Avoiding and Managing Complications in Cosmetic Oculofacial Surgery

Morris E. Hartstein
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To all of our loving families.

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Preface

Cosmetic oculofacial procedures continue to be immensely popular and are a central component of facial aesthetic rejuvenation. When properly selected and performed, these procedures have an enormous impact in terms of overall facial rejuvenation and provide a high level of patient satisfaction.

Currently there are many outstanding textbooks, how-to books, and videos on cosmetic facial surgery. Many of these publications often include a section on dealing with complications. Our book is unique in that it is completely centered around preventing and managing complications from cosmetic oculofacial procedures.

It has been said that unless one performs no surgery, there will be complications. Some of these complications are minor, common, and resolve with time or minimal intervention. Conversely, other complications may have a much larger, and disproportionately negative, impact on the patient and the surgeon. Patients with such complications, or unsatisfied expectations, can exhaust an enormous amount of time, energy, and emotion from the practice and practitioner.

With this in mind, we set out to write this book that focuses solely on educating practitioners on how to best avoid complications when performing aesthetic oculofacial surgical and non-surgical procedures. However, should complications occur, we describe the best approaches to addressing them, in terms of considering the patient's findings and anatomy, the best surgical options, timing of intervention, as well the patient's emotional state.

This book is divided into sections that are specifically focused on the recognition and treatment of complications, while simultaneously balancing aesthetic and functional outcomes. Equally important, we have included sections on appropriate patient selection, which is a crucial part of the process. Additional chapters discuss the assessment of the patient's biopsychosocial perspective to gain a more holistic understanding of the patient concerns and to consider whether additional surgery could be helpful or should be deferred.

We have drawn on our own experiences as oculofacial surgeons, as well as the vast experiences of our contributing colleagues, including those from other disciplines such as facial and general plastic surgery and cosmetic dermatology. Acknowledging the evolving nature of surgical practice, the contributing authors and editors present this current "state-of-the-art" text that offers a useful up-to-date

resource for surgeons managing challenging complications in oculofacial patients. We hope that this book will become a useful and vital tool for aesthetic practitioners.

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Part I

Preoperative Considerations in Periocular Cosmetic Surgery

1 Considerations in the Cost Impact of Complications and Revisional Surgery in Cosmetic Oculofacial Surgery

John B. Holds

A number of unhappy factors converge in the care of any disappointed aesthetic surgery patient, including the psychological aspects for the patient and how these concerns additionally burden the care team (see Chaps. 28 and 29). Monetary costs that factor in include the financial costs incurred by the patient, time, pain and suffering, potential litigation with legal and settlement costs, and costs incurred by a care team that may be reluctant to pass the entire financial burden on to the patient.

The famous plastic surgeon, Sam Hamra MD, commented to me some years ago at a plastic surgery meeting in Miami regarding how cosmetic surgery had changed during his time in practice, with a shift from wealthy stay-at-home spouses with few daily obligations to a more egalitarian group of working individuals whose ability to hide away for weeks or months if needed to recover from surgery is problematic. The incorporation of third-party loan arrangements to finance cosmetic surgery has worsened the problem, drawing in people with even less business pursuing cosmetic surgery. People with minimal or no savings or financial credit are undertaking expensive and often complex cosmetic surgery. Dr. Hamra commented that many patients should be asked before undertaking an operation whether they could pay for surgery a second time if needed. This is not a snarky question to the patient, but a reality check as to whether they are in a position to pay for revision surgery if something goes wrong with the initial surgery. This question is unfortunately almost never asked of any patient.

To the extent possible, I have always striven to provide surgical revision of any suboptimal surgical result of my own at no additional charge to the patient. Patients are generally very happy and accepting of this approach, if not pleasantly surprised. Being a perfectionist, I will usually offer modest revisions such as the injection of

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botulinum toxin into a tonic eyebrow or the excision of a small roll of skin if the tarsal platform show on a cosmetic blepharoplasty is not perfectly symmetric. The total time investment to do this is minimal (20–60 minutes including all follow-up visits), and patient satisfaction is high. The next "step-up" in postoperative management would be the injection of a filler to better volumize the tear trough and periorbital area after lower blepharoplasty. I generally bundle this treatment into the blepharoplasty fee preoperatively, with the filler injected weeks or months postoperatively. This is accepted and favorable for the patients, making the filler treatment an expected accompaniment of the surgery, and lowering the stress and financial anxiety of this treatment. It is also a positive way to continue to connect with a postoperative patient who is generally appreciative and will continue to offer good reviews and refer family and friends. In occasional cases where we have a result that I believe is suboptimal and would benefit from filler, I may perform that treatment as a previously unplanned free service.

Life becomes complicated when the surgeon must refer the patient out to another physician to manage a complication they are unable to treat, or when significant expense is incurred in the medical evaluation and treatment of the patient. Years ago, a patient on postoperative antibiotics developed a high fever and was admitted one day postoperatively to the hospital to rule out sepsis. The patient's medical insurance company initially ruled this to be purely related to the preceding cosmetic surgery (despite a lack of any surgical wound infection and a possible unrelated urinary tract infection). On appeal, we were able to get the insurance company to cover this admission under the patient's health insurance plan. Had they refused, the hospital would have billed all charges at "usual and customary" rates, and the total would have easily exceeded $40,000 for a one-day hospitalization. This would have left an awkward and ethically, morally, and financially difficult situation in the relationship between the doctor and the patient. A colleague had a patient suffer a cardiac arrest preceding a facelift. The patient was resuscitated, but potentially any ischemic or arrhythmic condition in his heart and all future consequences could have been determined to be due to the aborted surgery. This patient fortunately had a third-party insurance purchased to cover a rare circumstance such as this, as his ischemic coronary disease had developed during his entire lifetime, but the cardiac arrest event was blamed on this elective procedure.

Finally, there are the challenges encountered in treating the patient who consults you for a suboptimal surgical result in which the original surgeon cannot correct the problem, won't correct the problem, or the patient has lost faith in the original surgeon and is seeking outside help. These patients carry all of the psychological baggage detailed by the authors in Chaps. 28 and 29, and are often financially "tapped out." Furthermore, they are typically extremely challenging to the treating physician, monopolizing the surgeon's time, and requiring very technically difficult and time-consuming surgery and postoperative care. Surgical results are often suboptimal at best, while expectations are high. It is important to distinguish these patients from those who may actually have an excellent result but still believe themselves to look bad, thus suggesting an element of body dysmorphia.

Surgeon fees for the revision of cosmetic surgery should be higher than those for a routine, first time surgical patient presenting to the same surgeon, as the procedure is more complex, requires more time and expertise, and the patient is much more challenging to deal with postoperatively than a "primary" patient treated as a clean slate. It can be expected that a surgeon experienced in patient selection, communication, surgical technique, and postoperative management will have 3–6% of primary cosmetic patients that create some sort of significant "trouble" postoperatively, versus 15–30% "trouble" patients when performing revision of other surgeon's work. In addition, it is important to realize that once you operate on a patient requiring revision, they become "yours," making the problems created by the previous surgeons, and the complaints against them, now your complaints and problems. One noted specialist in this arena has related the expectation of 3–5% of patients requesting and being given refunds of surgeon's fees due to postoperative patient concerns and unsatisfied expectations, which he looks at as a cost of doing business and a maneuver essential to "move on" for both the patient and the surgeon. A 20–100% upcharge for a complex revision procedure from charges for the "normal primary patient" charge is appropriate and routine.

Typical fees for a revision upper or lower blepharoplasty surgery, depending on surgical complexity, locale, reputation, and fees of the surgeon along with the unique characteristics of the patient, can easily top out at over $50,000 when surgical facility fees and other factors are included. The expense and expectations are very regional and practice specific. There is a geographic variability in cost, with the top southern California revision surgery specialists being on the upper end for fees and the more staid "flyover state" practices often being more approachable for many patients. Travel, time off of work, and recovery time can compound this expense. Finally, these more complex procedures are generally necessitated by the severity of the patient's injured anatomy, and the results after revision surgery may seem lackluster to a patient who may have paid over 10 times more for their revision than for the original surgery that went wrong.

When compounded with the psychological damage the patient with a "botched" surgery has suffered, it is easy to see how threatened or real litigation can enter the picture. This only further drains time, money, and other resources from both the original surgeon and the revising surgeon. The paper by Fante et al. [1] provides important data from the Ophthalmic Mutual Insurance Company for ophthalmologists including most oculofacial surgeons in the USA over the period from 2006 to 1016. Although only 19% of claims in oculofacial plastic surgery derived from a cosmetic surgery case, cosmetic dissatisfaction was the most common reason for a claim. Despite this, only two of 74 (2.7%) claims for cosmetic dissatisfaction closed with an indemnity payment to the litigant. Indemnity payments were low ($10,140 and $17,500), but despite a median defense cost of $1403 on these apparently largely spurious "cosmetic" claims, the range of defense cost was up to $125,408. Also of interest, 100% of "inadequate informed consent" claims and 83% of "unmet standard of care" claims led to an indemnity payment.

In some areas, there is an ethos and arrangement that a patient with a distinctly substandard outcome will receive a refund of their surgical fee from the original

surgeon or have their revision paid for by the original surgeon to the revising surgeon. I have always refused to be an intermediary on the receiving end of funds from another surgeon, and have told any patient who mentions this that they must deal with the original surgeon and bring payment over once they have settled with them. Patients suggesting this sort of arrangement have often seen multiple doctors already to discuss revision surgery and are simply hoping to enforce rules on the past and present surgeons that they see as favorable to them.

Revision cosmetic oculofacial surgery presents a morass of disagreeable issues ranging from patient psychology and unhappiness to the technical challenge and emotional drain on the revisionist surgeon. Anyone considering entering this "marketplace" as a specialist who will perform revision surgery on another surgeon's patients must consider whether they have the skill as a physician and surgeon to undertake these challenges. An appropriate practice setup that allows for the care of such injured patients and appropriate case selection, patient communication, and care is paramount. Ultimately, the quality of life for the patient and the surgeon is an important end-goal in this equation. *Caveat emptor!* would be the best advice to all in this undertaking.

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Systemic Risk Factors

2

Edward J. Wladis and Michael I. Rothschild

Successful and safe surgery relies on careful preparation and appropriate patient selection. This chapter focuses particularly on the systemic risk factors that should be considered in the preoperative evaluation of patients interested in undergoing periocular cosmetic surgery. The most common conditions to consider with the patient's primary physician or specialist include the following factors:

- Anticoagulation
- Autoimmune disease
- Thyroid disease
- Defibrillator/pacemaker
- Obstructive sleep apnea
- Pulmonary disorders

Anticoagulation

In light of the need to balance several considerations, preoperative discontinuation of anticoagulation requires a meticulous, collaborative approach. The use of blood thinners creates a serious risk of hemorrhagic complications and hematoma formation, whereas abrupt discontinuation of these agents dramatically increases the risk of thromboembolic disease [1]. Furthermore, each anticoagulant has its own biophysical properties and only specific agents may be pharmacologically reversed. As such, the management of anticoagulants is optimally handled through careful communication between the surgeon and the appropriate prescribing physicians (i.e., cardiologist, hematologist, etc.). Of note, a recent study demonstrated that 40% of

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Table 2.1 List of common anticoagulants and current recommendations regarding timing of discontinuation. Collaboration with the patient's medical team is critical

Agent	Timing of discontinuation
Aspirin	2 weeks before procedure
Warfarin	3–5 days before procedure
NSAIDs	1 week before procedure
Dabigatran	1 week before procedure
Fondaparinux	3–4 days before procedure
Rivaroxaban	3 days before procedure
Clopidogrel	5–7 days before procedure
Apixaban	48 hours before procedure

patients that undergo oculoplastic procedures take anticoagulants, and a sizeable cohort does not report this fact to the surgeon [2].

Determination of a given patient's risk of a thromboembolic event is the first step in identifying a meaningful treatment strategy. For example, patients with a mitral valve prosthesis, a history of cerebrovascular accident within the past 3–6 months, or severe thrombophilia are at markedly elevated risk of developing a thrombosis, whereas the risk is lower for those with an aortic valve prosthesis, a remote history of venous thromboembolism, or reversed atrial fibrillation. This risk must be carefully juxtaposed against the risks inherent to the procedure; minor interventions may not necessitate discontinuation of the anticoagulant, whereas more invasive procedures put the patient at increased risk of bleeding. Unfortunately, large-scale, well-designed studies regarding the optimal treatment strategy have not been performed, meaning that clinical judgment remains the gold standard in handling anticoagulation.

Cognizance of each patient's anticoagulant agent is critical to determining when to hold a medication [3]. For example, warfarin has a biologic half-life of 36–42 hours, and the international normalized ratio (INR) may take 2–4 days to normalize; as such, many cardiologists recommend holding the medication for 3–5 days preoperatively. Consequently, patients may be left with a subtherapeutic INR for up to 8 days, and many clinicians will recommend a bridging agent in situations with a high risk of thromboembolism.

In general, if the anticoagulant is going to be stopped, current guidelines have attempted to match the duration of action of an agent with the optimal timing for discontinuation. Please see Table 2.1 for a list of these recommendations.

Autoimmune Disease

Given the heterogeneity of autoimmune disease, preoperative considerations must be tailored to specific patients and their underlying etiologies. However, certain common features suggest guidelines to optimize outcomes.

Both the nature of these diseases and the medications inherent to managing these maladies may impair wound healing. Patients should be counseled regarding the impact of their underlying diseases on their recovery. Given that many of these ailments are associated with an underlying vasculitis that may make appropriate healing difficult, the course of the autoimmune disease should be optimized

preoperatively. Careful collaboration with a specialist in the individual disorder (i.e., rheumatologist) may be critical to ensuring that the patient's systemic disease is optimized and the timing of a surgical intervention is appropriate.

The nature of the surgical experience must be individualized, based on the extent of a given patient's comorbidities. Specifically, many patients with autoimmune disease suffer from cardiovascular ailments, suggesting that an appropriate preoperative evaluation may ensure a safer anesthetic regimen. Patients with vasculitis may experience hypertension, whereas those with systemic lupus erythematosus, granulomatosis with polyangiitis, and myasthenia gravis may experience cardiac conduction defects.

The implications of autoimmune disease may also impact the nature of inducing anesthesia. For instance, patients with rheumatoid arthritis may suffer from subglottic narrowing and decreased cervical spine mobility and fragility of the oral cavity may be common in patients with granulomatosis with polyangiitis. Preoperative consideration of these issues and consultation with the anesthesia provider may simplify the induction of anesthetic agents.

Some authorities have advocated discontinuing disease-modifying agents out of concern that the anti-inflammatory properties of these medications may promote infection. However, current practices favor continuing with most of these treatments through the pre- and postoperative course, in order to avoid a flare of the underlying autoimmune disease. Extrapolating from the orthopedic literature, the use of low-dose methotrexate in the perioperative period appears to control inflammatory signs without increasing infectious risks [4]. Nonetheless, the literature is less clear regarding the requirement to withhold biologic agents in the setting of periocular surgery, and the decision to do so should be made in conjunction with the prescribing provider.

Thyroid Disease

Given the common nature of thyroid disease in the general population, a knowledge of its preoperative implications merits considerable consideration. Current recommendations do not mandate routine screening for thyroid dysfunction, although an appropriate series of symptoms or examination findings suggests that thyroid-stimulating hormone levels should be checked [5].

Hypothyroidism carries serious concerns related to surgery. Specifically, anemia, increased risks of cardiovascular events, enhanced coagulability, and decreased respiratory drive, all contribute to increased complexity. Fortunately, with appropriate replacement therapy, these changes are generally reversible, and, where appropriate, surgical intervention should be delayed until thyroid status has been optimized.

Similarly, hyperthyroidism also carries cardiovascular implications, although the nature of these issues differs from the hypothyroid state. In addition to hypertension and tachycardia, patients with hyperthyroidism also experience water and sodium retention and markedly elevated risks of atrial fibrillation. As with hyperthyroidism,

surgery should be held until patients experience both symptomatic and serologic evidence of improvement. Some authorities also advocate the use of beta-blockers preoperatively to ensure control over the increased cardiac drive associated with hyperthyroidism.

Defibrillator/Pacemaker

Over three million Americans have received either a pacemaker or an implanted defibrillator, underscoring the frequency with which these entities are encountered in clinical practice [6]. Patients are generally encouraged to carry the manufacturer's card for the device, simplifying the interrogation process that is typically performed by the anesthesia service. Several societies have developed recommendations for optimal perioperative management of these devices.

The use of an electrocautery unit may interfere with these devices, as it generates electromagnetic interference. This interference may disrupt pacing, leading to asystole. In order to avoid this issue, the device can be reprogrammed to an asynchronous pacing algorithm. Coordination with the patient's cardiologist and consultation with the appropriate anesthesiologist will facilitate appropriate management to minimize arrhythmias.

Obstructive Sleep Apnea

The incidence of sleep apnea has risen dramatically and correlates with the increased prevalence of obesity. In the setting of anesthesia, sleep apnea may result in significant pulmonary complications (including pulmonary edema, prolonged time to extubation, respiratory distress, and oxygen desaturation) and cardiovascular maladies (including atrial fibrillation, congestive heart failure, cardiac arrest, and myocardial infarction).

In appropriately selected patients (i.e., typical body habitus, those with significant comorbidities, those with disordered sleep, etc.), coordination with primary care physicians is essential to ensure optimization. As with other preoperative risk factors, surgery should be delayed until sleep apnea has been adequately treated. Current guidelines do not support the use of positive airway pressure immediately before surgery, although a definitive plan to postoperatively reinstitute this modality should be developed before surgery [7].

Pulmonary Considerations

Postoperative pulmonary complications may occur in some patients, and appropriate preoperative assessment for at-risk patients may facilitate optimization to provide the safest course. Previous investigations have identified patient-specific risk factors that heighten concerns for postoperative problems, including advanced age,

a history of pulmonary ailments (i.e., asthma, chronic obstructive pulmonary disease), smoking, obstructive sleep apnea, hypertension, upper respiratory infections, obesity, pulmonary hypertension, malnutrition, and worse health status [8]. Procedures that involve general anesthesia and those that last longer than 3 hours are classically associated with pulmonary complications.

Based on these concerns, identification of patients who meet the criteria that raise concerns should undergo appropriate evaluation, and collaboration with the appropriate consultants is critical to the avoidance of problems.

Physical examination is the gold standard to assess the pulmonary risk, and adjunctive testing remains controversial. Nonetheless, the use of pulmonary function testing, chest radiography, and exercise evaluation may identify patients at heightened risk. Based on these results, the pulmonary status of at-risk patients should be optimized prior to surgical intervention.

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Periocular Risk Factors

3

Davi Araf and Jaqueline Silva de Rezende

Periocular Risk Factors

This chapter aims to discuss ocular and periocular risk factors in cosmetic oculofacial surgeries that may occasionally lead to a surgical outcome that falls short of patient expectations. Systemic risk factors are covered in detail in the preceding chapter.

Some of the main periocular factors to consider, among others, that could negatively impact the final surgical outcome include the following:

- Skin type and quality (texture, tone, laxity, actinic changes)
- Positive/negative vector globe position
- Blepharitis, dry eyes
- Blepharoptosis and/or eyebrow ptosis
- Facial asymmetry
- History of prior surgeries
- Conjunctival cicatrizing disorders
- Strabismus (double elevator palsy)
- Poor Bell's phenomenon, neurotrophic cornea, facial nerve palsy

Skin Type and Quality

It is necessary to assess skin type and quality (texture, tone, laxity, actinic changes), firmness, degree of hydration and sebum production, presence and location of rhytids, dyschromia, expression lines and signs of aging (keratosis, melanosis),

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presence of melasma, formation of spots, and permanent postinflammatory hyperpigmentation.

Skin Type (Fitzpatrick)

Patients with mild dermatochalasis or wrinkles, and who have Fitzpatrick phototype, or Fitzpatrick skin type, I to III (lighter skins), may benefit from the addition of other rejuvenating procedures during surgery to improve skin quality without resection, such as chemical peels, intense pulsed light phototherapy for solar lentigines and telangiectasias, and ablative resurfacing with CO_2 laser and radiofrequency [1].

Patients with Fitzpatrick phototypes between IV and VI (darker pigmented skin) have a tendency for more apparent scar formation, due to dyschromia or formation of hypertrophic scars and keloids. In such cases, parameters should be adjusted or the concentration of medication be reduced to avoid excessive and undesired scarring, hyperpigmentation, or hypopigmentation (Fig. 3.1a, b).

Positive/Negative Vector Position

Adequate eyelid vector analysis is important for surgery planning in cosmetic cases to avoid inadequate outcomes, especially when increased tension in the lower eyelid is desired. In this situation, assessment of globe prominence is important [8].

The relationship between the anterior corneal surface and the inferior orbital rim is evaluated in the sagittal plane. There are three categories: negative vector (the globe projects anterior to the rim, as a result of large eye and shallow orbit, or midface recession), neutral vector (the globe is in line with the inferior rim), and positive vector (the globe projects posterior to the rim, compatible with more prominent bone support).

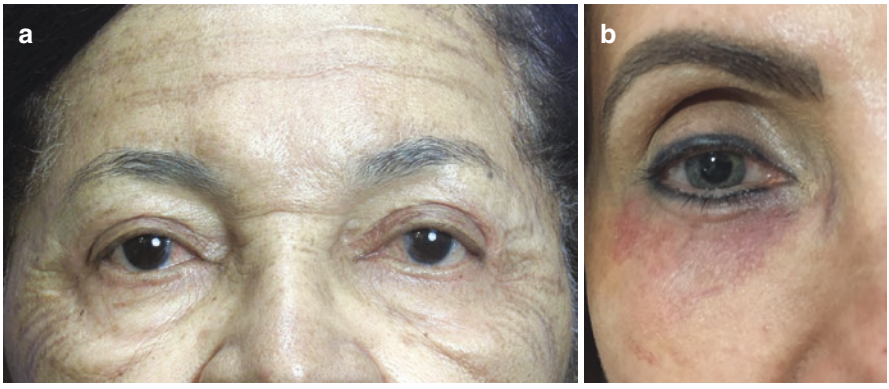

Fig. 3.1 Dyschromia following surgery (**a**) and skin treatments (**b**)

In cases of negative vector, if any procedure to increase tension in the lower eyelid is performed, it is possible to increase or induce a scleral show and lead to an even more prominent aspect of the eye. This lower eyelid retraction/scleral show occurs as the lower eyelid margin slides downward from the most prominent anterior projection of the globe. Modifications of surgical techniques to vertically lengthen the lower eyelid, insert supportive spacer grafts, or place orbital rim implants, or perform orbital decompression to change the vector may minimize this undesired aspect prior to considering cosmetic surgery [3].

Patients with a negative vector configuration have less midfacial support and are more at risk for eyelid malposition and contour irregularities after transconjunctival fat removal or transcutaneous blepharoplasty. Therefore, those with significant globe prominence and severe negative vector configuration may benefit from combined midface implants and midface lifting.

Regarding orbital fat in patients with a prominent eye, negative vector, and orbital fat protrusion, a fat-repositioning procedure may be more effective. Fat debulking would actually accentuate the globe prominence and risk retraction. For patients with a deeper-set eye, positive or neutral vector, and orbital fat protrusion, fat removal is more acceptable [4].

Blepharitis and Dry Eye

Patients should be carefully assessed in the preoperative evaluation prior to any oculofacial surgery for a history of dry eyes and decreased tear production that can worsen, particularly in the early postoperative period.

