorbable sutures because they are more inert and relatively ignored by the body’s immune system. Silk sutures are the principal exceptions to the above-mentioned guidelines. Silk causes significantly more inflammation than the synthetic monofilament sutures, but offers excellent ease of use. Supramid, polyester, and silicone are used predominantly for eyelid suspensions and canthal reconstructions. Steel wire is used for joining bones and for canthal reconstruction but is rarely used now with the wide availability of plating sets (Fig. 2.9).

Hemostasis

The eyelids and ocular adnexa are richly vascularized with arcades oriented in the eyelid in predictable locations. Although this generous blood supply reduces the risk of necrosis and infection, it makes perioperative hemostasis more difficult. Excessive bleeding obscures the surgical field and can prolong intraoperative time. The final surgical result

Fig. 2.6 Horizontal mattress suture allows speed of placement secondary to less tying and is useful for wounds under tension, as in reapproximation of the lateral canthal tendon during the lateral tarsal strip procedure

Fig. 2.7 Continuous locking suture

Fig. 2.8 Buried running subcuticular closure affords excellent cosmesis and ease of removal
may be delayed by hematoma, or the desired result may not be accomplished. Uncontrolled postoperative bleeding can lead to orbital hemorrhage and vision loss [4].

**Prevention**

The possibility of abnormal bleeding always exists. Historical clues should be sought preoperatively such as easy bruising with minor trauma or excessive bleeding during prior surgery, including dental surgery. This issue must be thoroughly reviewed with the patient, who frequently may not recall this information even with specific prompting. The patient’s medication list should be carefully evaluated. Preoperative bleeding studies may be considered such as platelet count and a coagulation profile (PT/PTT/INR). In rare instances, a bleeding time may be beneficial.

Control of perioperative blood pressure is an important preventive measure to avoid excessive bleeding during and after surgery. This is best accomplished by having the patient take his or her usual medication with a small drink of water the morning of surgery. Of particular note, the patient should take their midday medications if they are on the afternoon surgery schedule. If necessary, the patient can be given an additional long-acting oral agent to control the blood pressure on arrival to the surgical preoperative holding area.

Additional systemic measures can decrease the chance of hemorrhage in the perioperative period. They include use of antitussives as needed and the use of antiemetics to prevent valsalva during or after a procedure.

Careful attention to perioperative hemostasis is a critical element of any oculoplastic surgery. Injection of local anesthetic with a vasoconstrictor, such as epinephrine (1:100,000 or 1:200,000), is extremely helpful. It is important to pay particular attention to the time of injection, as epinephrine requires approximately 10 min for its effects to occur and has its maximal effect between 20 and 60 min after injection. Ideally the critical part of the surgery will be completed within this time. Additionally, epinephrine significantly prolongs the action of lidocaine and other similar anesthetics. Phenylephrine is an acceptable alternative when epinephrine is contraindicated owing to cardiac or other reasons. It can be added to a local anesthetic to achieve similar hemostasis as epinephrine without as much cardiac stimulation.

Conjunctival and mucosal bleeding frequently can be minimized or prevented by proper preoperative planning. When a conjunctival incision is planned, the application of phenylephrine drops 20 min before the incision can frequently eliminate most if not all of the bleeding typically encountered from this type of incision. Likewise, the use of 0.5% phenylephrine nasal spray before a dacryocystorhinostomy can dramatically reduce the amount of nasal mucosal oozing.

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**Table 2.1** Commonly used suture materials in oculoplastic surgery

<table>
<thead>
<tr>
<th>Suture</th>
<th>Characteristics</th>
<th>Strength retention</th>
<th>Typical use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nylon</td>
<td>Synthetic, monofilament</td>
<td>Permanent</td>
<td>Skin closure</td>
</tr>
<tr>
<td>Prolene</td>
<td>Synthetic, monofilament</td>
<td>Permanent</td>
<td>Skin closure</td>
</tr>
<tr>
<td>Silk</td>
<td>Natural, multifilament</td>
<td>2 years</td>
<td>Lid margin repair</td>
</tr>
<tr>
<td>Plain gut</td>
<td>Natural, monofilament</td>
<td>7–10 days</td>
<td>Skin and conjunctival closure</td>
</tr>
<tr>
<td>Chromic gut</td>
<td>Natural, monofilament</td>
<td>2–3 weeks</td>
<td>Deep buried wound closure, tarsal sutures</td>
</tr>
<tr>
<td>Polylactin</td>
<td>Synthetic, multifilament</td>
<td>3–4 weeks</td>
<td>Deep buried wound closure, tarsal sutures</td>
</tr>
<tr>
<td>Polydioxanone</td>
<td>Synthetic, monofilament</td>
<td>4–6 weeks</td>
<td>Deep suspension sutures, tissue flap support</td>
</tr>
</tbody>
</table>