Symptoms related to dry eye, such as feelings of dryness, burning, foreign body sensation, irritation, hyperemia, pain, and ocular discomfort are important to assess and document. Prior refractive surgery, rheumatic diseases (rheumatoid arthritis, lupus), use of medicines (medications for high blood pressure, benzodiazepines, and antiglaucomatous eye drops) must also be considered, as they may also increase the risk of associated dry eyes.

Specific exams such as the Schirmer test (Fig. 3.2), tear film break-up time, and rose bengal test may be performed to assess tear production and quality, integrity of the lipid layer of the tear film, and possible filamentary keratitis. Clinical evidence

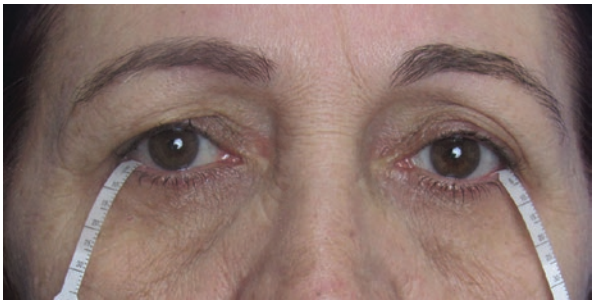

Fig. 3.2 Schirmer test

of lagophthalmos, superficial punctate keratopathy, or punctate epithelial erosions can also be assessed during blinking using the slit-lamp.

Confirmed hyposecretion can contribute to the onset or worsening of dry eye symptoms after blepharoplasty. Surgery in these patients should incorporate conservative cutaneous resection of the upper eyelids (to avoid lagophthalmos) and lower eyelids to prevent undesired lower eyelid retraction. Even patients without notable dry eyes prior to surgery may demonstrate some degree of transitory discomfort related to dryness postoperatively, especially women in the climacterium (hormonal factor) and patients with prior refractive surgery [2].

Patients with dry eyes should be carefully counseled about the postoperative risks of worsened symptoms, keratopathy, and potentially chronic discomfort and ulceration. This also allows the patient to demonstrate appropriate compliance with a regimen of artificial tear use prior to surgery, and punctal plugs can be considered if needed. In severe cases, surgery should not be recommended.

Blepharitis

The presence of blepharitis or meibomitis can also have an effect on patients with dry eye syndrome, due to alterations in the tear lipid layer. All patients with blepharitis should be treated prior to eyelid surgery, particularly in cases of *Staphylococcal* blepharitis, which may cause inflammation of the eyelid margin, resulting in eyelid margin ulceration, poliosis, eyelash breakage and thinning, hordeolum, chalazion, and epithelial keratitis.

Blepharoptosis, Eyebrow Ptosis, Facial Asymmetry

Eyelid or eyebrow ptosis, whether functional or cosmetic, should be addressed when present, to ensure a better final outcome. In the upper eyelid, evaluation should include skin laxity/tone; location, contour, and asymmetry of the upper eyelid folds; retraction; lacrimal gland prolapse/ptosis; and eyelid involutional/myogenic ptosis.

Blepharoptosis

When considering cosmetic blepharoplasty, the surgeon may focus on the skin excess and fat herniation, without assessing the upper eyelid properly. Failure to recognize concurrent blepharoptosis prior to surgery may result in a poor outcome [10]. If the skin redundancy sags over the eyelid margin, careful lifting of the skin can help assess the actual eyelid margin height in relation to the superior limbus.

If blepharoptosis is noted, adequate measurement of palpebral fissures, MRD_1 (eyelid margin-pupillary reflex distance), symmetry, eyelid crease height, and

levator muscle function should be performed to guide the surgical technique. A history of prior glaucoma surgery should also be documented to avoid elevating the eyelid too high, risking exposure of the trabeculectomy bleb.

Mild upper eyelid ptosis is rather frequent in patients with dermatochalasis and may be unmasked after blepharoplasty alone, resulting in postoperative dissatisfaction (Fig. 3.3). The 2.5% or 10% phenylephrine test to the ptotic side may indicate whether a concurrent conjunctivomullerectomy should be performed (Fig. 3.4a, b) [9].

Mild acquired involutional (or aponeurotic) blepharoptosis can be diagnosed via a low MRD_1, elevated eyelid crease height, and a decrease in the palpebral fissure with downgaze, such that the margin may block the pupil. In contrast, in congenital ptosis, there is an increase in the vertical fissure of the ptotic side in downgaze; in other words, the ptotic eyelid becomes higher than the contralateral side in downgaze [2].

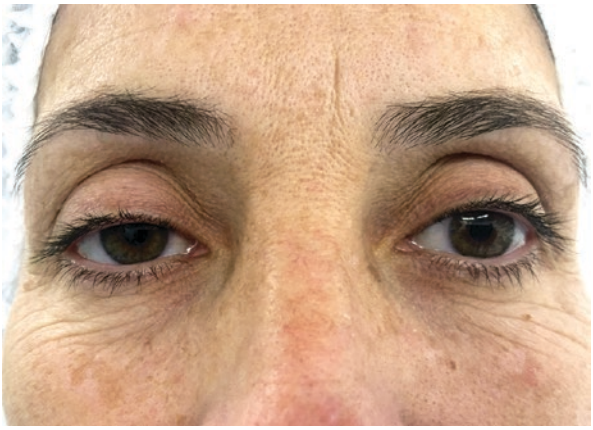

Fig. 3.3 Mild upper eyelid ptosis, right eye

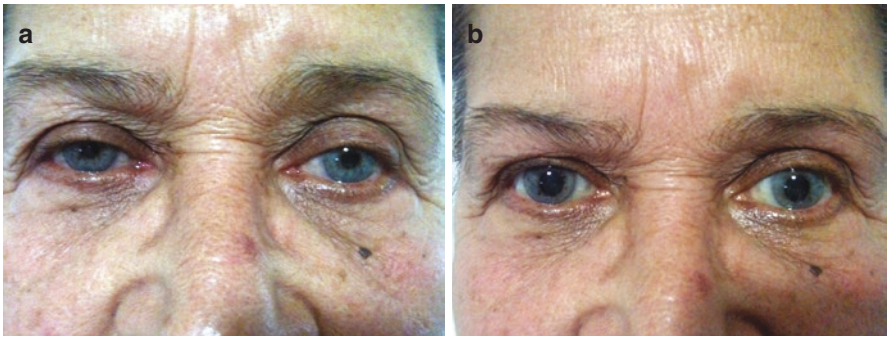

Fig. 3.4 Positive phenylephrine test. The ptotic right upper eyelid (**a**) elevates following instillation of phenylephrine on the right eye (**b**)

Eyebrow Ptosis

Analyzing the eyebrow position is essential prior to periocular cosmetic surgery, with the eyebrow in women typically 5–10 mm higher than the superior orbital rim (Fig. 3.5). The male eyebrow is often low along the orbital rim, flatter in contour, and thicker. Asymmetries in the eyebrow height should be noted, and may be related to asymmetric frontalis muscle flexion (Fig. 3.6). When one eyebrow is habitually elevated higher due to frontalis contraction, this may often be perceived by the patient as having a droopy eyelid, or more skin on the contralateral side, despite equal skin measurements. Noting whether the eyebrow ptosis is asymmetrical or segmental (lateral, medial) will also help identify the best surgical approach.

In cases of severe eyelid ptosis, the eyebrows may elevate further as a result of compensatory contraction of the frontalis muscle. However, patients with paresis or paralysis in the frontal portion of the facial nerve may demonstrate low eyebrows with a smooth forehead (Fig. 3.7).

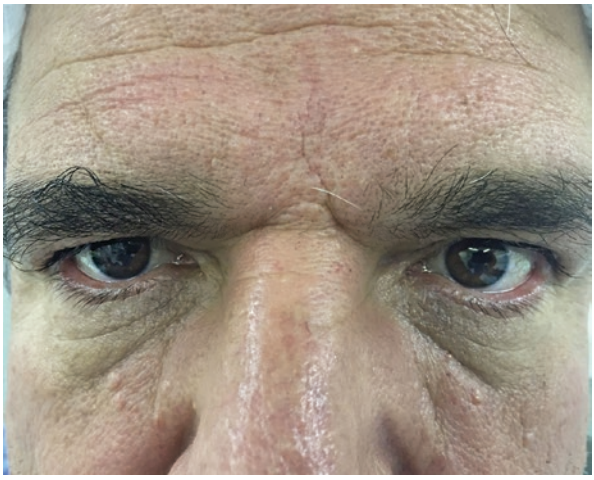

Fig. 3.5 Bilateral eyebrow ptosis

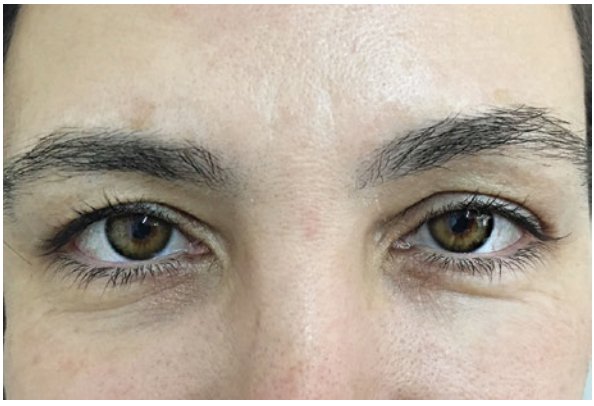

Fig. 3.6 Asymmetry caused by mild right eyebrow ptosis

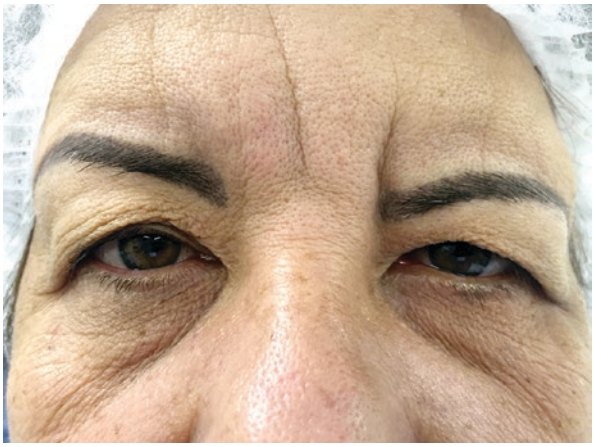

Fig. 3.7 Left eyebrow ptosis caused by paralysis of the facial nerve

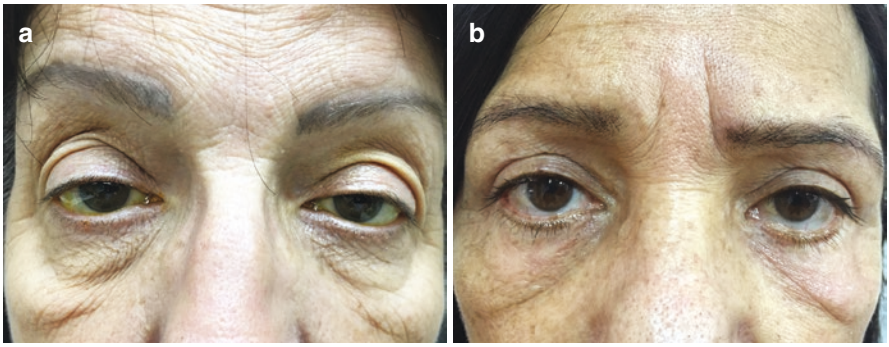

Fig. 3.8 Malar edema and festoons of the eyelid-cheek junction (**a**, **b**)

Besides eyelid and eyebrow ptosis, other facial areas should be evaluated carefully, with the goal of achieving an overall balanced and harmonious appearance. Some aspects to consider include presence of midfacial descent, malar edema, festoons, tear troughs, and deepening nasolabial fold creases (Fig. 3.8a, b). With midface ptosis and loss of soft tissue volume, hollowing of the inferior orbital rim and flattening of the malar region can be present. In these cases, volume augmentation and/or midface lifting with lower blepharoplasty may be indicated [2].

The lower eyelid should be examined for tarsal ligament laxity, retraction, punctal position, canthal angle dystopia, anterior lamellar shortage, and alterations in eyelid margin position (entropion, ectropion). These are discussed in more detail in subsequent chapters.

Preoperative tests to assess horizontal laxity of the lower eyelid include the distraction test and the snapback test (Fig. 3.9). Positive findings would suggest a higher risk of undesirable outcomes following lower blepharoplasty, such as eyelid retraction and ectropion. Adjunctive procedures, such as horizontal tightening with

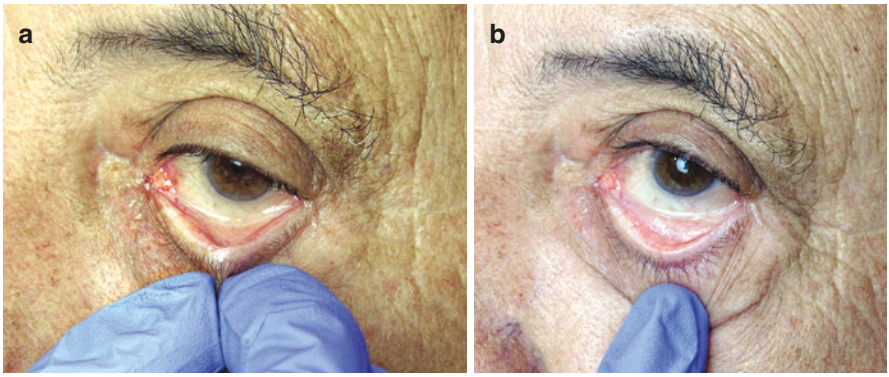

Fig. 3.9 (**a**) Distraction test, which measures the distance the eyelid can pull away from the globe surface. (**b**) Snapback test. Failure of the eyelid to quickly return to its normal position against the globe upon release of the eyelid indicates horizontal laxity

lateral canthopexy/canthoplasty, can thus be incorporated during surgery to minimize these risks, as well as considering a transconjunctival approach to prevent anterior and middle lamellar cicatrization [7].

Facial Asymmetry

It is important to discuss with the patient any perceived, or true, facial asymmetry to avoid noticing it only after surgery and erroneously attributing it to the procedure. Perceived static and dynamic asymmetries should be photographed and documented. It is often not necessary, or possible, to correct every asymmetry, and thorough discussion prior to surgery is essential to minimize postoperative dissatisfaction. Studies have demonstrated that patients' complaints regarding facial aging are often partially related to facial asymmetry, even when unrecognized by the patient [2].

As mentioned previously, in some cases, the asymmetry may occur with dynamic facial expression. For instance, a preference in elevation of one frontalis muscle may result in the appearance of a higher eyebrow and eyelid, as well as a deeper superior sulcus on that side, while the contralateral eyebrow/eyelid appears lower with more "pseudodermatochalasis." When measured in repose, however, the eyebrow heights may be symmetric and the amount of skin in the upper eyelids similar. Surgery should, therefore, be adjusted to correct for dynamic differences.

History of Prior Surgery

A history of prior surgery involving the periorbital region may be important, as there may be tissue adherence and fibrosis among various tissue planes. Previous removal of skin, muscle, and fat may also affect the surgical approach, and increase the risks of postoperative retraction or lagophthalmos.

Observing the characteristics of previous cutaneous scars, not necessarily in the periorbital region, can also be helpful to anticipate and minimize postoperative hypertrophic scars, keloids, hyperchromia (i.e., postinflammatory hyperpigmentation), and hypochromia.

Conjunctival Cicatrizing Disorders

Presence of cicatrizing diseases of the skin and conjunctiva, and evidence of symblepharon, should be noted. Symblepharon may be extensive, affecting the cornea or restricting ocular motility, or can be discreet/localized, simulating eyelid ptosis or focal eyelid retraction, entropion, or trichiasis.

Stabilization of the underlying disease is critical prior to surgery, in order to avoid acute exacerbation of the cicatrizing condition. This may include measures to eliminate irritative factors (such as trichiasis or dry eyes); in case of autoimmune diseases, immunosuppression may be required. It is also necessary to inform the patient that surgery may worsen the underlying disorder, despite appropriate precautions.

Strabismus

Unilateral inability to elevate the eye may occur due to a variety of local, peripheral, or central nervous system etiologies. Paresis and paralysis that affects both the superior rectus and ipsilateral inferior oblique muscle is termed double elevator palsy (DEP). DEP implies that both elevator muscles of one eye are weak, leading to restricted elevation and hypotropia. Since DEP is usually unilateral, it is sometimes referred to as monocular elevation deficiency [11].

In DEP, the deviation angle in the primary position varies, and compensatory head posture may be observed. The forced duction test is usually normal, but may sometimes reveal elevation restriction.

Caution must be taken in surgical candidates with this condition, due to the possible absence of Bell's phenomenon resulting in postoperative corneal exposure and lagophthalmos. They may also demonstrate pseudo-, rather than true, eyelid ptosis.

Poor Bell's Phenomenon, Neurotrophic Cornea, Facial Nerve Palsy

Assessing the presence and quality of Bell's phenomenon is critical in the preoperative evaluation, especially prior to upper eyelid blepharoplasty and ptosis repair.

Patients with neurological disorders who demonstrate a poor/absent Bell's phenomenon and impaired eyelid closure will have increased risks of developing postoperative ocular surface exposure, keratitis, and even corneal ulceration. If lagophthalmos is noted, the residual strength of the orbicularis muscle should be examined.

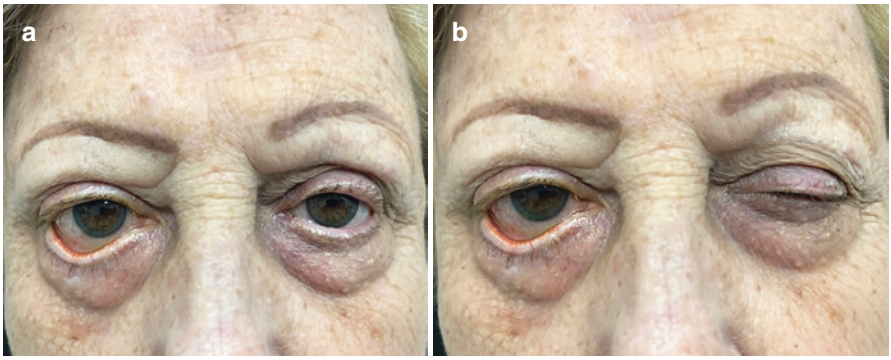

Fig. 3.10 Right lower eyelid ectropion (**a**) and lagophthalmos (**b**) secondary to facial paralysis

A poor Bell's phenomenon should warrant consideration of potential etiologies such as double elevator palsy, progressive chronic external ophthalmoplegia, oculopharyngeal muscular dystrophy, myotonic dystrophy, third cranial nerve palsy, and myasthenia gravis. Besides the postoperative exposure risks, binocular diplopia with eyelid elevation may be unmasked if concurrent motility deficits are present. In patients with myasthenia gravis, systemic treatment prior to surgery should be considered [6].

Patients with a previous history of facial nerve (seventh cranial nerve – CN VII) palsy warrant additional attention prior to oculofacial cosmetic surgery. Facial nerve palsy includes both paralysis and weakness of the seventh cranial nerve, with Bell's palsy (idiopathic, acute onset unilateral facial nerve palsy) as the most common etiology. However, facial palsy can be also idiopathic, congenital, infectious, traumatic, inflammatory, neoplastic, and iatrogenic [5].

Ocular symptoms and signs of facial nerve palsy include dry eyes, redness, tearing, burning, foreign body sensation, inability to close the eye, upper eyelid retraction, and lower eyelid ectropion.

Depending on the etiology, prognosis and recovery of function may vary. It is advisable to wait 6 months after onset to ensure stable symptoms prior to surgical intervention, unless corneal compromise is significant. Sequelae may include paralytic lagophthalmos, ectropion, eyebrow ptosis, and eyelid retraction (Fig. 3.10).

Patients may also demonstrate aberrant regeneration, synkinesis, and hemifacial spasm. Muscle tightness, discomfort, and facial asymmetry can be minimized with the use of botulinum toxin to selective muscles [5].

Preoperative Checklist

A thorough preoperative checklist should also include systemic comorbidities, prior surgeries, and medications used by the patient, particularly those that may cause intra- and postoperative complications. The previous chapter discussed the systemic risk factors in detail. In general, anesthetic complications or medication adverse

affects should be noted. Comorbidities such as diabetes mellitus, hypertension, and coagulation disorders may directly affect the surgical outcome. Tobacco smoking can have a negative effect on scarring and vascularization of skin grafts.

Medications for hypertension are typically taken on the day of surgery. Statins and antiplatelet medications should be suspended 7 days prior to surgery, and anticoagulants held 5 days prior. However, in patients with high risk for deep venous thrombosis, replacement bridging therapy with heparin should be considered. Phytotherapeutic medicines with anticoagulant or antiaggregant action should also be suspended. Estrogens increase the risk for thromboembolic events and should be suspended 1 month in advance. Oral hypoglycemic agents should not be taken on the day of the surgery. Subcutaneous insulin should be individualized for each case. As mentioned in the previous chapter, all medication recommendations should be closely coordinated with the patient's medical team and cardiologist.

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Psychological Risk Factors and Patient Selection

4

Paul S. Nassif and John W. Frederick

Introduction

Cosmetic surgery is often a strongly positive force in a patient's life, and multiple studies show that cosmetic procedures can improve a patient's overall social function and quality of life [1–3]. It can also reduce anxiety and neuroticisms. While most patients do experience a positive result, patient selection is key in maximizing this impact and avoiding unhappy patients with devastating psychological outcomes.

Various studies have shown that 47–70% of patients seen in consultation for cosmetic procedures meet the criteria for a mental disorder [4]. Meanwhile, 19% of cosmetic surgery patients report a mental health history compared to only 4% of non-cosmetic surgery patients [5]. The postoperative sequelae on a patient with underlying psychopathologies can range from general unhappiness or preoccupation to major depression with psychosis. Post-traumatic stress disorder (PTSD) can even be developed due to surgical intervention on a mentally unfit patient [6]. By identifying these patients preoperatively, postoperative pain and suffering can be reduced for both the patient and the physician.

Patient characteristics Associated with Poor Psychological Outcomes

Many factors have been associated with poor psychological outcomes in cosmetic surgery. While association of these factors has been made, formal evaluation and hypothesis testing of these factors is difficult due to various biases, difficulty validating diagnoses, and poor rates of patient participation. An analysis of

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psychosocial outcomes for patients seeking cosmetic surgery by Honigman et al. summarizes many of these factors nicely and includes the following [7]:

1. Demographic factors including being male and/or younger age
2. A known history of psychological illness such as depression or anxiety, dysmorphophobia, or personality disorder
3. Having relationship issues centered on the cosmetic procedure
4. Unrealistic expectations
5. Previous surgical procedure with "unacceptable" result
6. Minimal deformity

A pneumonic often used to summarize the patient demographics associated with psychopathology is SIMON: single, immature, male, overly expectant, and narcissistic. These patients should always be thoroughly evaluated in the preoperative setting with a low threshold for referral for formal psychological evaluation [8–10]. While this approach will require often unsavory discussions of psychological health at the time of initial consultation, it will protect the patient and surgeon from poor outcomes.