**Fig. 2.9** (a) Wire is twisted to hold it in position; it is not tied. (b) After the wire is twisted, the free end is bent toward the bone and deeply buried. Wire causes very little tissue reaction if the end is well buried.
Basic Principles of Ophthalmic Plastic Surgery

Reduction

Cautery is the mainstay of intraoperative hemostasis. It is targeted and works immediately. When used properly it tends to cause minimal associated thermal damage while closing the bleeding vessels. There are three types of commonly used cautery: (1) hot wire, (2) high-frequency radio waves, and (3) laser. All three methods use heat to coagulate the blood vessel and adjacent tissue to stop the bleeding.

Hot-wire cautery is generally accomplished with a handheld, battery-operated instrument. They are available in low and high temperature varieties. Low-temperature cautery usually contains a single AA battery and reaches a temperature of 1,000°C. The wire does not glow red. It is often used for ocular and pericocular surgery. The high-temperature cautery usually contains two AA batteries and reaches a temperature of 2,200°C. The wire glows orange red. The color of the tip glow indicates the temperature of the cautery; a bright orange is the maximum temperature. This temperature is helpful for dissection. Temperature and heat are different measures of the same phenomenon and should not be confused with each other. Temperature is determined by the relative speed of the molecules in an object. Heat is a product of the relative speed of the object’s molecules and the object’s mass. Although the two batteries in the cautery can raise the temperature of the wire to several thousand degrees, the total heat in the wire is small, even when the tip is glowing orange. Therefore it is important to apply the cautery with the tip glowing. This method allows maximum cauterization at the surface with minimal deep thermal effects. If the cautery is applied to the tissue before the wire glows orange, the cautery will be inefficient. The temperature does not rise much because the tissues absorb the extra energy and a deeper, less effective burn occurs that unnecessarily damages normal tissue.

High-frequency electrocautery is extremely useful in oculoplastic surgery. It is useful for dissecting as well as cauterizing tissue. The relative action of the instruments is controlled by the frequency and shape of the electrical wave that emanates from its tip. The power level controls the intensity of these effects. It can be used as a unipolar or bipolar instrument. In the unipolar mode, it is a very effective dissecting instrument and can coagulate vessels that are smaller than 1 mm in diameter by direct obliterator cautery. In the bipolar mode, it is a poor dissecting instrument but an unparalleled coagulator of larger vessels that are difficult to control with any other means. The bipolar mode seals larger vessels by also cauterizing and recruiting the surrounding connective tissue into the zone of coagulation and collagen shrinkage (Fig. 2.10).

Bipolar cautery is very helpful for shrinking prolapsed orbital fat. During orbital surgery, fat frequently prolapses into the surgical field. One option for managing this problem is bipolar cautery. The surface of the fat is lightly moistened with saline. The bipolar cautery power is set relatively low. The tips are applied to the fat’s surface in a painting motion with the power on and the waveform set to coagulate. The fat consistently contracts out of the field without the need to incise it and without the risk of causing bleeding.

The carbon dioxide laser can function as a scalpel or cautery, or both. When the laser’s energy flux or density is very high, it vaporizes tissue without leaving any heat in the remaining tissue to coagulate it. In this fashion the laser makes an excellent scalpel, but there is tremendous bleeding associated with its use. Conversely, the laser can be adjusted to heat tissue without cutting it, but causing tissue necrosis from the thermal effects. Most of the time, the carbon dioxide laser is used to simultaneously cut and coagulate. The relative effects are controlled by varying the intensity and duration of the beam.