Body Dysmorphic Disorder

The importance of identifying body dysmorphic disorder (BDD) patients in the preoperative setting cannot be understated. As Dr. Constantian points out, BDD is often associated with childhood developmental abuse and neglect resulting in negative body image [11]. While these patients may not overtly display classical warning signs (such as SIMON), attention to detail at the time of initial consultation may raise concern for potential BDD patients. A number of studies evaluating cosmetic outcomes in patients with diagnosed body dysmorphic disorder have shown terrible patient satisfaction [7, 12]. Phillips et al. evaluated 109 adults with BDD who received cosmetic procedure for minimal objective deformity. Of the patients receiving surgical intervention, only 17% reported an improvement in their perceived deformity [13]. Surgeons polled who have operated on patients with BDD report that only 1% of patients are symptom-free after intervention [14]. If BDD is suspected, formal psychological evaluation should be initiated prior to any intervention.

Patient Evaluation and Selection

While the topic of psychological illness and cosmetic surgery has been thoroughly investigated and described, it does not necessarily help in identifying those patients at the time of consultation. It is important to begin all initial consultations with an open mind. Attention to detail in the initial history and physical is of extreme importance. This must include inquiring about the number of procedures the patient has

had for a specific complaint and the duration of the complaint or perceived deformity. It should also include a full treatment history for all cosmetic concerns. Aside from an overt history of mental illness, red flags at this time include a patient who is devastated by their complaint and have sought numerous interventions from multiple physicians. The patient will often report that they are "unable to function" or "cannot go outside" because of a cosmetic concern. At times, these patients will refer to previous physicians as "terrible," "crooks," or "the worst." In addition, any history of legal action or physical threats should raise serious concern and prompt formal psychological evaluation.

As the initial consultation continues, review of expectations will often reveal at-risk patients. This includes patients with plastic surgery addiction or those requesting extreme body modification. Unrealistic expectations are often expressed in terms of wanting to look "perfect" or to obtain "complete symmetry." In addition, many authors have established that expectations of enhancing social networking or establishing relationships (personal or professional) are concerning.

As facial cosmetic surgery becomes more widespread and accepted, young patients are more common. Through social media and online marketing, younger patients are presenting for procedures previously reserved for a much older demographic. Examples include temporal brow lift or conservative upper blepharoplasty. In all of these patients, a direct and formal discussion should be had with attention to goals and perception of deformity. Often, due to social media filters and photograph morphing programs, patient expectations must be carefully garnered. Unrealistic hopes to achieve increased social media presence, to look like a "filter," or to become famous through cosmetic surgery warrant concern.

With regard to assessing a patient with "minimal deformity," BDD must always be considered. Simple ways to help identify these patients include asking how much of the day they spend thinking about the deformity, if this has changed their life or daily behavior, and what impact surgery will have on their overall life. Any patient that is devastated by a minimal deformity and believes the surgery will completely change their life is of great concern.

There are formal screening tools for psychiatric illness, such as the Primary Care Evaluation of Mental Disorders, which may be used as an initial screening tool [15]. However, patients are often embarrassed or unwilling to complete this type of survey in the cosmetic office setting. They also may untruthfully answer questions to avoid further psychological interrogation. A more discreet approach involves careful evaluation of the patient's complaints and history. This must include a review of current medications with attention to psychiatric mediations, benzodiazepines, and amphetamine derivatives. Any cosmetic intervention should not proceed further in these patients until a formal psychiatric evaluation and clearance for the specific intervention have been carried out.

To make patient selection more complex, absence of a psychological illness does not necessarily make the patient an appropriate surgical candidate. The result of cosmetic surgery is, as reviewed above, open to interpretation. A "great" result for the surgeon may not equate to a "great" result for the patient. Meeting accepted measurements or creating a specific angle does not always create a happy patient.

To identify and avoid these patients, the importance of in-office discussion cannot be understated. Screening for these patients begins *before* the office visit. Interaction with the patient scheduler and office staff is extremely important. Any preliminary report of poor treatment or unreasonable expectations should not be ignored.

If, at the time of the initial consult or subsequent office visits, the patient is not willing to accept a less than perfect result, they are likely not an acceptable surgical candidate. If they are requesting an aesthetic that you, as the surgeon, do not agree with, they are not an acceptable surgical candidate. This can be seen in, for example, patients requesting over-rotated noses or extreme brow elevation. Reviewing and discussing before and after photos can help illuminate these patients' goals if they are not overtly stated at the time of consult. Repeat questioning such as, "But could you lift that a little higher?" or "Could we get a little more lift in my case?" should alert the surgeon that the patient may be expecting or wanting something either unobtainable or aesthetically extreme. In these cases, the surgeon must take control of the encounter and explicitly state their opinion and recommendation. This includes (1) reviewing that there are limits to all surgical procedures and (2) discussing aesthetic "norms." A realistic and achievable goal must be set by the surgeon and meticulously detailed in the medical record. This should also include having the patient sign an outline of the surgical procedure and goals of surgery. If an agreement cannot be made, the patient is not an appropriate surgical candidate and should not be offered surgery. If surgery is agreed upon, however, it is important to document all postoperative visits and allow the patient to include their own comments and opinions at each visit.

Conclusion

Cosmetic surgery patients have a high incidence of psychological illness, and it is the surgeon's responsibility and to the surgeon's benefit to identify and evaluate those patients with suspected psychopathology.

Prior to recommending formal psychiatric evaluation, a frank discussion should be had with the patient explained exactly why this is being recommended. This can be difficult for the practitioner due to fear of upsetting a potential patient, concern about a negative social media review, or simple lack of clinic time. However, by explaining the importance of psychological health in cosmetic surgery to the patient and offering to continue to help the patient after psychological evaluation, overall complications will be reduced, and improved patient satisfaction will be achieved.

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Part II

Intraoperative Considerations in Periocular Cosmetic Surgery

Anesthesia-Related Complications of Periocular Surgery

5

Sathyadeepak Ramesh and Jonathan A. Hoenig

Introduction: Why Do Surgeons Need to Know About Anesthesia?

Periocular surgery is now routinely performed on an outpatient basis, either with local anesthetic, intravenous sedation, or general anesthesia. Cases can even be performed without an anesthesiologist in the office – with local anesthetic and oral sedation. While patients and surgeons alike benefit from the efficiency and convenience of surgery in the ambulatory setting, intraoperative anesthesia-related complications can be devastating when unrecognized or improperly treated. The "captain of the ship" doctrine, while not necessarily legally defensible in many states [1], nevertheless places the surgeon at the center of any liability arising from an adverse event in the operating room even when not related to negligence on the surgeon's part. Moreover, the increasing prevalence of certified registered nurse anesthetists (CRNAs), who may even practice independently depending on location, muddies the waters of medicolegal responsibility should such an event occur [2]. Most importantly, prompt recognition of anesthetic-related complications can save lives, and the periocular surgeon has a responsibility to learn about the potential adverse effects of and treatments for these complications. Medically appropriate anesthesia leads to smoother surgery, an improved patient experience, and better outcomes.

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Risks of Local Anesthetic

Local anesthetic can be associated with several complications. Direct damage from injection into vital structures (vessels, nerves, and the globe itself) can lead to immediate (hemorrhage, vascular occlusion) or late (extraocular muscle fibrosis) complications. Care must be taken at all times to ensure that sharp objects are not directed toward the globe while injection, particularly in the patient who is not under general anesthetic. Sudden sneezing or coughing due to intravenous anesthetic can lead to inadvertent globe injury. Furthermore, hematoma can distort tissues and weaken action of muscles such as the levator, complicating surgical planning during ptosis surgery and blepharoplasty. Finally, patients metabolize local anesthetic at different rates and can even be unresponsive to certain types of anesthetic. Short-lived or inadequate anesthesia can lead to patient dissatisfaction and a compromised surgical result.

Local anesthetic systemic toxicity (LAST) can be a devastating phenomenon that can suddenly lead to potentially lethal complications. Local anesthetics act primarily through blockade of voltage-gated sodium channels, preventing action potentials from being generated in affected nerves [3]. These sodium channels are also present in the central nervous system and cardiac tissue, as well as all other tissues, such that increased concentrations can cause unwanted side effects. Local anesthetics within the same class have different pharmacokinetics, including binding affinity, diffusion coefficient, lipophilicity, plasma protein binding, and molecular weight; these factors account for varying toxicity among these drugs. Moreover, physiologic states that induce increased blood flow to the brain (e.g., hypercapnia) or heart (e.g., metabolic acidosis) can increase the free fraction of drug and worsen toxicity. Coadministration of epinephrine with its subsequent vasoconstriction can delay systemic absorption of the drug, allowing for increased doses to be given.

Early clinical suspicion and diagnosis are paramount to prompt treatment. Prodromal symptoms include a metallic taste in the mouth, dizziness, tinnitus, auditory/visual disturbances, and perioral numbness; frank toxicity can lead to seizures, cardiac dysrhythmias, and even cardiac arrest [4]. These effects are primarily dose dependent (Table 5.1), although idiosyncrasies exist – bupivacaine, in particular, unbinds more slowly from sodium channels than other anesthetics (including lidocaine and ropivacaine), leading to an increased fraction of bound receptors and greater risk of toxicity without prodromal symptoms [4]. In fact, cardiac dysrhythmias from bupivacaine can occur as the first presenting sign, prior to any prodrome

Table 5.1 Recommended local anesthetic doses

Local anesthetic	Maximum recommended dose (mg/kg)	Maximum adult dose (mg)
Bupivacaine	2 (2 with epinephrine)	150
Cocaine	1.5	1.5
Lidocaine	4.5 (7 with epinephrine)	200 (500 with epinephrine)
Prilocaine	6 (8 with epinephrine)	400 (600 with epinephrine)
Ropivacaine	3	225

Adapted from Butterworth et al. [5]

or central nervous system symptoms. Ropivacaine is the pure S(−) enantiomer of bupivacaine, which binds much less avidly to sodium channels than the R(+) enantiomer [5] and potentially exhibits decreased cardiotoxicity; however, given reduced potency, higher doses are typically injected which may negate this benefit. Liposomal bupivacaine (Exparel, Pacira Biosciences, Parsippany, NJ) allows slow dissociation of the anesthetic which may improve its safety profile, although this has not been tested.

Timing of these reactions can be immediate (from direct, inadvertent intravascular injections) to delayed (due to slow absorption from the infiltrated tissue into the intravascular space), with plasma concentrations sometimes reaching their peak hours after initial infiltration and, in some cases, after discharge from the surgery center [6]. In particular, patients in the extremes of age should be monitored closely due to decreased lean muscle mass, hypoalbuminemia, and impaired cardiorenal function leading to decreased drug metabolism.

Treatment is directed at the specific adverse effect of the toxicity. Standard cardiopulmonary resuscitation guidelines should be followed for cardiac dysrhythmias, hypoventilation, and central nervous system depression or seizure activity with key exceptions – epinephrine should be given at a dose of <1 μg/kg, and vasopressin, calcium channel blockers, beta adrenergic receptor blockers, and other local anesthetics (e.g., lidocaine) are to be avoided. Airway maintenance is key as hypercapnia can exacerbate local anesthetic toxicity [7]. Seizures should be treated with benzodiazepines. Most importantly, intravenous lipid infusion [8] should be administered at a dose of 1.5 mL/kg, followed by a continuous infusion of 0.25 mL/kg/min for a maximum of 10 mL/kg in 30 minutes [7]. Adults can be treated with a simplified regimen of 100 mL over 2–3 minutes followed by 200–250 mL of the 20% emulsion over 15–20 minutes [9], with a maximum of 12 mL/kg or 1 L to be given. Lipid emulsion creates a potential space in which the local anesthetic rapidly accumulates due to its lipophilicity and also exhibits cardioprotective effects [10] which may ameliorate ischemia-related or reperfusion-induced injury. While propofol does contain lipid, it is only a 10% emulsion, and any benefits are outweighed by an overdose of the propofol itself; as such, propofol itself cannot be used to treat LAST.

Risks of Systemic Anesthetics

Whether a patient is undergoing conscious sedation or general anesthesia, inhalational and/or intravenous anesthetics can cause complications that can be inconvenient or even catastrophic. The distinction of monitored anesthesia care (MAC) versus general anesthesia (GA) is subtle and has to do with the level of sedation of the patient rather than the device used to secure the airway (laryngeal mask airway (LMA), endotracheal tube (ETT), versus no device (with nasal cannula)). A patient with a nasal cannula and deep intravenous sedation, who is not responsive to external stimuli yet still breathes spontaneously, is still considered to have undergone general anesthetic. In comparison, patients undergoing conscious sedation (or MAC) can have varying levels of responsiveness and can even be awoken

completely for portions of the procedure (e.g., ptosis surgery). Patients undergoing any type of sedation incur risks associated with the medicines administered (commonly inhalational anesthetics, opiates, propofol, and benzodiazepines), the airway, or postoperative nausea and vomiting. A full treatise on best practice for anesthesia is out of the scope of this book, but we will focus on selected points that are relevant for the periocular surgeon.

Malignant hyperthermia is a rare but potentially life-threatening condition that occurs due to an inherited skeletal muscle disorder. In response to certain inhalational anesthetics or succinylcholine, susceptible individuals experience sustained muscular contraction that leads to hyperthermia, cardiac dysrhythmias, and, eventually, death. The earliest signs include elevated end-tidal CO_2 and tachypnea; clinical suspicion should remain high in the young patient who is overbreathing the ventilator, and prompt recognition and treatment with discontinuation of the anesthetic and infusion of intravenous dantrolene (2.5 mg/kg loading dose, and then 1 mg/kg until the patient improves) can save the patient's life. All surgical areas where inhalational or intravenous anesthetic is administered should have a malignant hyperthermia treatment cart, even if the surgical area is within the plastic surgeon's office.

Airway-related complications, whether they are due to laryngospasm, pharyngeal obstruction, a misplaced tube, or hypoventilation/apnea, lead to downstream hypoxia and ischemic brain damage. Obstruction is common in patients with diagnosed or undiagnosed sleep apnea. Laryngospasm is particularly common in the pediatric population [11]. Respiratory depression or central apnea can result from excess dosages of sedative medicines. A reactive airway (e.g., from recent infection) can lead to coughing and straining during surgery. Aspiration risk can be reduced by adhering to published *nil per os* (NPO) guidelines [12]; in the event an LMA or nasal cannula is used, the airway is unprotected from gastric contents, and strict adherence to published guidelines is mandatory for elective surgery. The surgeon must be prepared to deal intraoperatively with these complications by helping the anesthesia staff secure the airway. This may include providing a sterile jaw thrust/chin lift, allowing an oral airway or LMA/ETT to be placed, or deferring cautery so that more concentrated oxygen can be delivered.

Cardiovascular complications including dysrhythmias and hypotension/hypertension can also occur. Continuous monitoring is necessary when any patient undergoes sedation, and staff should be trained in the relevant cardiovascular resuscitation protocols. It is crucial for the surgeon to recognize that it is *impossible* to attend to both the patient's vital signs and the surgical procedure at hand. As such, there should always be a dedicated staff member to continuously evaluate the patient's level of sedation, oxygenation, and other vital signs at all times – this can be an anesthesiologist, nurse anesthetist, or the circulating room nurse. All tools necessary for resuscitation (including airway management, drugs, and defibrillator) should be readily available and routinely checked for function. Staff should be trained and up to date on best practices in advanced cardiac life support. Most importantly, dysrhythmias and cardiovascular anomalies should be detected in an early state that obviates the need for dramatic interventions such as defibrillation.

Thorough communication with an attentive anesthetist is key to preventing disasters before they occur.

Each drug has a specific side effect profile that includes both dose-related and idiosyncratic reactions [13]. Benzodiazepines provide rapid anxiolysis and amnesia, which is often desirable for the initial injection of local anesthetic. However, in combination with opioids, this can cause respiratory depression or apnea. An atypical reaction to benzodiazepines can cause the patient to exhibit *increased* agitation or even delirium. Opioids can provide significant analgesia with some sedation and antitussive effect, at the risk of increased respiratory depression. Fentanyl in particular can cause chest wall rigidity in an idiosyncratic reaction that makes ventilation ineffective; reversal of the opioid with naloxone is key to treating this reaction. Propofol provides excellent sedation with ease of titration, although synergistically causes respiratory depression in combination with opioids and benzodiazepines. Dexmedetomidine avoids these risks of respiratory depression, although there is a higher risk of bradycardia, hypotension, and prolonged recovery due to a delayed peak effect. Any of these medications may cause a prolonged emergence from anesthesia, and staff in the recovery area should be available for continuous monitoring of sedated patients. Ketamine provides amnesia and analgesia without less risk of respiratory depression; however, a dissociative state may develop that confounds typical sedative effects, and hypersalivation may exacerbate a reactive airway. Adequate local anesthetic is key to allowing the patient to remain comfortable under sedation; in our practice, we are able to perform facelifts with oral benzodiazepines and local anesthetic, if the patient so desires. A thorough evaluation of the patient and thoughtful discussion with the anesthesia staff about the duration of surgery and level of cooperation necessary will allow the best cocktail of medicines to be given for each patient.

Fire Risk

Assessment of intraoperative fire risk is critical for the periocular surgeon given the proximity to the airway and common use of unsecured methods to deliver oxygen (e.g., nasal cannula). The "fire triad" describes the elements necessary for a fire to occur – an ignition source (cautery), oxidizer (intraoperative oxygen delivery), and fuel (hair, gauze, preparatory solutions, drapes, etc.) [14]. While most fires are quickly arrested, the consequences can be no less catastrophic, and an operating room fire is a "never" event.

Monopolar cautery and handheld battery-powered cautery are the most common ignition sources, and patient skin/hair and surgical gauze were the most common fuels [14]. Alcohol-based preparations also carry a higher risk of fire, and standard practice is to clean the face with 10% iodine solution; if chlorhexidine is required, then a 3-minute drying time is recommended with care to ensure no pooling of solution.

Supplemental oxygen delivery is the most common oxidizer, although a significant percentage of fires were reported to occur without any high-flow oxygen

delivered. As such, the surgeon must be aware that reducing oxygen delivery is important (ideally <30%) but not sufficient to eliminate the risk of fire while using cautery. Open draping of the face also allows rapid diffusion of concentrated pockets of oxygen, both reducing risk of ignition and limiting severity of fires should they occur. Should the patient require continuous high-flow oxygen delivery and concurrent cautery use, a sealed gas delivery device (e.g., LMA or ETT) should be considered.

Finally, battery-operated cautery devices have a disproportionately higher risk of ignition compared to other devices, and caution should be exercised. Bipolar cautery likely has the least risk of ignition, although the risk is not nil. Regardless of the type of cautery used, continuous communication between the surgeon and anesthesia staff is vital to reducing the risk of operating room fire.

Miscellaneous Risks

Loss of intravenous access can lead to inadequate anesthesia and an awake patient. Inability to treat dysrhythmias, drug reactions, or other cardiovascular abnormalities can lead to complications. Infiltrated needles can also lead to a compartment syndrome, which, if not quickly diagnosed, can lead to loss of function in the downstream appendages. Equipment failure, while thankfully rare, can complicate procedures. Backups of all relevant equipment must be available on site. Procedures must be in place for power outages, fires, or natural disasters. Protocols for dealing with these are well established by the certifying agencies for surgical centers. Care must be taken to ensure that the surgical facility, be it the office, outpatient surgical center, or hospital, is in compliance with these requirements.

Conclusion

Potential intraoperative complications during periocular surgery are numerous, and it is impossible to predict or account for each possibility. However, good patient outcomes depend on prompt recognition and appropriate treatment. Thorough preoperative and intraoperative planning between the surgeon, nurses, and anesthesia staff is critical in providing safe and effective anesthesia for the patient's periocular procedure.

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Surgeon-Related Complications

6

Craig N. Czyz

Infection

The periocular region has a robust, highly anastomotic vascular supply that allows for a reduced infection rate compared to other surgical sites [1]. The National Nosocomial Infections Surveillance system reported a postoperative infection rate of approximately 2% for all types of surgery [2]. In contrast, studies of common periocular procedures place the infection rate between 0.02% and 0.4% [3–5]. Despite these favorable statistics, serious infections can occur involving atypical mycobacteria, *Staphylococcus aureus*, and group A β-hemolytic *Streptococcus* necrotizing fasciitis.

Periorbital postoperative infections can be grouped into preseptal and orbital cellulitis. Preseptal cellulitis, also known as periorbital cellulitis, is infection that is confined to the eyelid skin and subcutaneous tissues anterior to the orbital septum. On examination, the eyelids are warm, edematous, erythematous, and tender to palpation. The extraocular motility is normal, and there is no proptosis. The most common organisms causing preseptal cellulitis are *Streptococcus pyogenes*, *Staphylococcus aureus*, and *Haemophilus influenzae* type B.

Recent reports suggest an increase in the incidence of cutaneous atypical mycobacteria postoperative infections [6, 7]. Cutaneous atypical mycobacterium infections are often difficult to identify causing a delay in diagnosis with potentially unfavorable outcomes. Onset of infection can range from 1 to 12 weeks postoperatively with the appearance of firm nodules, edema, erythema, and sometimes discharge (Figs. 6.1 and 6.2) [6]. Diagnosis is made by tissue culture and histopathologic evaluation. Treatment consists of systemic antibiotic therapy based upon organism sensitivity and may be combined with surgical debridement. Topical antibiotic treatment may be of benefit. Steroid therapy can prolong the course of infection and

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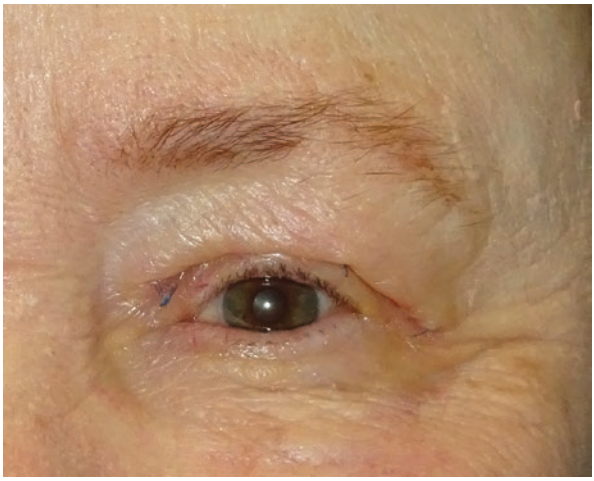

Fig. 6.1 Atypical mycobacteria 1 week post-op: Patient at 7 days postoperative visit following bilateral upper blepharoplasty. Sutures were removed at visit and routine healing was noted bilaterally

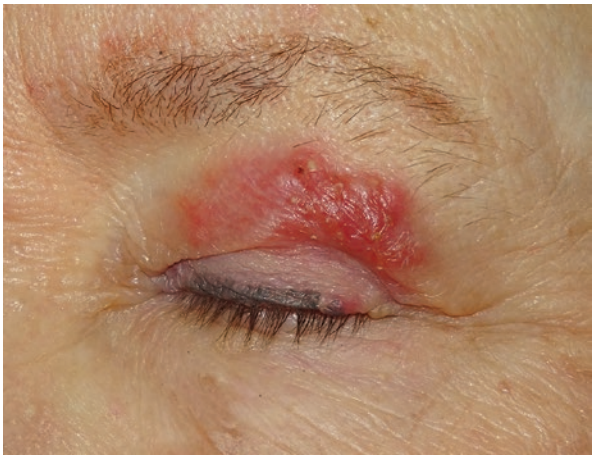

Fig. 6.2 Atypical mycobacteria 2 months post-op: Patient at approximately 60 days postoperative returned with erythema and pustule formation on the left upper eyelid that began 3–4 days prior. Right upper lid was normal. A tissue biopsy was taken which returned a diagnosis of *Mycobacterium chelonae*

should be avoided. Consultation with an infectious disease specialist may be helpful for selecting appropriate antibiotic therapy. Frequent follow-up is required to assess the treatment progress. The duration of treatment is typically greater than 5 weeks with a range of 4 to 24 weeks (Fig. 6.3) [6, 8].

Orbital cellulitis occurs when the infectious process involves the tissues posterior to the orbital septum. The clinical presentation differs from preseptal cellulitis by the additional symptoms of increased pain, proptosis, restriction of ocular motility, pupillary defects, dyschromatopsia, and loss of vision. Alterations in globe position, proptosis (exophthalmos), pupillary defects, and significantly decreased vision should not be seen if the process is isolated to the preseptal area. The most common causative organisms of orbital cellulitis are the same as those involved in preseptal

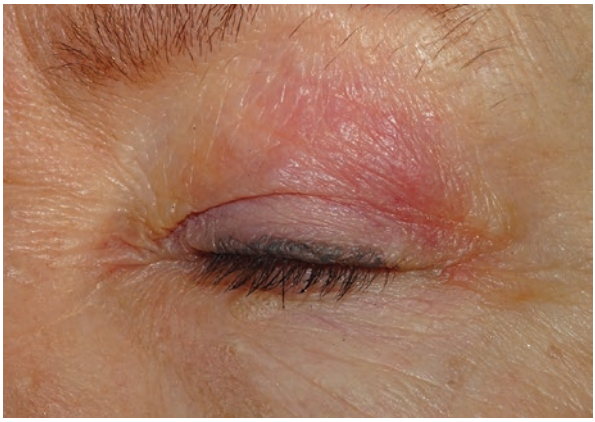

Fig. 6.3 Atypical mycobacteria 2 months post-treatment – 4 months post-op: Patient at 120 days postoperative and 60 days post-oral and topical antibiotic treatment for mycobacterium infection of the left upper lid. Patient was placed on oral clarithromycin and topical tobramycin ophthalmic ointment. Tissue texture and erythema gradually improved with appropriate treatment

cellulitis: *Streptococcus pyogenes*, *Staphylococcus aureus*, and *Haemophilus influenzae* type B.

Preseptal cellulitis is initially managed with oral antibiotics and clinical monitoring. Orbital cellulitis management is more aggressive, and early recognition and treatment is paramount to prevent further complications, such as subperiosteal abscess, orbital abscess, cavernous sinus thrombosis, optic nerve compression, meningitis, panophthalmitis, brain abscess, or vision loss. In cases of orbital cellulitis, the patient is admitted to the hospital for close observation, computed tomography (CT) of orbits and the brain is performed, and blood cultures and intravenous (IV) broad-spectrum antibiotics are started immediately. No other testing should delay treatment with the IV antibiotics. The patient should be monitored for clinical progression or improvement with serial visual acuity, pupillary testing, and confrontation visual fields. In the absence of noticeable improvement within 24–48 hours, CT should be repeated, and addition or alteration of antibiotics is considered. Radiologic identification of an orbital abscess, particularly in an adult, typically warrants surgical intervention.

Surgical intervention is indicated when there is inadequate improvement with antibiotics and/or evidence of an orbital abscess, progressive visual loss, and visual field constriction. There are primarily two types of interventions – orbital decompression and orbitotomy with exploration and drainage. Surgical approaches for drainage of orbital abscess include opening the upper eyelid blepharoplasty incision to reach the affected area, the Kronlein-Burke approach (lateral orbital wall orbitotomy), an inferior transconjunctival incision following the pathway of the lower eyelid blepharoplasty incision, or a transantral Caldwell-Luc decompression

(medial and inferior wall orbitotomy). The medial orbit can also be accessed through a trans-nasal endoscopic approach.

Orbital Hemorrhage

Orbital hemorrhage is one of the most feared complications of orbital and periorbital surgery. Orbital hemorrhage is the most common cause of postoperative permanent vision loss, and it usually occurs within the first 24 hours after surgery (Fig. 6.4). The mechanism of permanent vision loss from orbital hemorrhage is believed to be elevated intraocular (IOP) and intraorbital pressure (OP) caused by hematoma. Orbital compartment syndrome (OCS) describes a condition where there is an increase in intraorbital pressure within the confined orbital volume. When the intraorbital pressure exceeds the arterial pressure, optic nerve or choroidal ischemia may lead to irreversible vision loss. Risk factors for orbital hemorrhage include thyroid associated orbitopathy, blood dyscrasias, hypertension, atherosclerosis, vascular disease, and anticoagulation [9]. Careful assessment of the patient's risk factors for hemorrhaging should be performed prior to performing periorbital surgery. Any patient that complains of extreme pain, asymmetric swelling, proptosis, dimming or loss of vision postoperatively might have an orbital hemorrhage and must urgently be evaluated and treated. A complete ophthalmologic examination, including visual acuity, pupil assessment, intraocular pressure, and dilated fundus exam, should be performed but should delay treatment if there is an obvious collection of blood. Diagnosis is primarily made by clinical examination; however, orbital CT may be a useful adjunct.

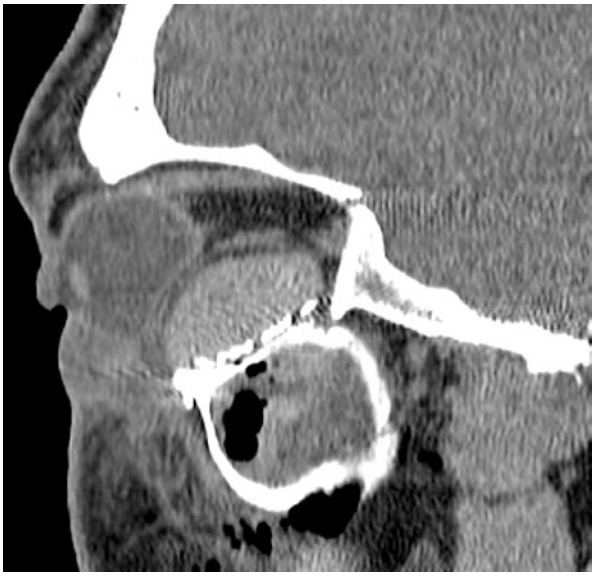

Fig. 6.4 Sagittal CT image showing a large orbital hemorrhage 12 hours following orbital floor fracture repair. The titanium implant can be seen inferior to the hemorrhage. Orbital compartment syndrome was diagnosed clinically in this case based upon the deformation of the globe and nerve on CT, a complete APD, increased IOP, globally decreased ocular motility, orbital pain, and no light perception (NLP) vision

Intraoperative hemostasis is crucial in prevention of orbital hemorrhage. In the postoperative period, one may consider the use of antiemetics to prevent hemorrhage secondary to valsalva. Medical management may include the use of systemic corticosteroids to reduce orbital and periorbital tissue edema. If intraocular pressure is elevated, topical or systemic medications to control intraocular pressure may be used to temporarily protect the optic nerve. Treatment of elevated intraocular pressure is only a temporizing measure to decrease the incidence of optic nerve insult. However, decreasing the intraocular pressure with combinant increased orbital pressure may further diminish intraocular blood flow. In cases where vision is intact and the hemorrhage is felt to be stable, progression can be followed with monitoring of the pupils and color plates, exophthalmometry, and serial Humphrey or Goldmann visual field testing. Serial orbital CTs can also be used to monitor progression; however, there are radiation risks with repeated exposures. There are also disposable compartment pressure measuring devices that use a standard 18-gauge needle and can provide objective orbital pressure measurements [10].

Definitive management of a progressive orbital hemorrhage causing orbital compartment syndrome is surgical intervention. The periorbital incision can be opened and explored, cauterizing or ligating any potential sources of bleeding. Any visualized clots are removed and compartmentalized blood evacuated. If the patient's presenting condition is severe, or progresses, then a lateral canthotomy and cantholysis is performed. When this does not sufficiently reduce the vision threatening symptoms, orbital decompression may be performed. Decompression can involve the canthal cutdown technique, where the orbital septum is opened at the site of the canthotomy incision and blunt dissection is used to disrupt the various orbital compartment septae [11]. The septum is incised at the 7–8 o'clock position in the right eye and 4–5 o'clock position in the left eye as these areas are devoid of ocular muscles and nerves. The inferolateral orbit can also be explored through the cantholysis opening to release loculated compartments of heme within the orbital septae [12]. If further decompression is required, the orbital floor can be infractured with a freer elevator. In the majority of cases, canthotomy and cantholysis, with canthal cutdown, are adequate to reduce the orbital pressure and prevent further optic nerve compromise. It is possible to reverse visual loss caused by orbital hemorrhage with immediate and aggressive surgical intervention. Therefore, recognizing the signs and symptoms of orbital hemorrhage and prompt intervention are instrumental in preventing permanent vision loss.

Globe Perforation

Globe perforation, or rupture, can occur during any periocular procedure. The globe is at risk for perforation during injection of local anesthetics, incision, dissection, cautery, laser usage, and suturing (Fig. 6.5). Globe perforation is an ophthalmic emergency and can lead to permanent vision loss. Perforation risks can be decreased by the use of plastic or metallic corneoscleral protective shields, placed prior to

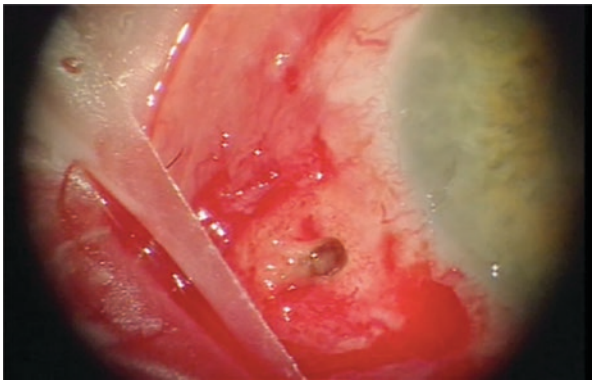

Fig. 6.5 Full-thickness penetration of globe, possibly from overaggressive removal of nasal fat pad with monopolar cautery. The patient went on to develop endophthalmitis resulting in no light perception vision (NLP)

surgery. A topical ocular anesthetic should be placed on the eye prior to insertion. Anesthetic should be applied approximately every 45 minutes or when the patient complains of ocular discomfort. If using laser for incision or dissection, nonreflective metallic shields should be used.

The placement of a corneoscleral shield at the start of surgery and proper injection and surgical technique can help decrease the chances of globe perforation, but the shield will only protect the area it covers. It is still possible for uncovered portions of the sclera to be perforated. The conjunctiva can also be lacerated without perforation. Seidel testing can be performed to evaluate for a leak of aqueous humor or vitreous from the wound to rule out perforation. However, puncture wounds can be self-sealing. A dilated funduscopic evaluation should be performed in the event of any suspected perforation incident.

Globe perforation or rupture is an ophthalmic emergency. The surgical procedure should be halted. There should be no manipulation of the eye. Broad-spectrum antibiotics should be given topically and intravenously, and an eye shield placed over the eye. An ophthalmologic evaluation must be performed immediately for evaluation and emergent repair if required.

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Part III

Postoperative Considerations in Periocular Cosmetic Surgery

Post-blepharoplasty Dry Eye

7

Craig N. Czyz and Morris E. Hartstein

Dry eye is often seen secondary to the complications of lagophthalmos, eyelid retraction, or lacrimal gland injury. However, individuals with preexisting eye dry syndrome can have exacerbations or increased severity of their symptoms, even when there is no frank lagophthalmos. Patients who have undergone laser vision correction are at an increased risk for developing dry eye following blepharoplasty. In this population of patients, extreme care should be taken to avoid lagophthalmos and lower eyelid retraction. However, even without lagophthalmos, this population is at risk for developing significant dry eye after blepharoplasty. It is advisable that blepharoplasty should not be attempted sooner than 6 months following laser vision correction. Patients in this population should be identified during the preoperative assessment and informed of the potential for increased risk of complications.

Patients experiencing dry eye will complain of eye irritation, foreign body sensation, eye redness, and potentially blurred vision. Individuals with preexisting dry eye syndrome can experience an increase in any of these symptoms following blepharoplasty. Dry eye predominantly results from inadequate tear production, instability of the tear film, or a deficiency in quality of the any tear film components. Following overly aggressive blepharoplasty, dryness may be caused or exacerbated by lagophthalmos, lid retraction, incomplete blink, or lacrimal gland injury. Even with a conservative blepharoplasty, a disturbance in any one of layers of the tear film can tip the susceptible patient over the edge into severe dry eye.

Conservative management of dry eye syndrome is comprised of ocular lubrication with artificial tears and/or lubricating ointment. Postoperative symptoms of dry eye may occur even in the absence of complications. Symptoms of dryness may

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abate as the normal speed and frequency of the blink returns when orbicularis function normalizes. Patients with preexisting dry eye syndrome should be lubricated more aggressively in the early postoperative recovery period. In patients who are refractory to ocular lubrication, punctal plugs are sometimes beneficial in alleviating symptoms of dryness. Besides aggressive lubrication, topical steroid drops can help alleviate associated inflammation and improve the dry eye symptoms. Another topical anti-inflammatory medication is Restasis, which takes at least 6 weeks to produce an effect. Topical cyclosporine has been used to increase tear production, but it is better suited as a long-term intervention in chronic dry eyes syndrome than as acute therapy.

Oral medications, such as doxycycline, can help improve meibomian gland function. It was thought that omega-3 had a similar effect, but this been largely disproven. There are other oral supplements such as flax seed oil pills, cod liver oil pills, as well as some commercial products specifically for dry eye. In certain patients, these can be extremely effective. They also have few to no side effects so it is easy to have patients try them.

Finally, a number of devices aimed at treating dry eye have come onto the market in recent years. Most of these devices focus on improving meibomian gland dysfunction. LipiFlow (Johnson and Johnson TearScience), IPL (Lumenis), and Tixel (Novoxel) are just a few of the devices on the market in this space. While many patients have been successfully treated using these devices, there is still a lack of evidence-based studies proving their effectiveness, and cost can be prohibitive for many patients.

Surgical management of dry eye is limited to correction of the complications of lid function such as lagophthalmos and eyelid retraction. *The corrective methods are discussed elsewhere in this chapter*. In cases where punctual occlusion is clinically beneficial, permanent surgical punctual occlusion can be performed following evaluation and recommendation by an ophthalmologist. The best way to prevent post-blepharoplasty dry eye is to screen patients carefully, maximize preoperative treatment in those who may be susceptible, and consider a more conservative procedure in those who are at risk. It is best to not take a cosmetic patient and turn them into a functional one.

Chemosis

8

Tsong Qiang Kwong and Naresh Joshi

Introduction

Chemosis is a phenomenon whereby edema accumulates in the bulbar and sometimes forniceal conjunctiva, creating a jellylike appearance on the ocular surface. In mild cases patients can be asymptomatic, although a wide range of symptoms which include redness, irritation, pain and epiphora have been reported. Visual disturbance such as monocular diplopia can even occur due to the altered tear dynamics. In cases where chemosis is severe, eyelid closure can be compromised resulting in sight-threatening complications derived from corneal exposure.

Chemosis has been well described as nonspecific reaction to many ocular, orbital and periocular conditions as well as a reported complication of functional and cosmetic oculofacial surgery [1, 2].

Causes of Chemosis

- Conjunctivitis – allergic, bacterial and viral
- Ocular rubbing
- Oculofacial surgery
- Angioedema
- Thyroid eye disease and other congestive orbital diseases

One case series has reported the incidence of chemosis following lower eyelid blepharoplasties to be around 15%. The incidence following upper eyelid blepharoplasties, however, is significantly lower at 0.8%. Interestingly, with combined upper

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and lower eyelid blepharoplasty, chemosis occurred in approximately a third of patients [3].

Etiology

It appears that chemosis is a common end point for many conditions, but the pathological mechanism is poorly understood.

As the conjunctiva is loosely adherent to the underlying Tenon's capsule (also known as fascia bulbi, bulbar sheath) which in turn is loosely adherent to the sclera, there are potential spaces for fluid accumulation.

The primary driver, particularly in iatrogenic cases, is the disruption of the normal lymphatic system during surgery which will prevent edema from draining adequately. This leads to fluid accumulation that can be very slow to resolve. Cadaveric anatomical studies have elucidated how interconnecting deep and superficial lymphatic systems drain lymph from the eyelids [4]. The conjunctival lymph usually drains through the tarsal plate to the deep lymphatic system. Incision and dissection within the superficial infraorbital region could potentially disrupt the superficial lymphatic system, whereas the deep system is more vulnerable to dissection around the orbicularis retaining ligament and zygomaticocutaneous ligament. It has been suggested that simultaneous surgical disruption to both the superficial and deep lymphatic system makes postoperative chemosis more likely.

Secondary drivers include postsurgical inflammation which increases conjunctival capillary permeability leading to serous fluid leakage into these potential spaces.

Additionally, focal dryness as a result of conjunctival exposure whether intraoperatively or postoperatively also has a role to play in the development of chemosis [5, 6].

Desiccation of the conjunctiva leads to vascular endothelial dysfunction which similarly to inflammation produces serous fluid extravasation. Postoperative chemosis may inhibit eyelid closure, particularly when significant and prolapsing over the eyelid margin, and the subsequent lagophthalmos causes further conjunctival desiccation and chemosis, leading to a vicious cycle [5, 6].

Risk Factors

A few case series have attempted to identify risk factors for the development of chemosis [5, 6]

Preoperative

- Male
- Poor blink/dry eye/lagophthalmos – increased risk of postoperative exposure and conjunctival desiccation

- Ocular allergy history
- Conjunctivochalasis
- Eyelid laxity
- Smoking
- Diabetes
- Excessive sodium consumption leading to fluid retention

Intraoperative

- Prolonged surgical time
- More extensive surgery (i.e. simultaneous upper and lower eyelid blepharoplasty/face lift surgery)
- Transcutaneous lower eyelid blepharoplasty
- Excessive dissection and cautery
- Lateral canthal surgery

Classification

The authors prefer to simply classify chemosis according to whether the area of involvement is focal (Fig. 8.1) or diffuse (Fig. 8.2) and whether the extent of chemosis is causing lagophthalmos or eyelid malposition (Fig. 8.2).

Other classifications have been employed particularly in relation to thyroid eye disease.

In the VISA classification score for thyroid eye disease, chemosis is classified according to severity [7].

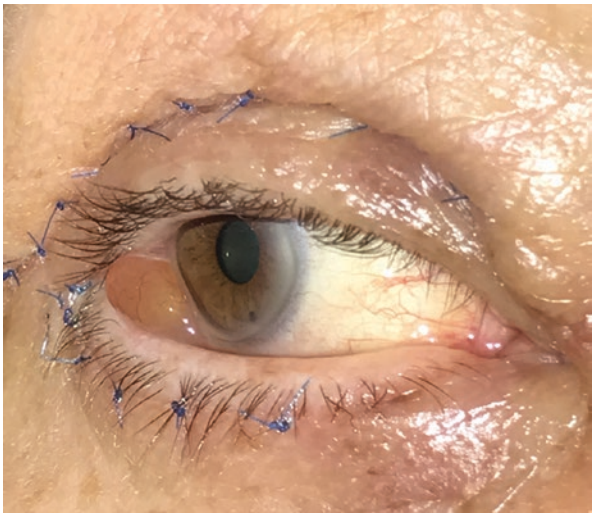

Fig. 8.1 Focal chemosis. Right-sided temporal chemosis anterior to the grey line

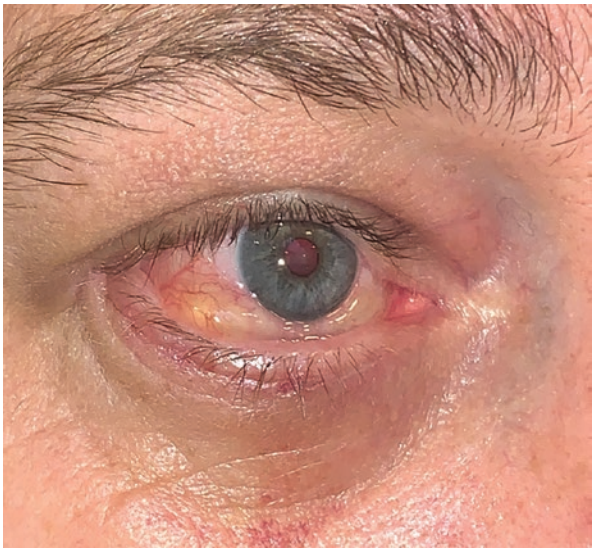

Fig. 8.2 Diffuse chemosis extending both temporally and nasally causing lower eyelid inferior displacement

- Type 1 – Conjunctiva lies behind grey line allowing complete eyelid closure
- Type 2 – Conjunctiva extends anterior to grey line usually resulting in lagophthalmos

Two additional types have been postulated for cases following oculofacial surgery which are subchronic (Type 3) and associated with lower eyelid malposition (Type 4) [6].

Why Is It Something We Need to Worry About?

Most cases of chemosis are mild where it resolves spontaneously during the early postoperative period with use of regular lubricating drops.

However, some cases can be severe when the lids are unable to close, and corneal exposure keratopathy and dellen formation may occur that risk vision. Chemosis might also be severe enough to result in lower eyelid malposition and if not treated early will lead to lower eyelid ectropion which would require further surgery to correct.

What Can One Do to Prevent This?

Preoperative

- Assess for presence of lagophthalmos, ocular surface exposure, eyelid laxity
- Consider using preoperative anti-inflammatory medications

Intraoperative

- Maintain normotensive anesthesia, elevated head position, minimal IV fluids
- Use corneal protector, regular lubrication during procedure to prevent conjunctival desiccation
- Manually apply intermittent forced eyelid closure during surgery
- Limit surgical dissection
- Consider an eyelid-tightening procedure if horizontal laxity is present
- Consider a temporary tarsorrhaphy in cases with extensive dissection
- Consider Frost suture tarsorrhaphy
- Intraoperative steroid/topical vasoconstrictor

Postoperative

- Apply a postoperative overnight pressure patch
- Recommend routine use of postoperative artificial tears and ointment
- Limited sodium consumption advice

Management

Most chemosis is prevented with routine care in the early postoperative period. However, conservative management options below should be started should chemosis be reported by the patient or noted on examination.

Conservative Management

- Frequent preservative-free lubricant drops during the day and ointment at night
- Topical steroids drops
- Prolonged eye patch for several days

If persistent and recurrent despite above treatment, reassess the other causes of chemosis and consider checking systemic parameters such as thyroid function.

Consider early surgical intervention in cases where there is lagophthalmos or if there is eyelid malposition.

Surgical Drainage of Chemosis

- Apply proxymetacaine and tetracaine drops.
- Place a cotton tip applicator soaked in tetracaine for 2 minutes on the chemotic area (Fig. 8.3a).