Adjuvant Agents

Some bleeding is so diffuse that cautery is impractical or unwise. This happens frequently with mucosal surface bleeding, especially when preoperative hemostasis has not been effective before a dacrocystorhinostomy. In these cases hemostasis is augmented nicely by several different materials. An excellent option is to utilize one of the charged collagen products such as Helistat or Collistat. These materials are sheets containing many ends of charged collagen simulating a cut tissue surface. These sheets strongly induce thrombogenesis. They may be left in the operative field,
although some believe that a small inflammatory reaction may ensue. Other readily available materials include absorbable gelatin foam (Gelfoam), oxidized cellulose (Surgicel), and microfibrillar collagen (Avitene). Gelfoam and Avitene can be left in the surgical field. Surgicel may cause too much inflammation to be left in the eyelids or orbit.

Bleeding from bone is best controlled with direct application of bone wax into the bleeding sites. It is very difficult to control bone bleeding with cautery of any kind even with a well-defined bleeding site because the vessels do not have much surrounding connective tissue that can be incorporated into the coagulated area.

**Incisions**

Incisions in and around the eyelids demand precision but offer the attentive surgeon the possibility of completely hiding well-constructed wounds in the natural skin folds and creases around the eye [5]. To make successful skin incisions into the eyelids requires an understanding of their muscular, fibrous, and vascular anatomy as well as that of all of the adjacent structures. It also requires knowledge of the surgical principles involved.

Whenever possible the incisions should be placed in or parallel to skin folds and skin tension lines. These skin lines often coincide with lines of facial expression and are especially prominent around the eyes. Subtle skin tension lines can be identified by compressing the skin at 90° angles and observing the indentation pattern. Incisions in or along periorbital rhytids help decrease wound tension, thereby creating thinner scars (Fig. 2.11).

Lymphatic drainage from the eyelids can be adversely affected by poor incision placement. Poor lymphatic drainage can significantly delay wound healing and can lead to a suboptimal long-term result. The normal lymphatic channels of the eyelid extend obliquely, posteriorly, and inferiorly from the lateral eyelids to the preauricular and submandibular lymph nodes. Vertical incisions in the lateral canthus tend to disrupt the flow of lymph fluid and heal poorly. Vertical incisions in the medial canthus do not affect the lymphatics as much as those in the lateral canthus. Simultaneous vertical incisions in the medial and lateral canthal regions of the same eyelid may cause chronic eyelid lymphedema.

**Skin Defects**

**Primary Closure**

Small skin defects without significant tension are closed best by direct apposition. If the skin edges are under significant tension, the surgeon can undermine the skin from the underlying tissue by sharp dissection; the surgeon is effectively creating a small sliding advancement flap. This approach allows the edges of the incision to be advanced without creating tractional forces that will tend to broaden the scar as it heals (Fig. 2.12). Small eyelid skin lesions can be excised with elliptic incisions that easily convert to linear closures with minimal tissue distortion (Fig. 2.13). As with all incisions, it is important to evert the wound edges as they are closed. All tissue margins are swollen during the wound closure.
Detumescence occurs as the scar heals. A depressed scar is avoided by carefully and consistently everting the wound edges during the closure (Fig. 2.14). Each layer of skin should be approximated to the equivalent layer in the opposite wound edge to avoid creating a bump in the scar. If a raw edge is sutured to an epidermal surface, an elliptic abnormality in the scar will result because the two will not properly seal.

**Dog Ears**

Dog ears are created by redundant tissue at the termination of an incision. Unequal incision lengths and incisions joined at an angle that is too acute frequently cause dog ears. Creating incisions of equal length and joining them at appropriate angles minimizes dog ears. Dog ears are eliminated by creating a flat, unpuckered incision before closure (Fig. 2.15).

![Fig. 2.13](image1.png) Elliptic defect closed with interrupted sutures

![Fig. 2.14](image2.png) Poorly placed suture is too far from the wound and caused inverted wound edges

**Flaps**

The oculoplastic surgeon must be able to adjust the surgical plan as the intraoperative situation dictates. What is perceived preoperatively as a simple excision of a mass and direct closure may become more difficult because of unanticipated tissue loss in an attempt to achieve clear surgical margins. Therefore, familiarity with the technique of creating skin flaps is important. The specific flap is based on the extent and location of the defect.

One of the most helpful techniques to facilitate wound closure is undermining the edges. In most instances it is straightforward to undermine the adjacent tissue in the subcutaneous planes beginning at the wound margins. The surgeon may have to dissect a significant distance to decrease the tension of the tissue to an acceptable level. During the dissection, the wound edges are repeatedly grasped with toothed forceps and drawn together until the surgeon is satisfied that the wound can be closed relatively tension free. In effect, a simple advancement flap is created without any skin incisions. If the wound is closed with significant, persistent skin tension, the scar will broaden postoperatively and will tend to either hypertrophy or atrophy. This is particularly true if the scar has repetitive stretching forces on it, such as a scar in the upper eyelid.

When undermining is insufficient to relieve incisional stress, more advanced techniques are necessary. The next step is a simple advancement flap with skin incisions. This is particularly helpful for square or rectangular defects (Fig. 2.16). Careful measurement of the defect to determine the size and shape of the tissue is necessary to fill the defect, following the woodworker’s dictum of “measure twice and cut once.” The flap is outlined and the skin incisions are made sufficiently deep to include the vascular bed that nourishes it. Failure to include the bed can lead to loss of the flap through tissue...
necrosis or poor wound healing. The length of the flap can safely be up to 2.5 times the width of the flap. With great care taken by the surgeon to retain the vascular integrity of the tissue, the flap is dissected until it can slide easily into the defect with minimum tension. With this maneuver, an area of stress may appear along the edges of the advancing flap that may impede the successful advancement of the flap. The eyelids are a privileged sight with great vascularity; therefore it is rare to see tissue slough. Nevertheless, these principles apply to the periorbital regions as well as other sites. Small releasing triangles, called Burrow’s triangles, may be made at these stress points to lessen the tension and minimize scarring (Fig. 2.17). After the flap is advanced into position and the apparent stress is acceptable, it is sutured into position. In those areas with larger flaps, buried absorbable sutures may be used to join opposing subcutaneous tissue and obliterate the surgical dead space (Fig. 2.18). These buried sutures also decrease the tension on the skin and distribute it more evenly.

An alternative method of tension reduction is the V-Y plasty (“V to Y plasty”). Determining the force vector on the skin is critical for this flap. Once the direction of the main vector is known, a V-shaped incision is made along the meridian of the main vector bisecting the V. The area lateral to the V is undermined. This results in a release of the V in one direction, and the former base of the V lengthens. This area is then closed by suturing the former base of the V in a linear fashion. The arms of the V are automatically converted into a Y (Fig. 2.19). It is also possible to make a Y into a V by a reverse process. These techniques are most helpful in the reconstruction of the medial and lateral canthi.

A rotation flap is very helpful for rotating tissue around a fixed base to fill in a defect. A flap of tissue is dissected free of the subcutaneous tissue, as in a simple advancement flap. The flap is rotated into position, and the defect is closed by sliding flap closure. (b) Simple linear advancement flap. (c) Rotation flap with triangle removed to facilitate closure. (d) Combined sliding and advancement flap. (e) Transpositional flap used to close nonadjacent defects.
Fig. 2.17 (a–c) Tongue-in-groove advancement flap with Burrow’s triangles excised from the end of the incision

Fig. 2.18 Elimination of surgical dead space with flap advancement

Fig. 2.19 V-Y plasty

Fig. 2.20 Transposition flap from nonadjacent area

beginning at both ends to minimize undue tension (Fig. 2.20). Those areas of puckered tissue can be excised as a triangle and closed with interrupted sutures.

The Limberg or rhomboid rotational flap is a useful variation of the standard rotational flap for situations that make a less complicated flap insufficient to close the defect [6]. It is particularly helpful for closing diamond-shaped incisions or elliptic incisions that have been converted to a rhomboid shape. The configuration of the flap is shown. The critical elements are the 120° and 60° angles, as indicated, so that the flap sits snugly into position (Fig. 2.21). The key to success is the orientation of the excision site. Before demarcating the lesion, the surgeon should determine in which direction the skin is most extensible. This line becomes the lateral aspect of the channel. This approach ensures minimal wound tension at the conclusion of the procedure. The guideline cannot be perpendicular to the lid margins because this position may cause abnormal tension and result in malposition of the eyelid (Fig. 2.22). The procedure lends itself well to use in the orbital adnexal areas. After creation of the defect, the flap is formed with the top extending from an imaginary line bisecting the 120° angle. It is the same length as the corresponding side of the diamond. To complete the flap, the lateral incision is formed by placing it at a 60° angle and parallel to the bottom or top side of the diamond, depending on which way the flap will be rotated. Meticulous dissection is used to properly undermine and isolate the flap until it can be rotated into the defect. After it is rotated, near-far, far-near sutures are used to secure it.
Z-plasty