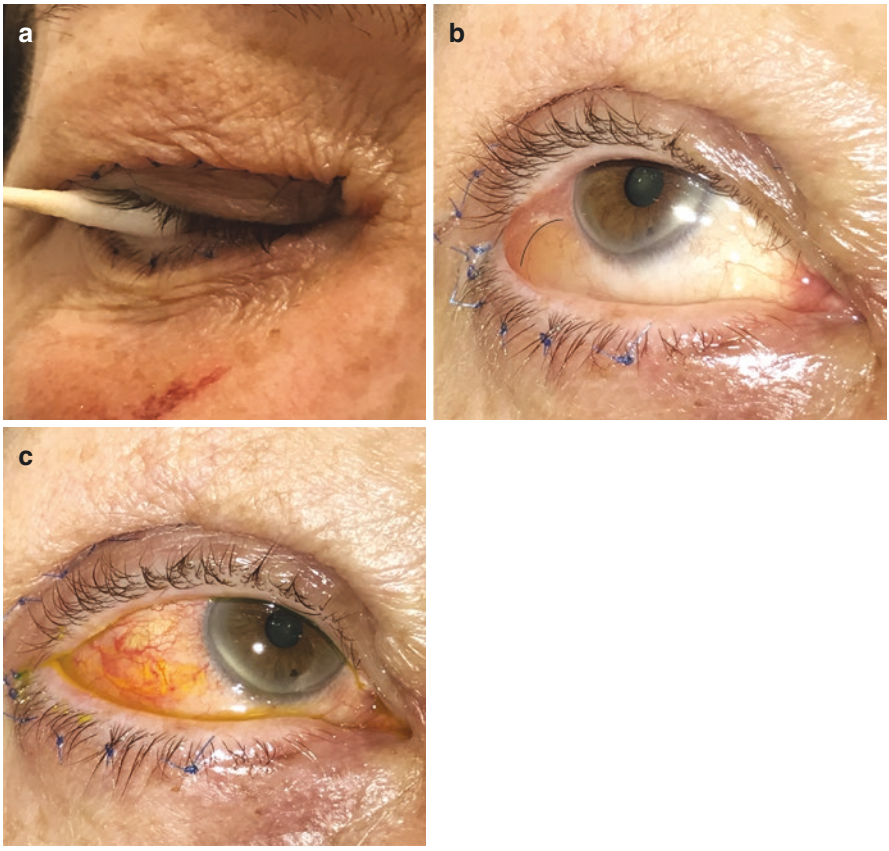

Fig. 8.3 (**a**) Tetracaine-soaked cotton buds applied to the region of chemosis. (**b**) Site of conjunctival incision indicated by the curvilinear black line. (**c**) Flattening of conjunctiva seen after milking fluid out of the incision site

- At an inferior point of focal chemosis, incise the conjunctiva with spring scissors and gently splay the blades to enlarge the opening (Fig. 8.3b).
- Make an incision through Tenon's capsule radially and splay scissor blades to enlarge the opening.
- Using tetracaine-soaked cotton tip applicators, milk the fluid out through the incisions until the area is flat (Fig. 8.3c).
- Consider multiple incisions if there is more extensive swelling.
- Once drained, apply a compressive padding for 2–3 days or a large 20 mm bandage contact lens for 5–7 days.
- High recurrence/reaccumulation of fluid is not uncommon, particularly without prolonged pressure patching or large contact lens.
- Once the chemosis has resolved without recurrence, then any residual conjunctivochalasis should be treated by simple excision.

Other reported techniques to manage persistent chemosis include:

- Modified Snellen suture to restore inferior fornix, although there is a risk of creating more inflammation and foreign body reaction [8].
- Conjunctivoplasty can be considered – Westcott scissors are used to cut a limbal peritomy through Tenon's fascia, followed by subconjunctival/sub-Tenon's fascial dissection to the fornix [9].
- Snip conjunctivoplasty – excision of small strip of conjunctiva and Tenon's capsule at the inferior edge of chemosis [10].
- Perilimbal needle manipulation – a 27-gauge needle can be used to cause bleeding and release of fluid [11].
- Subconjunctival tetracycline in the area of chemosis to act as a sclerosant that induces chemical closure of the subconjunctival space [12].
- High-frequency radiowave electrocautery to the interpalpebral bulbar conjunctiva – thought to create adhesions between the substantia propria and conjunctival epithelium as well as cause cicatrization of the chemotic conjunctiva [13].

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Eyelid Crease Asymmetry

9

Kenneth Steinsapir

Introduction

High creases that are asymmetric are cosmetically unacceptable to our patients. Often this issue is ignored or dismissed by the operative surgeon. It is important to listen to your patient and their concerns. This chapter discusses this issue, its underlying anatomy and associated features, and how it is corrected. However, the number one treatment is prevention. For that reason, a few words on this are in order.

1. Eyelids should be assessed for ptosis and latent ptosis. In assessing unilateral ptosis, the likelihood of a sequential, contralateral Hering's law ptosis must be ruled out. That requires unilateral phenylephrine testing on the ptotic eyelid to determine if the contralateral eyelid will fall when the ptotic eyelid is raised. When this is documented, ptosis surgery at the time of initial blepharoplasty should be performed bilaterally [1, 2].
2. Too much focus has been placed on the removal of the skin, muscle, and fat rather than creating eyelid structure.
3. The mobile eyelid platform must not be sutured to immobile structures such as the superolateral orbital rim (so-called brassiere suture [3]) or the orbital septum (so-called supratarsal fixation). The anchor blepharoplasty makes a hard crease between the eyelid platform skin, the orbicularis oculi muscle, and levator aponeurosis [4]. These are all mobile structures.

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4. Creases should be lower than described in the past and carefully measured and marked to ensure symmetry. Asian creases should be between 5.5 and 7.5 mm for double folds. In Western eyelids, the crease should be set between 6.5 and 8 mm. The location of a natural crease is no justification for making a high eyelid crease incision.

Post-Upper Blepharoplasty Syndrome (PUBS)

Patients are often still told "nothing can be done to lower an upper eyelid crease after blepharoplasty." Twenty years ago, that statement was accurate. Innovative work has yielded a means for addressing unsatisfactory Asian eyelid surgery where even a small overcorrection of the eyelid crease position is often highly unsatisfactory [5]. This has given us a range of tools for lowering the upper eyelid crease in both Asian and Western eyelids (Video 9.1).

Fundamentally we see two types of eyelids: innie and outie. While these are lay words, they give us a context in which to think about eyelids. Geologists have terms for land strata that fold relative to an axial center. "Antiform" refers to land strata that are convex relative to an axial center. An outward upper eyelid fold is analogous to this type of topography, and I refer to that outward - folding eyelid as an "antiform" eyelid (Fig. 9.1). There are two sources of the volume in the antiform eyelid when the eye is open. One source is anterior orbital fat volume that prolapses forward in a relaxed orbital septum. The other source of volume is the retro-orbicularis oculi fat pad or sub-brow pad. These two volumes blend and make up the volume of the upper eyelid fold in a normal "outie" upper eyelid fold. In geologic terms, "synform" refers to land strata that are concave relative to an axial center. The inward upper eyelid with the so-called hollow sulcus, I refer to as a "synform" eyelid (Fig. 9.2). Quite commonly

Fig. 9.1 Antiform upper eyelid fold. This is a normal upper eyelid with a fold that partially covers the upper eyelid platform. Volume of the upper eyelid fold is contributed by both the sub-brow retro-orbicularis oculi fat pad and anterior orbital fat that bulges forward behind a lax orbital septum.

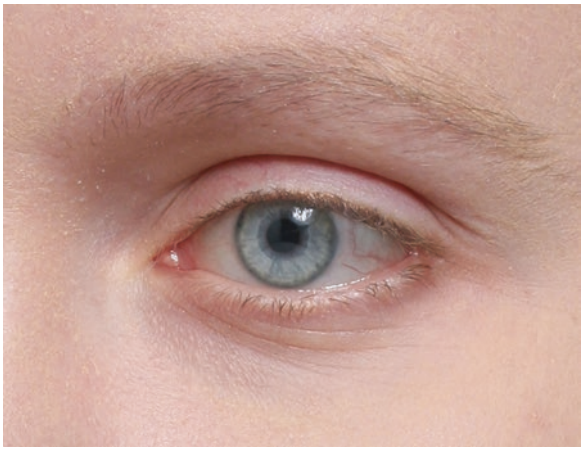

Fig. 9.2 Synform upper eyelid fold. In this eyelid, there is a relative absence of volume in the upper eyelid soft tissue. Notice that the eyelid is ptotic. The sulcus is high with a centrally disinserted upper eyelid fold. There is generally an associated compensatory eyebrow elevation reducing the contribution of the retro-orbicularis oculi fat pad to the upper eyelid volume. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

Fig. 9.3 Typical post-upper blepharoplasty appearance with a hollow upper eyelid sulcus, compensatory eyebrow elevation, loose eyelid platform skin, upper eyelid ptosis, and upper eyelid eyelash ptosis. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

one sees with these synform eyelids upper eyelid ptosis and a high or absent upper eyelid crease. Generally, a compensatory eyebrow elevation is also present.

Anatomic Considerations

The post-upper blepharoplasty syndrome (PUBS) includes the follow features to varying degrees: a high or absent upper eyelid crease, a hollow upper eyelid sulcus (synform fold eyelid), compensatory eyebrow elevation, upper eyelid ptosis, an indistinct eyelid crease with "crepey" upper eyelid platform skin, and eyelash ptosis (Fig. 9.3). This is a very common eyelid configuration after blepharoplasty. As

others have pointed out, preservation of the upper eyelid fold is a desirable outcome of upper blepharoplasty [6]. In order to lower a crease, the inferior edge of the levator aponeurosis needs to be sewn onto the anterior surface of the eyelid tarsus at the level of the new crease. To reposition the levator aponeurosis, one needs to know where to find it. Normally it will be found behind the orbital septum and under the anterior orbital fat. However, in the post-blepharoplasty eyelid, it is often folded into the internal scar from the prior blepharoplasty.

In the post-upper blepharoplasty syndrome (PUBS) eyelid, there will be a partial or nearly complete white line disinsertion of the central levator aponeurosis. Normally the levator aponeurosis, the fan-shaped distal tendon of the palpebrae superioris muscle, inserts across the tarsus in the pretarsal space of the eyelid (Fig. 9.4). In a white line disinsertion, the horns of the levator aponeurosis are intact medially and laterally in the upper eyelid. The surgeon, who opens the pretarsal space by removing pretarsal skin and orbicularis, expects to encounter the distal expanse of the central levator inserting into the tarsus. Instead, in these PUBS eyelids, what is encountered is the absence of the distal levator aponeurosis in this space (Fig. 9.5). One is viewing instead the tarsus, the superior vascular arcade, and the superior tarsal (Mueller's) muscle. The flap above this contains the disinserted distal levator aponeurosis. The levator must be identified and mobilized out to this scar tissue to reconstruct its proper insertion in the eyelid. This scar tissue develops after the eyelid is closed following upper blepharoplasty (Fig. 9.6). It comes from the septostomy or septal opening performed to expose and excise retroseptal orbital fat.

If the levator is fully disinserted, the tarsus is cleanly exposed, making a dissection between the levator aponeurosis and the Mueller's superior tarsal muscle relatively straightforward. When the levator is partially disinserted, one observes an anterior layer of the levator incorporated into the septal scar and a posterior sheath over the tarsus [7]. This posterior sheath must be incised and dissected off the tarsus to enter the potential space between the superior tarsal muscle and the posterior surface of the levator aponeurosis. On the anterior surface of the levator aponeurosis, the orbital septum inferior to the septostomy runs into the levator aponeurosis where these two structures fuse at the septolevator junction. Some believe that this

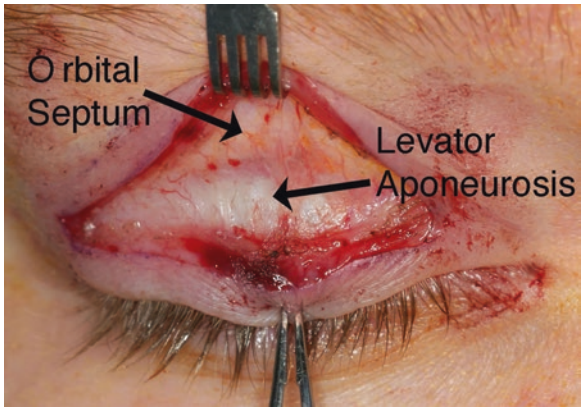

Fig. 9.4 The upper eyelid has been opened into the pretarsal space. The orbital septum and the inferior expanse of the levator aponeurosis are visible in this surgical dissection. They are in their normal anatomic positions. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

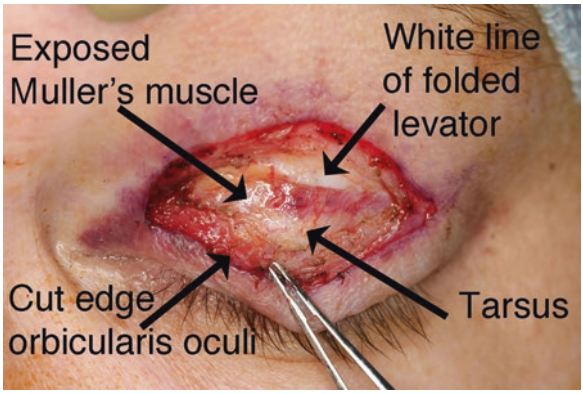

Fig. 9.5 Dissected eyelid showing a white line disinsertion of the levator aponeurosis. The white line is the folded edge of the disinserted levator. One is seeing the undersurface of the levator aponeurosis. This tendon needs to be mobilized to from septal scar tissue that developed as a result of the original blepharoplasty. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

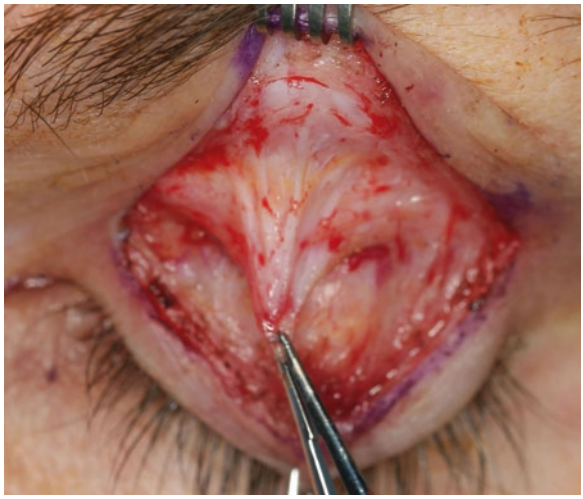

Fig. 9.6 This demonstrates the septal scar that caused the distal aponeurosis to disinsert in the eyelid shown in Fig. 9.5. The levator aponeurosis is bound into this scar and must be mobilized to reconstruct the eyelid. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

location defines the upper eyelid crease [8]. In order to lower the crease, it is necessary to identify the levator so it can be mobilized with dissection and optimally positioned into the eyelid.

Crease Lowering Surgery

The upper eyelid crease can be raised or lowered as desired. Raising a crease is straightforward but not so lowering a crease. That is generally due to a lack of anatomic understanding. The prior discussion should be to help the surgeon

conceptually. In PUBS eyelids, the anatomy has been altered. The levator aponeurosis and the septal scar are both white. For this reason, it is impossible to perform the surgery that will be described under general anesthesia. The patient must be cooperative so they can look up or down as directed. Intravenous sedation leaves the patient comfortable, cooperative, but sedated. Local anesthesia must be parsimoniously injected. Once the levator palpebrae superior muscle becomes anesthetized, it is impossible to accurately advance the levator aponeurosis, and this is a potential source of complications that will be discussed below.

The first step is to mark the upper eyelid. The new crease will be defined by the lower skin excision mark. As noted above, these are generally made between 5.5 and 8 mm depending on personal considerations and ethnic factors. Asian eyelid creases should be lower (Fig. 9.7). Often the preoperative post-blepharoplasty crease can be as high as 14 mm or more. It is not necessary or desirable to remove all of the skin between the location of the new crease and the prior crease. Often there is insufficient skin for this to even be possible. When the old crease is not so high, its removal can be carried out with a conservative skin excision. In designing the new crease, one wants the eyelid platform skin and orbicularis to be snug to the new crease to tighten the upper eyelid platform and support the upper eyelid lashes. There is no formula for this. The levator will be advanced as needed to the new crease, but intraoperative judgment must be exercised. The needed excisions are limited. Commonly only 3–6 mm of skin is removed from these revisional eyelids. The shape of the excision is concavo-convex (Fig. 9.7) and should not extend beyond the orbital rim. In entering the eyelid, it is important to inspect the pretarsal space. In a normal eyelid, once the skin and orbicularis have been excised, one should be looking at the distal levator aponeurosis as it inserts over the tarsus. As noted above, the levator in these eyelids is generally disinserted and pulled into the pre-septal scar from the original eyelid surgery. A careful dissection is then needed to identify and preserve the distal levator aponeurosis. This requires a dissection just under the cut edge of the orbicularis oculi muscle along the superior edge of the blepharoplasty wound (Fig. 9.8). Doing so will expose the remnants of the intact distal orbital septum and levator. Once exposed, making a vertical cut through the orbital septum down to the level of the fusion with the levator aponeurosis, the

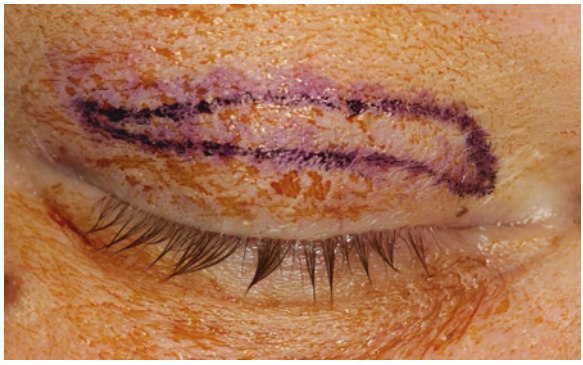

Fig. 9.7 The skin marking set a new crease height between 5.5 and 8 mm depending on the clinical circumstanced. To avoid making a visible scar laterally, the incision is stopped lateral before the orbital rim. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

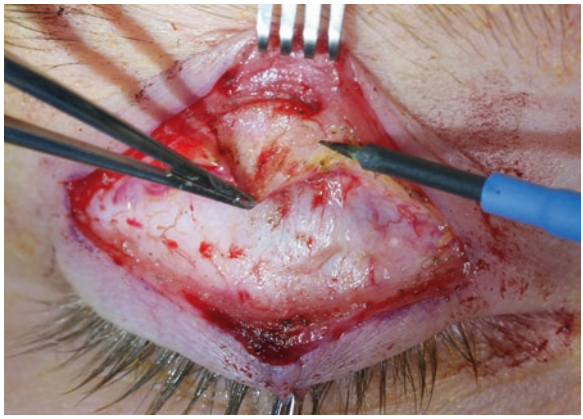

Fig. 9.8 The folded leading edge of the levator aponeurosis being dissected from underneath the cut edge of the orbicularis oculi muscle at the superior blepharoplasty wound. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

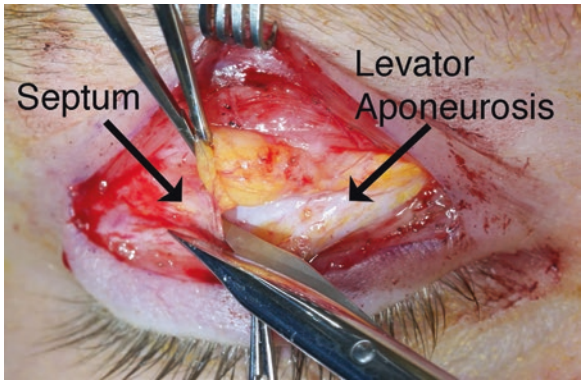

Fig. 9.9 The Westcott scissors blade is incorporating the distal orbital septum as it inserts into the levator aponeurosis. The forceps is holding the anterior orbital fat to aid in exposure. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

remnants of the pre-septal fat and levator aponeurosis can be laid out (Fig. 9.9). Once the septum is opened and laid out, the extent of the levator can be identified by lifting off the retroseptal fat. It is not necessary or desirable to resect this fat. That fat is needed to restore volume to the upper eyelid fold. At this point, the surgery becomes an anterior levator ptosis surgery, which will be described in brief.

Those who are comfortable with anterior levator resection ptosis surgery will be very comfortable with what needs to be done. For others, additional operative detail is provided. The distal levator is assessed. In some cases, it is cleanly disinserted from its attachments to the anterior surface of the upper eyelid tarsus. In that case a direct dissection can be performed between the levator aponeurosis and the superior tarsal muscle. In other cases, the levator is effectively split with posterior fibers remaining adherent to the anterior tarsus. To expose the anterior tarsus, it is necessary to perform a dissection to incise the distal levator and dissect it off of the anterior tarsal surface. This dissection is performed with a high-temperature battery-operated cautery (Fig. 9.10). Once the dissection reaches the superior limit of the tarsus, dissection continues between the superior tarsal muscle (Mueller's muscle) and the posterior aspect of the levator aponeurosis. This is in a potential

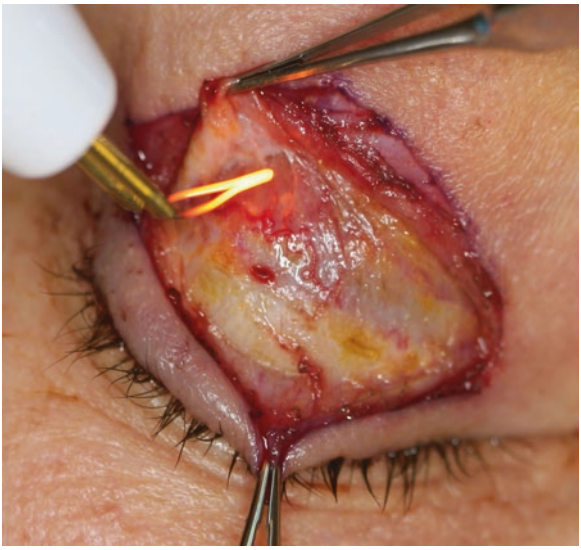

Fig. 9.10 A battery-operated cautery is being used to delicately dissect the scar present between the superior tarsal muscle (Mueller's muscle) and the undersurface of the levator aponeurosis. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

space that normally is filled with diaphanous, loose areolar tissue, and occasionally fat. In the reoperated eyelid, this plane is often obscured with scar tissue. While it is possible to dissect this plane to Whitnall's ligament, it may not be necessary. For many of these cases, only 1 or 2 mm of ptosis correction is needed. A dissection somewhere between the superior edge of the tarsus and Whitnall's ligament may be all that is necessary.

The levator needs to be advanced onto the exposed anterior tarsal face. A 6-0 nonabsorbable, double arm suture on a spatulated needle is preferred. A fine-toothed forceps is used to find a single point of tarsal suspension that provides for a smooth upper eyelid contour. The suture is passed partial thickness through the tarsus at this point. The eyelid is everted to confirm that the needle has not perforated the corneal side of the eyelid, which will lead to corneal erosions and possible ulceration. Both ends of the suture are then passed through the levator at approximately the same level and tied on a releasable knot (Fig. 9.11). The patient is then sat up to judge the effect of this pass. If the eyelid margin is too low, the suture will need to be repassed higher in the levator aponeurosis. Too high, and the suture will need to be lowered. Contour is another issue. The point of suspension must provide a smooth upper eyelid contour. A second levator/tarsal suspension suture may be needed to control the eyelid contour. Excess levator should be trimmed judiciously.

With the levator resuspended, the next step is performing an anchor blepharoplasty. This step ensures a hard crease. The crease is what your patient will see. For this reason, it is essential to take time to design the upper eyelid crease. This is the lower edge of the blepharoplasty incision. As much as possible, its location in the two eyelids should match. That means the incision should be the same distance from the eyelash base and start and stop in the analogous locations on both sides. The anchor is performed by suturing the cut edge of the eyelid platform skin and

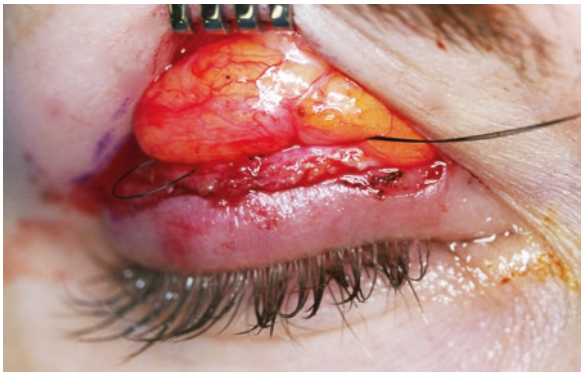

Fig. 9.11 The main ptosis suture in place anchoring the levator to tarsus. The suture has been tied on a "shoestring" overhand knot. The patient is placed in the sitting position will be sat up. If eyelid position is acceptable, the knot will be permanently tied. Otherwise it will be untied and repositioned. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

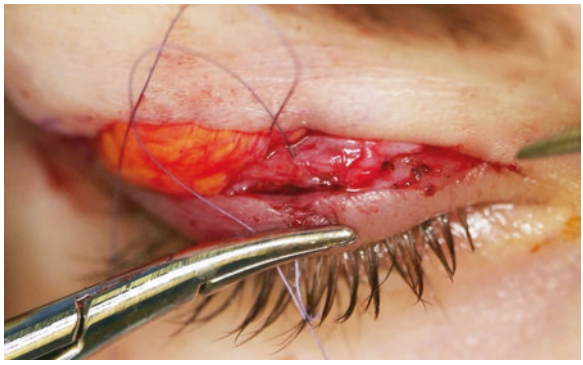

Fig. 9.12 The central anchor suture being placed. It is passed from the skin through orbicularis oculi, cut edge of levator aponeurosis, and then back before being tied. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

orbicularis oculi muscle to the cut inferior edge of the levator aponeurosis (Fig. 9.12). As the levator has just been advanced into the upper eyelid tarsal bed and trimmed, it is perfectly positioned for the placement of the anchor sutures. The anchor sutures are horizontal mattress sutures that are externalized and tied. They are passed through skin, muscle, levator, levator, muscle, skin, and tied. If the bite is too aggressive, which occurs when too much levator aponeurosis is included with the suture pass, the lid margin will evert showing the water line of the eyelid. It is a type of a frank ectropion. The stitch should be removed and replaced with a more relaxed pass. That goal is to snug the eyelid platform skin and orbicularis oculi muscle with provision of slight upward support for the upper eyelid margin eyelashes without over-rotation (Fig. 9.13). Although these sutures are removed 6 days after surgery, a 6-0 polyglactin suture is preferred. Three anchor sutures are usually sufficient to define the eyelid platform. They are placed mid-pupil and paralimbal on each side.

Prior to closing the upper eyelid, mobilized anterior orbital fat should be redraped over the anterior levator aponeurosis. In rare cases, so much anterior orbital fat has

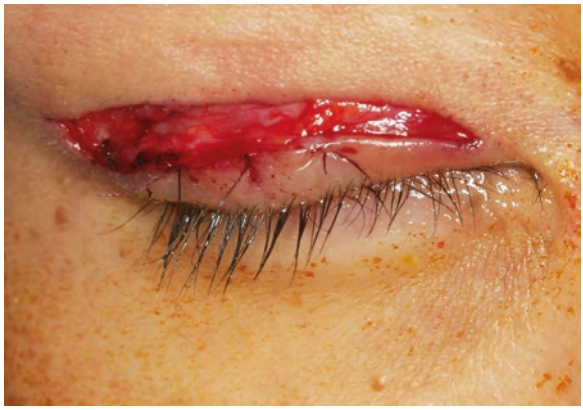

Fig. 9.13 The eyelid showing all three anchor blepharoplasty sutures in place. Note the distal levator has been trimmed to finish at the cut skin edge without extra bulk. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

been resected that there is simply no fat to redrape. In approximately 3% of cases, fat grafting is beneficial. A small amount of fat it harvested from the abdomen or flank, settled in the syringe it was harvested in, and the oil and supernatant decanted. The remaining fat is broken up into small particles and transferred to a 1 ml syringe. It is then manually layered over the anterior levator. It is seldom necessary to place more than 1 ml of grafted fat for this purpose.

The surgery is completed by closing the skin with a running gut suture. Each pass can incorporate a small bite of levator as the wound is sewn closed to reinforce the hard crease. Externalized sutures are removed at 1 week. Figures 9.14 and 9.15 show the result of this work before and 1 year after surgery.

Postoperative Care and Complications

Patients are seen on the first postoperative day. Lids that are heavy after surgery are normal. If the eyelid position was accurately set intraoperatively, one should develop confidence that with resolution of swelling, the eyelid will return to the anticipated position. Extreme patience is warranted. In keeping with that, early intervention with additional surgery should be avoided. If the eyelid eventually heals with a lower position than desired, I will not intervene until 6 months have passed. I may place patients on a 6-day tapering course of methylprednisolone to help telescope initial postoperative swelling, but that is not routine.

At 24 hours, an eyelid that is too open is an entirely different kettle of fish. The most common cause of an overcorrected eyelid is operating on an eyelid where local anesthetic has infiltrated into the levator palpebrae superioris. Despite best efforts, I see this in approximately 2% of cases. Patients are warned before surgery about the possibility. It is in my surgical consent. They are advised that should it occur, that day or the next, I will take them back to the operating room and adjust the eyelid. Local anesthetic can be introduced into the eyelid, the suture cut, and the tissue

Fig. 9.14 A 44-year old woman who had subtractive blepharoplasty at age 29. She lived with a result that she was never happy with. She described the eyes as being sad. In the afterimage, the ptosis has been improved, the eyelashes are better supported, and the upper eyelid creases have been lowered from 14 to 7 mm. Anterior orbital fat was mobilized from anterior orbital scarring to help with the upper eyelid volume. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

Fig. 9.15 A 31-year old Asian woman with post-upper blepharoplasty syndrome (PUBS). The eyelids have high creases. There is a relative lack of upper eyelid fold volume and eyelash ptosis. The upper eyelids are ptotic, and the eyebrows are overly elevated. After correction, the creases have been lowered. Her upper eyelid fold volume and upper eyelid ptosis have been improved. (Published with kind permission of © Kenneth Steinsapir 2019. All Rights Reserved)

brushed open to expose the levator. The deep levator/tarsus ptosis suture is removed and replaced. Once the eyelid position is satisfactory, the eyelid is sutured closed. The patient is seen the following day to confirm that the eyelid is correctly set.

It has been observed that performing blepharoplasty will result in improvement in the upper eyelid margin position even in the absence of a ptosis procedure [9]. As these eyelids heal, they are subject to similar healing forces. Consequently, it is not uncommon to see eyelids that have healed for 1 week or 2 weeks appear flared or slightly retracted. These eyelids are generally not managed with surgical revision. Instead, they are best managed with eyelid massage. That massage is not haphazard. Rather it is a downward pushing of the eyelid at the point of maximum contour retraction. Rather than pushing on the tarsal platform, massage should be done from above the upper eyelid crease, pushing into the tarsal platform. Three sessions per day for approximately 1 or 2 minutes are recommended. Patients are instructed they should feel a stretch but not pain. It is important to counsel patient that this process is very successful but time consuming. The first 2 months after surgery is a wound contraction phase. Massage of the eyelid is unlikely to make any real progress until 8 weeks have passed. It is critical to maintain patient focus on eyelid massage. This approach is more predictable than subjecting the eyelid to another cycle of surgical healing.

The levator resuspension can lead to eyelid margin peaking. While message can help these, some eyelids will need to be reset surgically in about 2% of cases. I generally will let a peaked eyelid heal for 6 months and have the patient try massage before committing to surgical revision. A peaked levator is best prevented by putting effort into finding the best point of resuspension of the eyelid at the time of surgery. Patients need to be sat up during surgery to judge both the position of the eyelid contour and its shape. Secondary fixation sutures should be placed as needed to control the contour. This effort can save months of postoperative management, but this does not always prevent this issue.

Insufficient upper eyelid fold volume has two potential sources: The eyebrow retro-orbicularis fat pad fails to contribute volume to the upper eyelid fold, and there may be insufficient anterior orbital fat. The PUBS patient will have a compensatory eyebrow elevation that takes volume away from the upper eyelid fold. If the ptosis repair is insufficient, there will be continued compensatory eyebrow elevation. Revisional ptosis repair should be deferred until the eyelid has healed for 6–12 months. Slow resolution of upper eyelid swelling can contribute to relative upper eyelid ptosis. As this resolves, often the ipsilateral eyebrow (occasionally both eyebrows) will settle down contributing volume to the fold. The other possibility is simply not enough anterior orbital fat is present. This can result from post-reconstruction fat matting or simply over-resection of fat at the time of the original surgery. This possibility should be discussed preoperatively along with mention of the value of simply adding a small amount of hyaluronic acid filler to supplement the fold as a practical alternative to grafting fat if not all the desired fold volume is achieved. Generally, hyaluronic acid filler is not considered until 2 months after surgery.

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Periorbital Volume Loss

10

Craig N. Czyz and Morris E. Hartstein

Hollow Superior Sulcus

Hollowing or deepening of the superior sulcus may occur from senescent volume changes in the orbit or iatrogenically as a result of periorbital surgery. Extensive removal of the orbital fat in the upper eyelid sulcus may lead to a "skeletonized" or sunken appearance [1, 2]. Asymmetrical fat removal may produce irregular contours within and/or between the sulci (Fig. 10.1, DFG preoperative). Certain individuals have a preexisting deep sulcus that is masked by dermatochalasis and may become more prominent following blepharoplasty.

The best method of treatment is prevention. During the preoperative evaluation and intraoperatively, care should be taken not to over resect tissues. However, once a hollow sulcus has occurred, there are varied surgical methods to correct volumetric superior sulcus defects which include autologous fat grafting, alloplastic implants, injectable tissue fillers, and dermis fat grafting [3–9]. There are distinct advantages and disadvantages to each modality. Autologous fat is biocompatible with existing tissues, but fat survival is variable, and fat reabsorption can be asymmetric [3–6]. Alloplastic implants are relatively permanent and allow for precise volumization but require surgical placement with risks of infection, exposure, and inflammatory reaction. Improperly placed or oversized implants may also interfere with ocular and/or lid function. Further, alloplastic implants do not adapt to the continued progress of facial aging changes. Injectable tissue fillers require a minor procedure for placement, but duration of effect is variable and limited. There is also significant risk of inadvertent intra-arterial injection and permanent vision loss.

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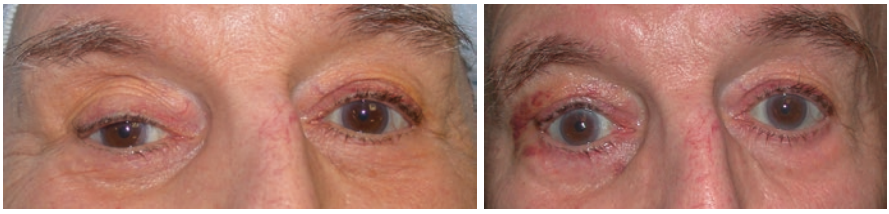

Fig. 10.1 Patient with right superior sulcus defect. The patient also has ptosis of the right upper eyelid which is common in individuals with sulcus hallowing. Patient from at 7 days postoperaive. The contour of the superior sulci is now nearly identical bilaterally. Similarly, the upper lid position and symmetry have improved from the immediate postoperative photograph

Dermis fat grafts have good biocompatibility, long-term stability, are readily available, and can be contoured at the time of surgery [7]. The procedure does require someone experienced in periorbital surgery with an understanding of eyelid and orbital anatomy.

Fat Grafts

The hollow superior sulcus can be corrected with autologous fat transfer. Goals of correcting a hollow sulcus include restoring the convexity between the lid crease, decreasing tarsal platform show, and creating parallel lines between the lid crease and the lashes. The goal is not to fill the entire lid and eliminate tarsal platform show. Rather, filling beneath the superior rim in the deepest part of the sulcus can decrease the shadowing caused by the hollow sulcus. The advantages include that is readily available, autologous tissue, can easily be added to upper eyelid surgery, and allows for a natural contouring of the lids. The disadvantages include variable uptake and resorption, the need for a separate surgical site, and possible need for additional sessions.

Fat is harvested in standard fashion under low suction, filtered, and then prepared for injection [9]. The fat can be filtered using gravity and pushing the fat over a telfa pad, or it can be spun down in a centrifuge. Once the fat is ready, it is loaded into 1 cc Luer lock syringes using a 0.7 or 0.9 blunt cannula. Entry sites for fat transfer are made with an 18-gauge needle lateral or medial to the upper eyelid or from above the brow. Fat is infiltrated along and below the superior orbital rim in the preperiosteal plane. When injected perpendicular from the brow, the cannula is gently withdrawn as the fat is injected to create a teardrop effect. Unlike HA filler, the quantity of fat injected is empiric and based on the preoperative clinical exam. It is difficult to use intraoperative judgment to determine how much fat should be injected [8].

Postoperatively, patients should be counseled that they will have significant bruising and swelling. The final results may not be apparent for several months as the fat is integrated into the tissues (Fig. 10.2). There also may be significant

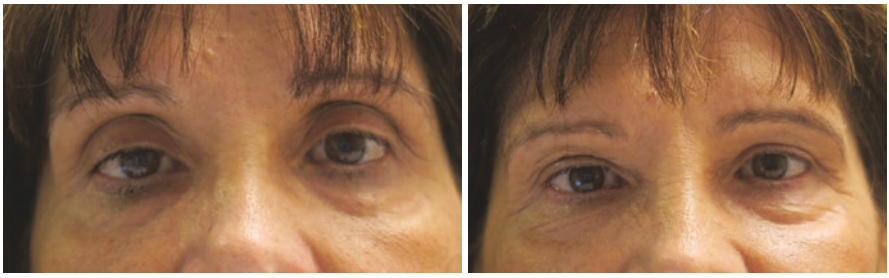

Fig. 10.2 Patient before and after right ptosis repair and autologous fat transfer to both superior sulci

resorption. If additional volume is required, an additional session of fat grafting can be scheduled. However, with the choice of dermal HA fillers available, it is easier to supplement using HA injections.

Filler

The least invasive of the surgical options is the use of hyaluronic acid (HA) soft tissue fillers. Volume augmentation with HA can be used as a primary or adjunct method of volume correction in the superior sulcus. If a patient is considering fat transfer, fillers can be used to demonstrate the effect of filling the sulcus before committing to a fat grafting procedure. A lower viscosity HA should be used as "thicker" fillers may interfere with eyelid function. Serial depot injections are placed below the orbicularis and anterior to the orbital fat. The injection is fairly superficial. It is helpful to begin injecting at the superior rim, above the hollow sulcus, while slowly working inferiorly until the lid is unfolded. The volume required will vary depending on the extent of the deformity. Typically, one should avoid placing more than 0.5 cc for initial correction. Additional material can be placed at a later time if required. Due to the highly vascular nature of this region, intravascular injection is a concern, especially in the area of the nasal fat pad. This modality is minimally invasive, can be done if the office in a short time, and has fairly predictable results. Although the nature of HA injections is transient, we have found that the effects in the upper lid last for quite some time (Fig. 10.3). When there is a need to supplement, the volumes required are usually minimal.

Surgery

Dermis fat grafting to the superior sulcus can be performed under local anesthesia with sedation or general anesthesia [7]. The dermis fat is typically harvested from one of the following sites: (1) inframammary fold of the breast, (2) abdomen just superior to the iliac crest, and (3) thigh. An eyelid incision is made at the position of the desired lid crease. The orbicularis and orbital septum are dissected until the

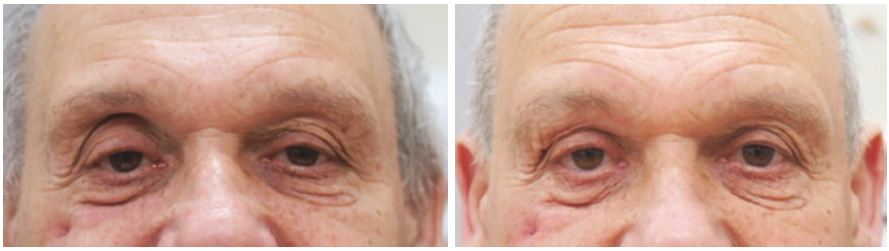

Fig. 10.3 Hollow right superior sulcus after trauma with correction using HA filler

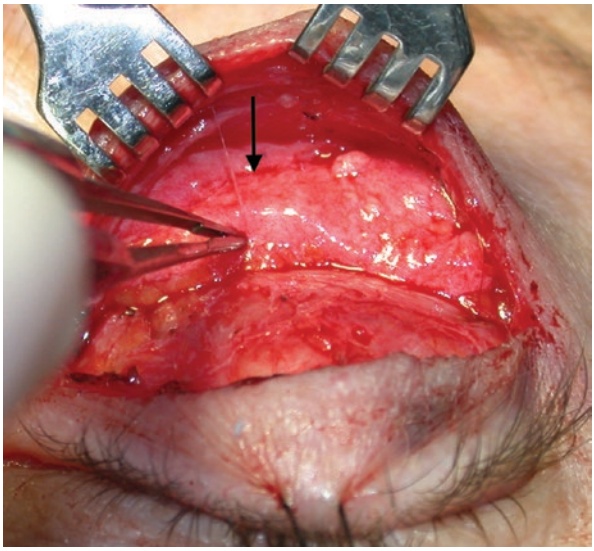

Fig. 10.4 The fat graft is shown in place prior to fixation to assess graft size and shape. It is typical to contour the graft in a stepwise fashion to achieve the final size and shape to avoid over sculpting

preaponeurotic fat is exposed. The capsules of the preaponeurotic and nasal fat pads are then opened. Dissection is performed to delineate and expose the anterior capsule of the fat pads. The horizontal length of the eyelid incision is then measured with a ruler. A corresponding length is marked at the dermis fat graft donor site. These dimensions typically range from 25 to 29 mm in width to 7 to 10 mm in height. These dimensions represent an approximately 25% oversizing of the graft to account for postoperative atrophy. The percentage of graph atrophy will vary from surgeon to surgeon and should be adjusted accordingly. After incising the skin, the epithelium is removed from the dermis with scissors. The graft is then harvested with 7–10 mm of underlying fat. The harvest site wound is then closed in a layered fashion.

The dermis fat graft is then contoured to correspond to the sulcus defect. The graft is placed in the eyelid with the dermis facing anteriorly and the fat in apposition to the exposed preaponeurotic fat. Using 6-0 polyglactin on a P-1 needle, the superior 180° of the dermis border is anchored in place to the superior edge of the preaponeurotic fat capsule (Fig. 10.4). The inferior 180° of the dermis fat graft is not sutured (Fig. 10.5). The graft may require further contouring to fit the available space. The orbicularis and skin are draped over the graft to assess volume. Initial

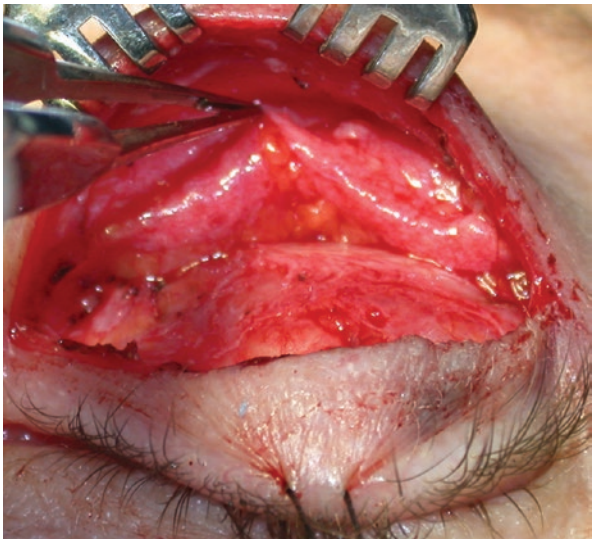

Fig. 10.5 The superior 180° of the dermis border is sutured to the superior edge of the preaponeurotic fat capsule. The arrow indicates where the intersection of the fat capsule and dermis is

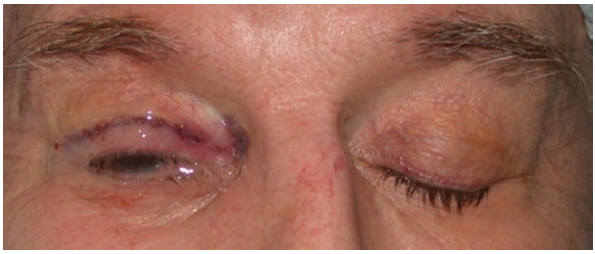

Fig. 10.6 The superior 180° of the dermis border is anchored in place to the superior edge of the preaponeurotic fat capsule. The inferior portion of the graft is elevated with forceps to show that the inferior 180° of the dermis fat graft is not fixated

overcorrection of the superior sulcus defect by 20–30% is the goal at the time of surgery. The eyelid crease is then reformed using 6-0 polyglactin suture placed from the orbicularis muscle at the inferior border of the eyelid crease incision to the anterior surface of the levator aponeurosis at 2–3 mm intervals. The eyelid crease skin incision is then closed with simple interrupted 6-0 plain gut sutures. Ophthalmic antibiotic ointment is placed on the incisions and in the eye (Fig. 10.6). A typical patient presentation and postoperative results are shown in Fig. 10.1 and 10.7. A unilateral case was selected to provide added contrast.