Z-plasty is an important surgical option to release a contracted scar. It is a transpositional flap, and it is used to decrease the tension on a scar. It is also possible to completely excise the scar or a mass within the central incision of the Z-plasty by enclosing it within a spindle-shaped excision. The combination of a Z-plasty with a spindle-shaped excision of a mass is called an O-Z plasty (Fig. 2.23). The flap is started by orienting the long or central arm of the Z through the scar or lesion and parallel to the principle line of tension. After the central incision is oriented and sized, the outside incisions are created with an equal length to the central incision and are angled at 60° to the central incision. This creates two flaps shaped like equilateral triangles of equal size. The flaps are undermined extensively so they can be rotated into position and joined together without significant tension (Fig. 2.24). This process is facilitated by creating flaps of equal size that are mirror images of each other across the central incision.

Once the triangular flaps are formed, the subdermal tissue is examined. Subcutaneous fibrous bands may be present that the surgeon had not appreciated preoperatively. These bands must be excised completely because failure to release them may result in an inadequate surgical result. The flaps are joined by anchoring the bases of the flap first and then
evenly distributing the tension along the remainder of the flap with multiple interrupted sutures. It may be appropriate to use buried sutures to minimize the effects of late scar contracture. Sometimes it is necessary to anchor the flap apexes with vertical or horizontal mattress sutures to distribute the tension better along the flap edges. Undue stress caused by inequality of the flaps promotes poor or incorrect wound healing. Such problems may actually exacerbate the underlying condition rather than improve it. If it is not possible to make these flaps of equal angles, there should be no more than 20° of difference between them.

The use of the Z-plasty may range from apparently simple applications to extremely complex situations. It is useful for relieving vertical contracture in the eyelids after trauma. It is also helpful for long, complicated scars of the face.

To correct a vertical shortening of the upper eyelid from scar contracture, the tension-relieving incision or excision is made vertically through the cicatrized area of the lid. The two arms of the Z are made at 60° angles to the central incision to form the two equilateral triangles. The flaps are completely mobilized. All of the underlying scar tissue is excised. Any scar tissue that remains will compromise the desired surgical result. The flaps are carefully transposed. A significant lengthening of the vertical dimension of the eyelid will result. It is frequently possible to increase the vertical dimension of the eyelid by one-third of the length of the scar (Fig. 2.25). To enhance the early healing process, a traction suture should be placed through the upper eyelid margin and taped to the cheek for approximately 1 week. A double-armed 6–0 silk suture with cutting needles is placed through
the eyelid margin directly below the Z-plasty, over a bolster material of the surgeon’s choice (Fig. 2.26). At the surgeon’s discretion, the suture may be brought through the lower eyelid margin to completely close the eyelids for the week that the suture is in place. By keeping the eyelid stretched for the first week, the initial wound contraction is controlled and the vertical elongation of the eyelid is enhanced. Gentle massage of the area can soften the subcutaneous scar.

Z-plasty can also be used for more-complex types of facial scars. Multiple Z-plasties can be used for long scars that would not respond well to a single large Z-plasty. The initial, central incision is made through the center of the scar. The first two arms are created at 60° to the central incision to create the first two equilateral triangles of tissue for the flaps. Additional arms are created as necessary to completely treat the scar (Fig. 2.27). Great care must be taken to ensure that these incisions parallel the original offset incisions. It is easy to become slightly disoriented, and each mistake will result in successive mistakes in placement of the incision. The number of pairs of incisions depends on the length of the scar and adequate distribution of the wound tension. Each pair of offset incisions that forms a Z-plasty is treated as described above.