Lower Lid Hollows

Post-blepharoplasty lower lid hollowing may result from overaggressive fat pad resection. Although patients will often complain about their lower lid "bags," complete removal of the bags may result in a hollow, aged, and sunken appearance. In

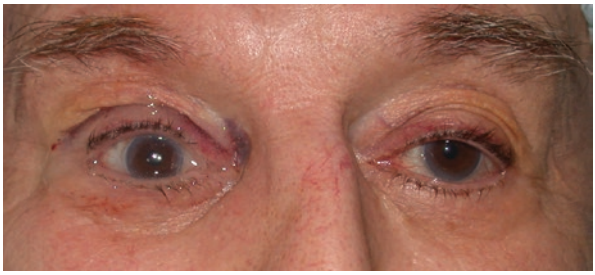

Fig. 10.7 The left upper eyelid crease is reformed using 6-0 polyglactin suture placed from the orbicularis muscle at the inferior border of the eyelid crease incision to the anterior surface of the levator aponeurosis at 2–3 mm intervals. The eyelid crease skin incision is then closed with simple interrupted 6-0 plain gut sutures. Ophthalmic antibiotic ointment is placed on the incisions and in the eye. Note the slight fullness that can be seen in the right superior sulcus compared to the left. This represents the desired intraoperative 20–30% overcorrection

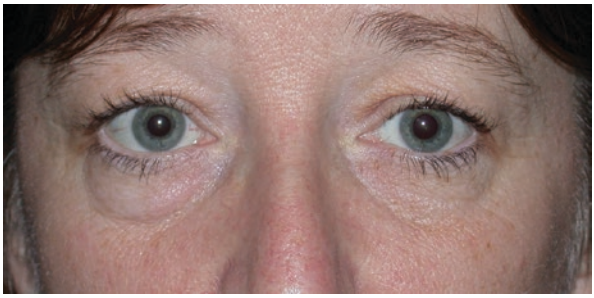

Fig. 10.8 Preoperative patient for lower lid blepharoplasty

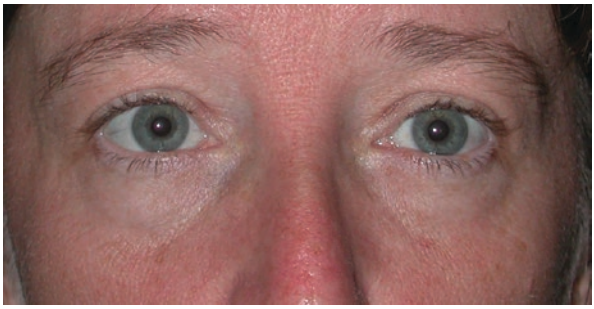

Fig. 10.9 Postoperative lower lid hollowing

some cases, this can affect lower lid position. Furthermore, the tear trough depression may still be visible and bothersome to patients. Fortunately, in the era of dermal fillers, this is relatively simple to correct. Correction of the hollow with further surgery may be possible, but in many cases, the problem is further volume loss, and thus volume must be restored (Figs. 10.8, 10.9, 10.10, 10.11, 10.12, and 10.13).

Dermal HA fillers can be used to fill in the lower lid hollows and depressions remaining after surgery, much in the same way this area is treated in non-operated lids. While fat grafting may be considered, it is simpler and faster, with more predictable results using dermal HA fillers.

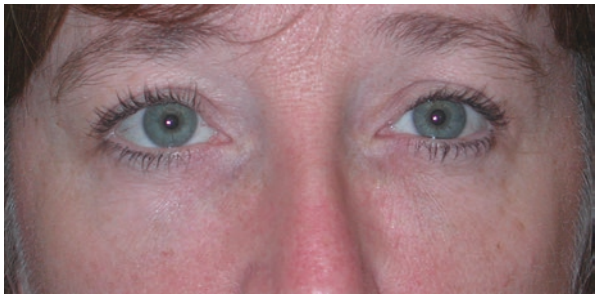

Fig. 10.10 Correction of postoperative hollowing with dermal HA filler

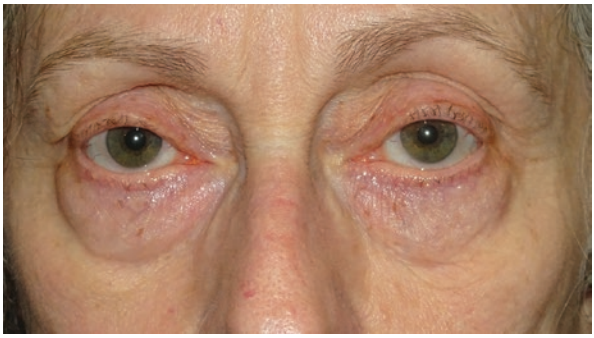

Fig. 10.11 Preoperative lower lid blepharoplasty

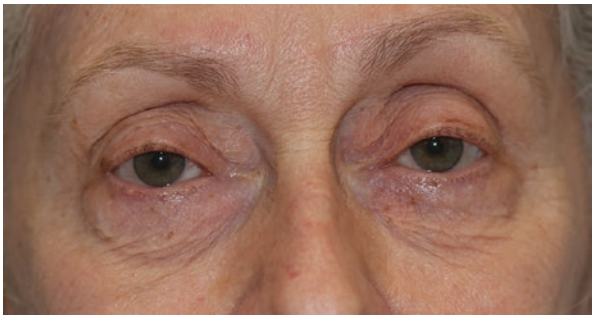

Fig. 10.12 Postoperative lower lid hollowing with apparent excess skin

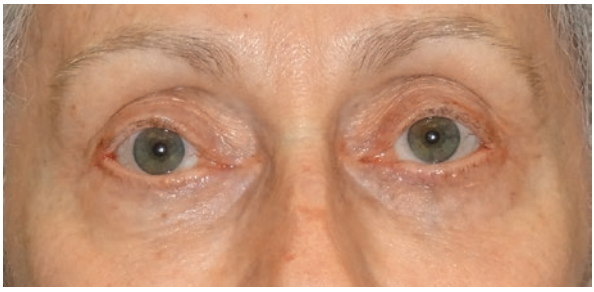

Fig. 10.13 Correction of hollowing and volume loss with dermal HA filler. Note the improved skin tightening effect as well

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11 Lower Eyelid Retraction: Middle/Posterior Lamellar Correction Using Autologous Grafts

Zvi Gur, Clara J. Men, Don O. Kikkawa, and Bobby S. Korn

Introduction

Lower blepharoplasty is one of the most common procedures performed by oculofacial surgeons and can be accomplished through a transconjunctival or transcutaneous approach, with the goal of blending the eyelid and cheek junction. Lower eyelid retraction is a challenging complication associated with blepharoplasty and, in addition to an aesthetically disfiguring outcome, may lead to functional corneal exposure resulting in tearing, ocular irritation, and corneal scarring (Fig. 11.1). Severe lower eyelid retraction is both surgeon and technique dependent and has been reported as high as 20% of lower eyelid blepharoplasty cases [1, 2].

The preoperative risk factors for lower eyelid retraction after blepharoplasty are multifactorial and include the following:

- Unforeseen lower eyelid laxity (Fig. 11.2)
- Negative vector/proptosis (Figs. 11.3 and 11.4)
- Festoons/malar mounds (Fig. 11.5)

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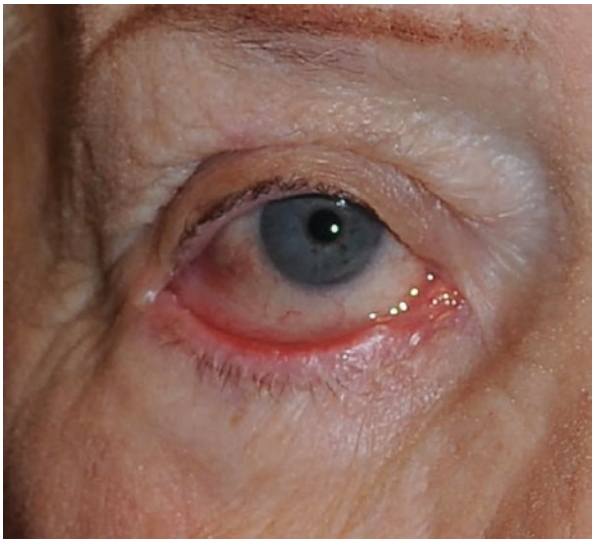

Fig. 11.1 Post-blepharoplasty lower eyelid retraction. Note the increased inferior scleral show, conjunctival injection, and cicatricial ectropion

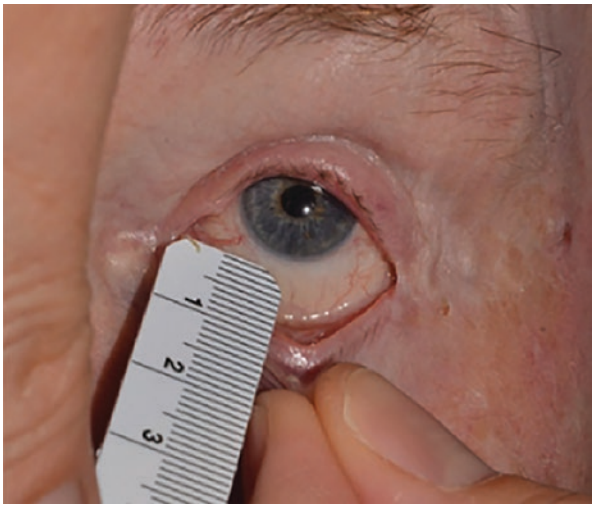

Fig. 11.2 Distraction test. The lower eyelid is pulled away from the globe, and the distance is measured. Lower eyelid distraction greater than 6 mm is considered abnormal and indicates increased laxity. In this photograph, more than 10 mm is measured

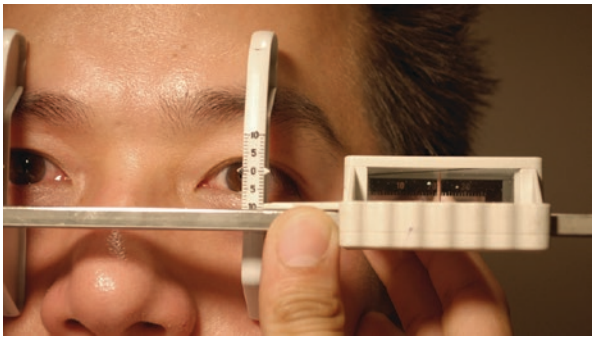

Fig. 11.3 Assessment of proptosis using the Naugle exophthalmometer. A difference of greater than 2 mm prompts further evaluation

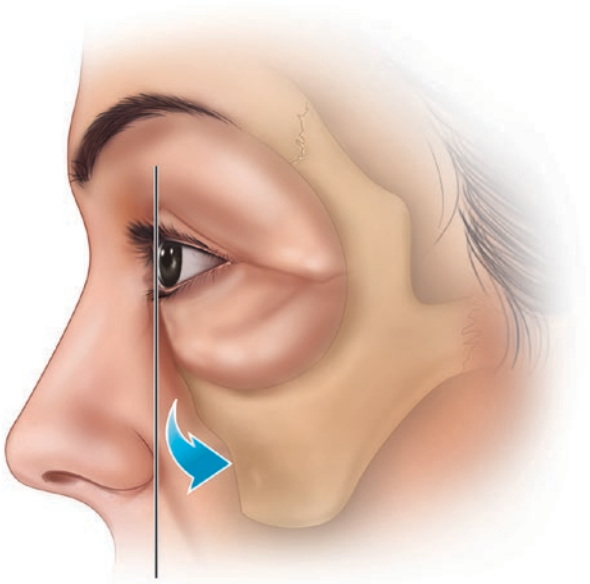

Fig. 11.4 Negative vector. Negative vector is present when the globe projects anterior relative to the inferior orbital rim. This may be due to several factors including thyroid-related orbitopathy, orbital space-occupying lesions, myopia, and age-related maxillary retrusion. Lower eyelid blepharoplasty with excessive eyelid tightening procedures, particularly the lateral tarsal strip, may further accentuate lower eyelid retraction

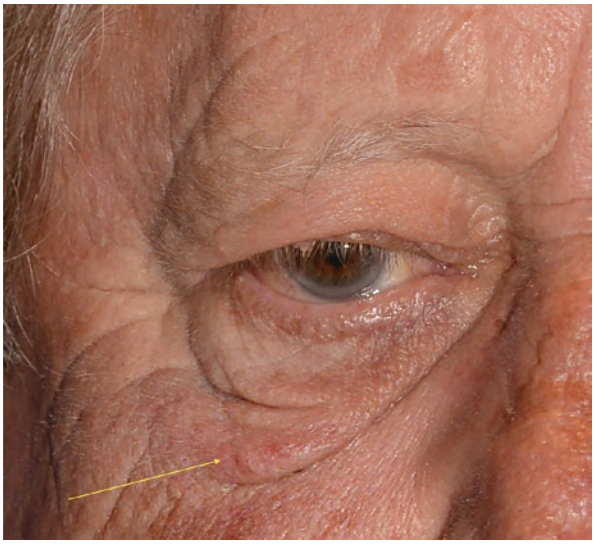

Fig. 11.5 Lower eyelid festoon. Note the redundant skin associated along the lower eyelid. Recurrence is common after excision and may be associated with postoperative eyelid malposition

Intraoperative risk factors include the following:

- Aggressive skin, orbicularis, and fat resection
- Unrecognized lower eyelid laxity
- Overzealous shortening of the eyelid (particularly with a negative vector)
- Exuberant scarring of the middle lamella (orbital septal plane)

As the majority of cases of lower eyelid retraction result after aesthetic lower blepharoplasty, this chapter will focus primarily on the correction of lower eyelid retraction using posterior lamellar spacer grafts. The choice of the graft material should take into consideration surgeon experience, desired tissue composition, long-term contraction rate of the spacer, and donor site morbidity and will be discussed below.

Posterior lamellar graft options include the following:

- Autologous
  - Hard palate
  - Dermis fat
  - Ear/nasal septal cartilage
  - Fascia lata
- Allograft
  - Same choices as autologous
- Alloplastic
  - Porous polyethylene (Medpor)
  - Polytetrafluoroethylene (PTFE)
- Xenograft
  - Acellular dermal matrix (Alloderm, Enduragen)
  - Decellularized bioengineered graft (Tarsys)

The repair of lower eyelid retraction focuses on systematic evaluation of the causative factors and tailoring the approach to address the underlying pathology. The general approach is as follows [3]:

- Lysis of the middle lamellar scarring
- Placement of the posterior lamellar spacer graft
- Recruitment of anterior lamella via midface lifting
- Lower eyelid tightening
- Vertical elevation and immobilization of the lower eyelid with a Frost suture

Access to the lower eyelid begins with a lateral canthotomy and inferior cantholysis and continues with a transconjunctival incision approximately 2 mm below the inferior tarsal border (Fig. 11.6). It is critical to release all fibrosis in the posterior lamella and/or septal plane of the middle lamella until the eyelid is completely free to elevate without focal areas of tightness/adhesions. Scar lysis should use minimal cautery in order to avoid more thermal injury that would lead to subsequent fibrosis.

The sub-orbicularis oculi fat (SOOF) is then freed in a subperiosteal plane (Fig. 11.7). Then, the SOOF is secured with 4-0 polyglactin (Vicryl) suture for the midface lift (Fig. 11.8). The desired posterior lamellar graft, trimmed to fit the posterior lamellar defect created after scar lysis, is then secured to the recessed lower eyelid retractors and inferior border of the tarsal plate with 6-0 Vicryl sutures (Fig. 11.9). To promote extension of the conjunctival epithelium onto the graft, the inferior edge of the palpebral conjunctiva can be draped over the spacer graft. Lastly, the lateral canthus is shortened if laxity is present or reinserted if no laxity is

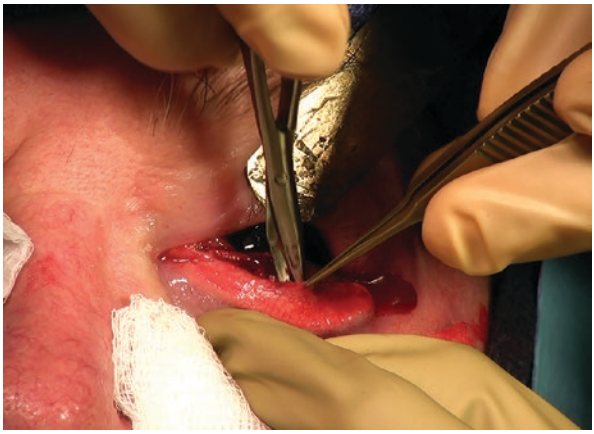

Fig. 11.6 Release of middle lamella scarring. Transconjunctival incision is made 2 mm below the inferior tarsal border and dissection carried toward the inferolateral orbital rim

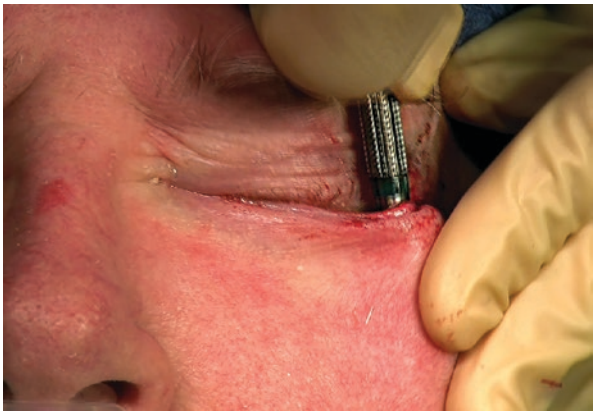

Fig. 11.7 Releasing the orbitomalar ligament. After the periosteum is released along the arcus marginalis, the orbitomalar ligament is elevated and released along its stout inferolateral attachments. A Freer elevator is used to free the sub-orbicularis oculi fat (SOOF) in the subperiosteal plane. Care is taken to preserve the zygomaticofacial nerve and vessels which are located approximately 5 mm below the inferolateral orbital rim

present. A large diameter (18–20 mm Kontour) plano bandage lens is placed to protect the corneal surface. Lastly, a Frost-style suture tarsorrhaphy to the eyebrow is placed with 5-0 Prolene sutures to immobilize the lower eyelid for 7 days (Fig. 11.10).

Hard Palate

Reconstruction of the lower eyelid with autologous hard palate was first described by Siegel [4]. The hard palate is similar in tissue composition to the lower eyelid tarsus and provides vertical length as well as stabilizes the lower eyelid contour. In addition,

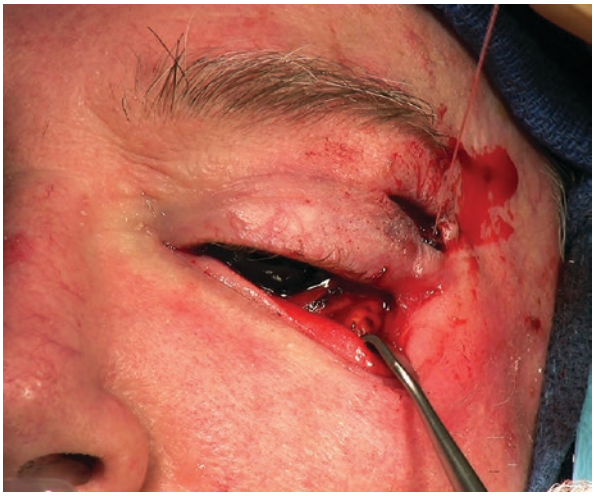

Fig. 11.8 Sub-orbicularis oculi fat (SOOF) elevation. Once the desired fixation point is determined, the SOOF is secured with 4-0 Vicryl suture and then retrieved through upper eyelid crease. The suture is secured to the periosteum near the frontozygomatic suture line, providing a superolateral vector of pull

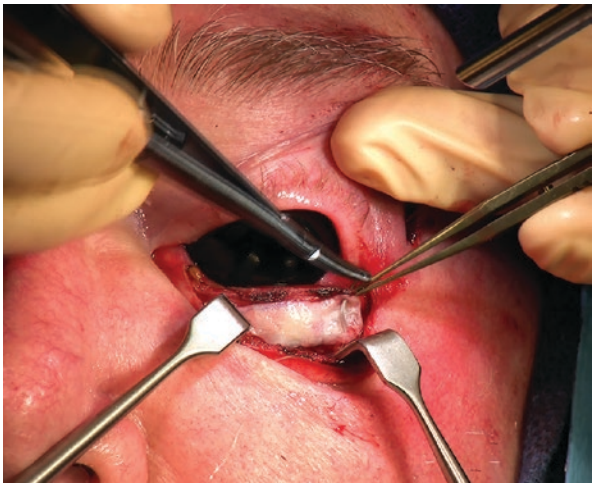

Fig. 11.9 Spacer graft fixation. The spacer graft (hard palate) seen in the photograph is secured superiorly to the inferior edge of the tarsal plate, and inferiorly, the spacer graft is secured to the lower eyelid retractors

its epithelialized mucosa lining is similar to the conjunctival surface, making the hard palate an excellent composite autograft to augment the posterior lamella. Hard palate is easy to harvest and undergoes minimal postoperative contraction (Fig. 11.11). Hard palate, similar to the other autologous grafts, does not incur the added expense of commercially prepared xenografts or allografts (Table 11.1).

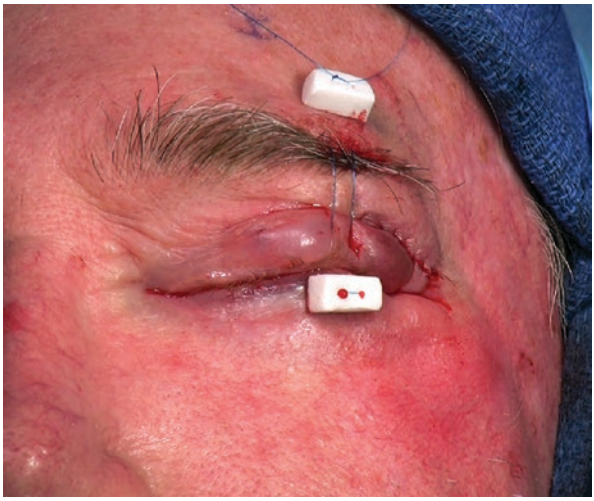

Fig. 11.10 Placement of Frost suture. Double-armed 5-0 Prolene sutures are passed through the gray line of the lower and upper eyelids and then secured above the brow to provide superior traction. Foam bolsters are used to prevent cheese-wiring through the skin

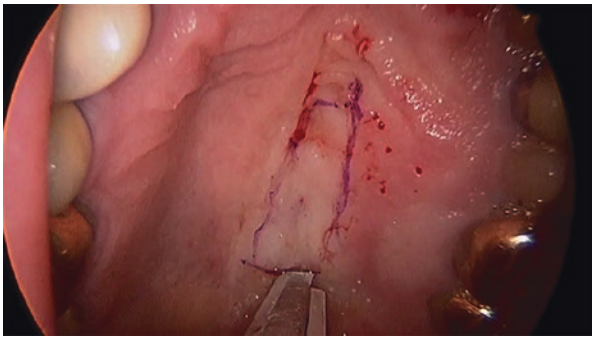

Fig. 11.11 Mucosal excision site of hard palate. In this photograph, a crescent blade was used to incise the hard palate graft

Table 11.1 Advantages and disadvantages of autologous hard palate

Advantages	Disadvantages
Epithelialized surface	Donor site morbidity Oronasal fistula formation Granuloma formation Pain/oral surface irritation Infection Potential to transfer oral mucosal malignancies (i.e., squamous cell carcinoma)
Excellent structural support	Limited by size of hard palate or coexistent pathology (Fig. 11.12)
Long lasting	Potential need for hard palate obturator
Negligible rejection/ allergic risk	Minimal reconstitution of orbital volume

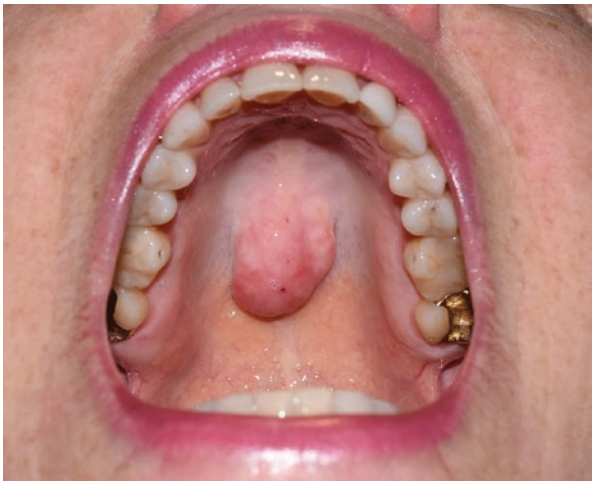

Fig. 11.12 Presence of oral roof pathology. Patients with suspected oral mass should be further reevaluated. The presence of any pathology may limit or defer graft harvesting. In this photograph, torus palatinus (painless bony overgrowth) is present

Surgical Technique

The donor size is assessed in preparation for the hard palate graft harvest. This step is crucial as hard palate/mucosal grafts generally measure 5 × 20–25 mm and rarely exceed 6 mm in vertical height. For every 1 mm of desired vertical lower eyelid lift, we recommend using 2–3 mm of the hard palate graft.