Z-plasty is also helpful to rotate the eyelid or brow margin. In this role it can be a useful alternative to skin grafting. When caring for burn patients, there is minimal skin available for grafting, and avoiding a graft can be critical. To enhance incision placement and accuracy, the surgeon places the eyelid on stretch before the incision. This can be accomplished with a 4–0 silk suture. The incision is made through the skin 2–3 mm outside of the ciliary margin. The arms of the Z are completed on the side of the eyelid that the tissue flaps will be moved toward (Fig. 2.28). The flaps are meticulously dissected, and all fibrotic bands are excised. In cases of lateral or medial canthal transposition, the angle of the flaps may not be at 60° angles. It may be necessary to
angle the flaps more acutely to allow the flaps to work within the available space. It may also be necessary to incise and reattach the lateral canthal tendon before final placement of the flaps.

A similar problem such as elevation of the lateral canthus can be solved by adapting this technique. The flap is taken from the lateral portion of the lower eyelid and used to rotate the lateral canthus downward. The level of the medial canthus is used as a guide to estimate the optimal placement of the lateral canthus. In this adaptation, the central portion of the Z is marked first. It is placed 3 mm below the cilia line. Parallel to the lid margin, it extends from the middle of the lower eyelid to the angle of the malpositioned lateral canthus, not the future site of the new lateral canthus. Then the incision sweeps medially, superiorly, and obliquely toward the supratarsal crease of the upper lid. The inferior arm of the Z is brought laterally and ends at the desired position of the new lateral canthus. This step is extremely important. The cicatrix creating an abnormal canthal position is excised segmentally until the lateral canthus freely drops into the desired position. The inferior angle is then transferred to fill the superior defect.

Skin hooks or delicate atraumatic forceps are extremely helpful during these manipulations. The wound is then closed.

An elevated brow can also be corrected by a Z-plasty. The incisions are marked out while keeping in mind that the future position of the elevated brow will be determined by its placement in the temporal and inferior arm of the Z (Fig. 2.29). The site is estimated by comparison both to the contralateral brow and the medial aspect of the ipsilateral brow. The absence of cilia in the elevated brow or aberrant growth should be noted. If they are found, placement of the brow should be adjusted accordingly. The central portion of the Z is placed under and parallel to the arch of the affected brow. The superior arm is then offset to follow the curve of the superior orbital rim. The inferior arm of the Z is placed parallel to the superior incision. It may be necessary to extend the lateral aspect of the inferior incision slightly in order to lessen wound tension and accommodate the transposition. This frequently makes the Z resemble the number 2. The flaps are dissected carefully to minimize the risk of injury to the lash follicles. The flaps are transposed as shown and sutured into position.
Transmarginal Repair of the Eyelid

All incisions or lacerations of the eyelid margin require surgical repair to restore the structural integrity of the eyelid. This is true even if the involvement is only partial thickness. This type of surgical repair can be performed with a general or local anesthetic as the situation dictates. As always, when using a general anesthetic for eyelid surgery, it is very helpful to infiltrate local anesthetic with epinephrine into the operative area for short-term pain control and vasoconstriction. The technique of pentagonal wedge resection can be used to close a horizontal lid defect regardless of the underlying cause.

The medial wound edge is first straightened with a super-sharp knife or a No. 11 Bard-Parker scalpel (Fig. 2.30). This allows a more precise closure and removes debris from the incision. The eyelid margin is grasped with toothed forceps. While keeping the eyelid under tension, the blade is inserted through full-thickness eyelid. It is brought upward in one continuous motion to remove all of the irregular tissue while creating a smooth wound edge. The lateral wound edge is treated in a similar fashion. Attention is directed to closing the wound edge without leaving a notch in the eyelid margin. The center point of this effort is placing three 6–0 silk sutures through the eyelid margin. The sutures should be passed through the meibomian gland orifices, the gray line, and the lash line approximately 2–2.5 mm from the wound margin on either side (Fig. 2.31). The first suture passed should be through the gray line, just anterior to the mucocutaneous junction. A double throw is placed in the suture and the eyelid margin is evaluated. The eyelid margin should be well approximated with a solid mirror-image pass. If the wound edges are symmetrically joined, the suture is completed with two more throws to make square knots and the suture is cut long and placed within a hemostat which is rested on the patient’s brow and aids in retraction for the next pass. If the wound edges are not symmetrically joined, the above-mentioned process needs to be repeated. The second suture is placed through the lash line by starting the needle 2–2.5 mm from the wound edge and passing it in a smooth, symmetric fashion through the opposite side of the wound at the same level. This suture is tied, cut long and placed in a hemostat, and retracted inferiorly (rested over the patient’s cheek) to aid in retraction for the last lid margin suture. The third suture is passed in between the first two (along the meibomian gland orifices), usually in one single pass which is aided by the retraction provided by the initial two sutures. This suture is also cut and left long (Fig. 2.32). All three lid margin sutures are then placed in the same clamp which is rested on the brow and provides retraction for the deep, tarsal closure. Absorbable 5–0 or 6–0 sutures are used to close the tarsal plate. They are passed anteriorly through the tarsus in a lamellar fashion to approximate the tarsal edges during the

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Fig. 2.28  (a) Z-type incision prepared to correct lower lid deficiency. (b) Upper lid flap transposed to fill deficiency and sutured into place. (c) Central incision made along lid margin in attempt to lower lateral canthus. (d) Lower lid flap transposed to upper lid and sutured in place.
Fig. 2.29  (a) Correction of elevated brow by Z-type incision. (b) Transposed brow with placement at temporal end of lower arm.

Fig. 2.30  Freshening of wound edges

Fig. 2.31  Correct placement of sutures for full-thickness eyelid repair

Fig. 2.32  Closure of posterior lid margin sutures away from the cornea.

Fig. 2.33  Closure of posterior lid margin sutures away from the cornea. By placing sutures in the tarsus, the wound stress is more evenly distributed, the likelihood of a dehiscence is decreased, and the risk of a lid notch is minimized. The skin is closed with interrupted 6–0 sutures, and the lid margin sutures are tied inferiorly into one of the skin sutures to avoid corneal-suture touch. The patient is instructed not to rub the eyelid and to wear a shield whenever sleeping for the first 2 weeks after surgery to avoid inadvertently rubbing the eyelid during twilight sleep. The lid margin sutures are left for 7–14 days. The patient is usually seen at 7 days, and a determination is made at that time regarding optimal suture removal. The decision of when to remove the lid margin sutures is greatly influenced by the
surgeon’s personal experience and the patient’s ability to heal. Since the dense connective tissue of the tarsus requires 9–10 days to heal, removal of these sutures is most often performed at about 10 days from surgery.

After suture removal, the lid margin should be slightly everted. The eversion resolves with complete resolution of the postoperative edema. It is also acceptable to have the lid margin smooth and flat. A small depression developing at the incision site will fill in with epithelium. If a depression larger than 2 mm develops, it will probably require surgical revision.

Sometimes the defect is too large to allow direct closure. In these cases, it is necessary to obtain additional tissue to relieve the tension on the wound, otherwise the wound will stretch and separate in the early postoperative period.

The simplest way to obtain additional tissue is through a lateral canthotomy. A straight mosquito hemostat is placed around the lateral canthus, with the blades straddling the horizontal raphe. The hemostat is advanced until the inner tip reaches the cul-de-sac at the level of the bony rim. The canthal tissue is crushed (Fig. 2.35). The area is then incised with minimal bleeding. The eyelid has now gained several millimeters of additional horizontal length. If this is sufficient, the wound is closed and the canthal incision is closed with interrupted sutures. If additional tissue is required to close the incision, the appropriate crus of the lateral canthal tendon can be partially or completely lysed. The tendon is isolated from the orbicularis anteriorly and the conjunctiva posteriorly by carefully dissecting within the canthotomy incision (Fig. 2.36). The tendon can be incised in a graded fashion to provide progressively more horizontal lid tissue until the tendon is completely severed (Fig. 2.37). Complete severing of the inferior crus of the lateral canthal tendon creates approximately...
Fig. 2.37 Lysis of the inferior crus of the lateral canthal tendon

Fig. 2.38 Sliding full-thickness eyelid into place medially after lysis of the inferior crus of the lateral canthal tendon

Fig. 2.39 Final closure of incisions after lateral canthotomy and inferior cantholysis for lid margin reconstruction

followed by the canthal incision (Fig. 2.39). When the inferior crus of the lateral canthal tendon has been completely lysed, deep sutures are useful from the lateral aspect of the eyelid orbicularis and tarsus to the inner aspect of the lateral orbital rim, to serve as lower eyelid support and reforming sutures.

References

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