The hard palate forms the floor of the nasal cavity and the roof of the oral cavity. It is composed of the maxillary and palatine bones. It can easily be distinguished from the soft palate by both color and palpation. The hard palate is firm and pink in color, while the soft palate is flaccid and red. Visualization and palpation of the border between them can aid in confirming the correct identification. Anterior to the hard palate and just posterior to the central incisors are the nasopalatine nerves and vessels that pass through the incisive foramen. Lateral to the hard palate and medially to the third molar are the greater palatine nerve and vessels that pass through the greater palatine foramen. The lesser palatine vessels and nerves pass through the lesser palatine foramen, which is located posterior to the greater palatine foramen. Knowledge of these important landmarks is important to prevent bleeding and dysesthesia. After thorough visualization of the oral cavity with particular attention to the oral cavity roof, careful examination of the hard palate should be performed to rule out atypical lesions, growths, or ulcerations, which may warrant consideration of alternative options.

Then, the appropriately sized graft is marked on either side of the midline, followed by injection of local anesthetic. Incision can be made with #15 or 69 blade. Care should be taken not to penetrate the mucoperiosteum. A crescent blade can aid with lamellar dissection in the submucosal plane. Dissection should stop at least 3 mm anterior to the junction of the soft palate in order to avoid damaging the

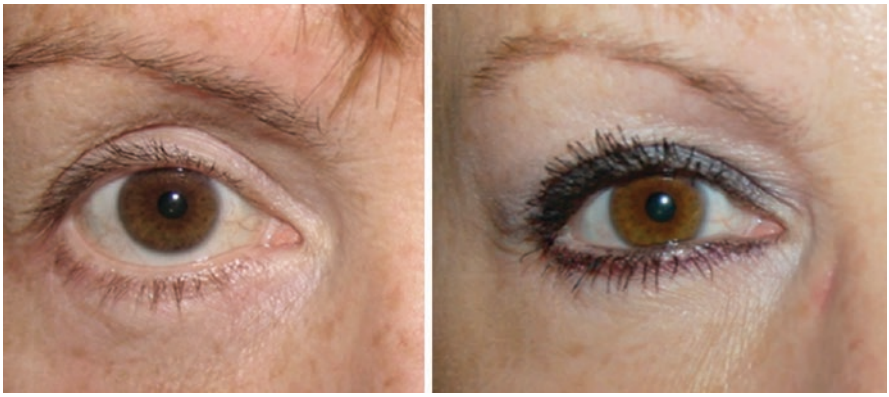

Fig. 11.13 This photograph shows before and after right lower eyelid post-blepharoplasty retraction repair with a hard palate graft

greater palatine vessels and to prevent creation of a soft palate fistula. Local hemostasis can be achieved using bipolar cautery, fibrin glue, or cellulose polymer dressing. After obtaining complete hemostasis, an optional prefashioned hard palate obturator is placed over the roof of the mouth. The obturator minimizes discomfort and will protect the raw mucosa until it is healed, which usually takes 5–7 days. In cases where the patient is edentulous, the upper denture can be replaced at the end of the procedure. This will provide the patient with improved comfort and the ability to resume normal diet almost immediately. After harvesting the hard palate, the graft should be inspected, thinned, and placed on a wet gauze.

Figure 11.13 shows patient before and after right lower eyelid retraction repair with hard palate graft to the posterior lamella.

Dermis Fat Graft

The use of dermis fat graft in periocular surgery was described four decades ago for the treatment of enophthalmos [5]. The main advantage of autologous dermis fat as a spacer graft is the ability to restore both orbital volume and support the posterior lamella. Moreover, the presence of adipose tissue in the middle lamella is postulated to promote long-term success by acting as an anti-inflammatory buffer, particularly during the wound healing phase [6]. In comparison to hard palate graft, healing of the donor site is more comfortable, and the supply of the dermis fat is plentiful.

There are several donor site options for the dermis fat graft including the gluteal, flank, and periumbilical region. The gluteal donor site provides ample surface area and volume with minimal morbidity compared to the periumbilical region and is our preferred source. Another potential donor site is the retroauricular area, although this site has a limited amount of adipose tissue (Table 11.2).

Table 11.2 Advantages and disadvantages of dermis fat

Advantages	Disadvantages
Virtually unlimited donor size	Donor site morbidity Granuloma formation Potential for damage to surrounding tissues (i.e., herniation of muscle/peritoneal perforation)
Able to restore lost orbital volume	Variable resorption rate
Moderate structural support	May enlarge with weight gain
Negligible rejection/allergic risk	Dermis requires conjunctival epithelialization
	Ocular surface irritation from cilia transfer
	Persistent mucoid discharge

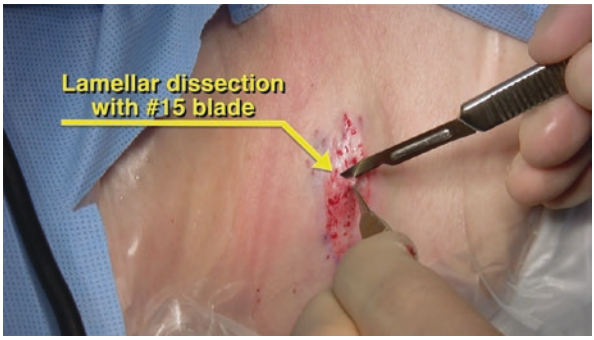

Fig. 11.14 Dermis fat grafting. Prior to skin incision, the epithelium should be completely removed from donor site. Meticulous removal of the epithelium minimizes keratin production and follicle transfer

Surgical Technique

When utilizing dermis fat, the surgeon should take into account graft contraction. In general, the width of the dermis graft (and resultant vertical elevation of the eyelid) should be at least 1.5–2.0-fold greater in size. Complete removal of the epithelium is essential to minimize keratin production and cilia transplantation. A #15 blade can be used to excise the epithelium or a 4 mm diamond burr rotating at 40,000 rpm (Fig. 11.14). At least 5 mm of fat tissue should be retained with the dermis for volume restoration. The donor site is then closed with deep 4-0 monocryl sutures and a running subcuticular 5-0 monocryl suture. Adhesive strips are placed tangential to the incision for added strength.

The graft is then placed in the orbit with the fat side directed toward the SOOF and the dermis side continuous with the ocular surface (Fig. 11.15). Redraping of the palpebral conjunctiva over the dermis fat graft will facilitate epithelialization.

Placement of a large diameter bandage contact lens is essential to minimizing corneal irritation from the newly debrided dermis face.

Figure 11.16 shows patient before and after right lower eyelid retraction repair with dermis fat graft.

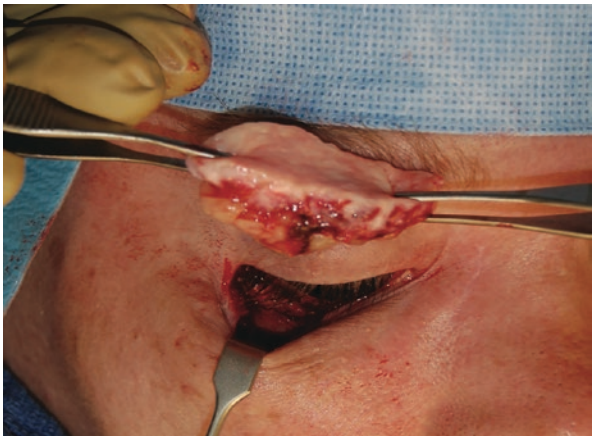

Fig. 11.15 Fixation of the dermis fat graft. The graft is placed with the fat side directed toward the SOOF and the dermis side toward the ocular surface

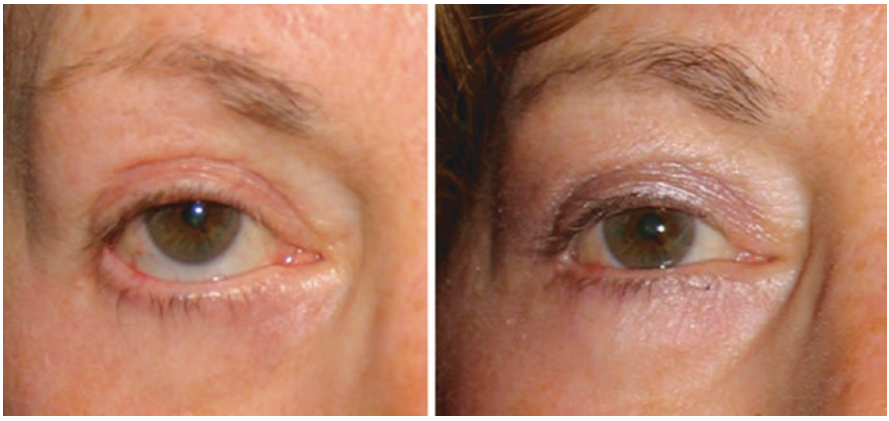

Fig. 11.16 This patient is shown before and after right lower eyelid retraction repair with a dermis fat graft

Cartilage

Another potential autologous spacer graft is cartilage. The most common donor sites are the conchal and septal cartilages. Cartilage from the two sites has different characteristics. The conchal cartilage is an elastic material, which is relatively pliable and soft. The nasal septal cartilage is made of hyaline and thus stiffer and harder to shape [7].

One advantage of using autogenous cartilage is its low rate of contraction or shrinkage. Therefore, estimation of the appropriate size of cartilage needed for the correction of lower eyelid retraction is relatively easy, and a 1:1 ratio (1 mm of graft for 1 mm of retraction) is considered a successful formula [7] (Table 11.3).

Table 11.3 Advantages and disadvantages of cartilage

Advantages	Disadvantages
Excellent structural support	Donor site morbidity Disruption of ear Nasal septal defect
1:1 ratio of donor size to eyelid elevation	Variable contour and thickness of graft
Low rate of resorption	Surface requires epithelialization

Surgical Technique

Many techniques exist for auricular cartilage graft harvesting. In the typical anterior approach, the skin incision is made at the anterior edge of the helix, followed by elevation of the skin and perichondrium. The desired strip of cartilage is then harvested from the anterior surface of the scapha, and skin closure is accomplished with interrupted 6-0 fast-absorbing plain gut sutures. The conjunctiva should be draped to cover the posterior graft to avoid ocular irritation since auricular cartilage is not covered by mucosa and may increase the risk for corneal damage.

In contrast, the nasal septal cartilage is covered by a mucosal surface and results in a shorter recovery process. Nasal septal cartilage provides for a graft with relatively abundant volume and a nonkeratinized epithelial surface. The stiffness of this type of cartilage may also be desirable in lower eyelid reconstruction in which vertical height is needed. Care should be taken to preserve the nasal septal mucosa on at least one side to minimize formation of septal defects.

Fascia

Autologous fascia was first used by oculoplastic surgeons for congenital ptosis repair. Fascia lata consists of a collagen matrix with fibroblasts and elastic tissue and has also been used successfully for cicatricial entropion repair and retraction repair [8]. Autologous fascia induces minimal recipient site reaction and demonstrates little contraction or absorption over time; however, it provides little structural support of the lower eyelid and relies on conjunctival epithelization to cover the graft.

Surgical Technique

The iliotibial band is first identified extending from the anterior superior iliac spine to the lateral condyle of the tibia. An incision is made 10 cm superior to the lateral condyle, and dissection is carried down through the skin and subcutaneous tissue to reach fascia. An appropriately sized segment of fascia is undermined and excised.

Take care to blunt dissect with scissors to remain in the avascular plane and minimize bleeding. After hemostasis is confirmed, the wound is closed with deep vertical mattress and a running skin suture. The fascial graft is then trimmed to the proper size. In general, 2–3 mm of fascia is used for every 1 mm of eyelid retraction correction desired.

Alloplastic

Porous polyethylene (Medpor spacer) and polytetrafluoroethylene (PTFE) have also been described as interpositional lower eyelid grafts and are commercially available obviating the risk of donor site morbidity [9, 10]. Owing to the foreign nature of these materials, infection risk is always a concern (Table 11.4).

Xenografts

A variety of xenografts are commercially available for use as spacer grafts [11]. Decellularized porcine bioengineered membrane graft (Tarsys) and acellular porcine collagen matrix (Enduragen, Alloderm, and Integra) are used as a scaffold to support the retracted lower eyelid. Fibroblast and vascular infiltration result in biointegration of the graft. In our hands, we find the thicker acellular grafts (Alloderm and Enduragen) provide more structural stability than the thinner membrane graft (Tarsys). Owing to the thin nature of these grafts, volume restoration is minimal compared to dermis fat (Table 11.5).

Table 11.4 Advantages and disadvantages of alloplastic grafts

Advantages	Disadvantages
Excellent structural support	Infection risk
Readily available	Extrusion/exposure risk
No donor site morbidity	Costly
	Rigid/minimal eyelid plasticity

Table 11.5 Advantages and disadvantages of xenografts

Advantages	Disadvantages
Excellent structural support (Alloderm/Enduragen)	Contraindicated with porcine allergy
Readily available	Variable resorption
No donor site morbidity	Ocular surface irritation
	Extrusion/exposure risk
	Costly
	Collagen matrix requires conjunctival epithelialization
	Does not restore volume

Surgical Technique

The graft is placed transconjunctivally as well after release of the lower eyelid cicatrix. The graft is secured to the lower eyelid retractors in the fornix and superiorly along the inferior tarsal border (Fig. 11.17). In this manner, the graft provides excellent vertical structural support of the lower eyelid. Epithelialization is facilitated again by redraping a 1–2 mm conjunctival cuff over the superior border of the xenograft (Fig. 11.18). Corneal protection with a large diameter bandage contact lens is essential during the first week of Frost suture placement (Fig. 11.19).

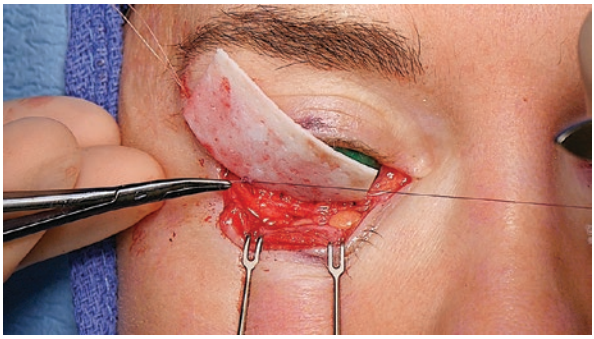

Fig. 11.17 Placement of xenograft. In the case above, 1-mm-thick porcine acellular dermal matrix graft (Enduragen, Stryker Corporation, Kalamazoo, MI) was used as an eyelid spacer graft

Fig. 11.18 A 1–2 mm conjunctival cuff is overlapped on the superior edge of the graft. This will facilitate conjunctival epithelialization of the spacer graft

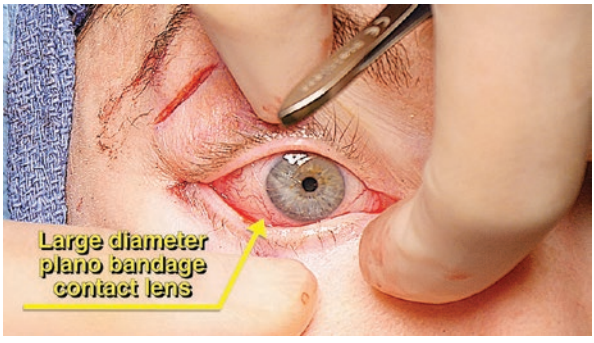

Fig. 11.19 A large diameter (>16 mm) plano bandage contact lens should be placed to protect the cornea from non-epithelialized spacer grafts

Fig. 11.20 This patient is shown before and after lower eyelid retraction repair with the acellular dermal matrix

Figure 11.20 shows a before and after right lower eyelid retraction repair with acellular dermal matrix (Enduragen).

Conclusion

Lower eyelid retraction is a challenging complication associated with blepharoplasty. Understanding the preoperative and intraoperative risk factors for development will minimize complications and to design a customized approach for repair when it does occur. The choice of a posterior lamellar spacer graft is complex and should be tailored to each patient.

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12 Lower Eyelid Retraction: Middle/Posterior Lamellar Correction Using Xenografts

Robert G. Fante

Introduction

Although the exact incidence of lower eyelid retraction is not known, it is a relatively common involutional malposition seen in the elderly, and is also frequently seen as a complication of facial, orbital, and lower eyelid surgery; facial trauma and burns; thyroid eye disease; facial neuropathy; and cicatrizing diseases of the conjunctiva. Associated symptoms may include redness, tearing, burning, and foreign body sensation, while clinical signs may include superficial keratitis and bacterial keratitis. Surgical treatment is aimed at improvement in the eyelid malposition with resolution of signs and symptoms when lubricating ointments and other medical therapies are ineffective.

Evaluation

Since lower eyelid position relative to the cornea is dependent on the direction of gaze and the orientation of the patient's head, examination and photographic documentation for possible lower eyelid retraction should use a reproducible standard head orientation such as the Frankfort plane, the frontal plane, or natural head position [1], with the patient's eyes in primary gaze. Measurements (in millimeters) are commonly made either relative to the limbus as *inferior scleral show (ISS)* or relative to the corneal light reflex as *margin-reflex distance 2 (MRD2)*. In any of the standard positions, the lower eyelid normally rests at the inferior limbus for younger patients. For older persons, horizontal laxity of the lower eyelid is associated with gradual descent [2], resulting in increased ISS and MRD2 measurements. Instead, pathological descent of the lower eyelid can be caused by facial trauma and burns;

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thyroid eye disease; facial neuropathy; cicatrizing diseases of the conjunctiva; and iatrogenically by facial, orbital, or lower eyelid surgery. Lower eyelid retraction can be identified by an ISS > 0 and/or an MRD2 > 6 and a classification scheme has been suggested by Bartley [3].

Standard oculoplastic examination will also disclose concomitant rotational malpositions of the lower eyelid, such as ectropion and entropion, laxity of the canthal tendons, orbicularis oculi weakness, and diseases of the skin, conjunctiva, and cornea. It is also important to measure *resistance to passive lid movement* (RPLM). In the absence of pathology in the anterior, middle, or posterior lamellae of the eyelid, an examiner can passively move the typical lower eyelid upward approximately 1 cm with little resistance and without rotation of the globe. When present, RPLM can be documented on a severity scale (e.g., 0–3+) and the examination will usually reveal whether the restriction is primarily in the posterior, middle, or anterior lamella. Restriction in the posterior or middle lamellae will frequently require spacer graft correction, as well as repair of any horizontal laxity or anterior lamellar insufficiency (see following chapters). Spacer grafts in the posterior lamella have become accepted as an important part of surgical treatment for lower eyelid retraction [4].

Xenograft Options

For many reasons, autologous tissues have been generally preferred as spacer grafts for correction of lower eyelid retraction, and other chapters discuss the use of hard palate, auricular or nasal septal cartilage, dermis, and composite dermis-fat grafts. However, some patients will refuse harvest of autologous tissues, and sometimes, harvest of autologous tissues is inappropriate or not possible due to previous surgery or disease. Allografts from another nongenetically identical human (e.g., preserved sclera, human-derived acellular dermal matrix [cadaveric: Alloderm®, noncadaveric: Belladerm®]) may be considered, but xenografts from different species are commercially available and are often utilized. Also, in this category are a variety of bioengineered spacers manufactured for human reconstructive surgery.

Acellular cross-linked porcine collagen (Enduragen®) is a flexible implant intended for reconstruction in the head and neck. It does not require hydration prior to use and provides a scaffold for fibroblast infiltration and vascularization. It is available in several sizes, with thickness of 0.5 mm and 1.0 mm. It does not require coverage with conjunctiva from the patient. Unlike human-derived acellular dermal matrix, it does not contain basement membrane and requires no special intraoperative orientation. Dailey et al. [5] have published the largest retrospective series using Enduragen®; they reported mean improvement in MRD2 of about 1 mm at 14 months among 160 eyelids, with few complications. Similar results were noted by McCord et al. [6] in 129 eyelids. A prospective, randomized comparative trial among Enduragen®, auricular cartilage, and Surgimend® (see below) for 42 retracted lower eyelids reported an average improvement in MRD2 of 2.3 mm at 6 months, with no significant difference between the three materials [7].

Fetal bovine acellular dermal matrix (Surgimend®) is rich in types I and III collagen. It is available in one thickness that varies from 0.75 to 1.54 mm and must be prehydrated for approximately 5 minutes prior to implantation. It has been extensively studied in breast reconstruction, but few reports are available regarding its use in eyelids [8]. However, as noted above, Barmettler and Hai reported no significant difference in clinical results in a prospective, randomized trial among auricular cartilage, acellular porcine collagen, and bovine acellular dermal matrix [7].

Decellularized porcine-derived membrane (TarSys®) derived from small intestine submucosa and consisting of collagen types I, III, and VI with glycosaminoglycan matrix similar to tarsus has been used for correction of lower eyelid retraction. It is manufactured in only one size (1 × 4 cm) and must be rehydrated for 20 minutes prior to implantation. The smoother side is preferred for epithelialization. Borrelli et al. [9] initially reported successful use of TarSys® for eyelid retraction in 2012, and Liao et al. [10] subsequently reported its successful use in 32 patients with TED, noting a mean improvement in MRD2 of 1.4 mm without significant complications. A recent case report documented florid inflammation in one patient following TarSys® implantation [11].

A bilayer matrix (Integra®) is a more rigid option, consisting of a porous dermal replacement layer of bovine collagen and glycosaminoglycan to promote neodermal formation and an epidermal layer of polysiloxane to provide a moisture and bacterial barrier. It has been approved by FDA for burns and treatment of scar contracture; it was designed to precede epithelial autografting (immediately following removal of the polysiloxane layer at 14–21 days). However, it has been used successfully without secondary epithelial autograft in correction of lower eyelid retraction and cicatricial entropion [12].

Porous Polyethylene (Medpor®) eyelid spacers are manufactured in one size (42 × 20 × 0.35 mm) but can be customized intraoperatively. They are typically placed using an infraciliary (subciliary) transcutaneous approach, secured to the inferior tarsal border and periosteum at the orbital rim, and have been shown to biointegrate [13]. Conjunctiva is necessary to cover the posterior surface of the spacer. A prospective study showed significant improvement in ISS, MRD2, lagophthalmos, and palbebral fissure size using porous polyethylene inserted preseptally via an infraciliary incision [14]. However, 15/32 patients had minor or major complications that required additional surgery and the authors recommended using the implant sparingly. Other authors have reported high incidence of eyelid contour deformities, malpositions, and exposure, and this implant is now used less frequently [15, 16].

Polytetrafluoroethylene (e-PTFE, Gore-Tex®) was initially described for use in eyelid reconstruction by Karesh et al. [17, 18] and has been since used extensively for frontalis sling ptosis repair. Intraoperative perforation of the material with a 21-gauge needle may facilitate fibrovascular ingrowth. It is potentially more useful when placed in the middle lamella using a transcutaneous approach, since it typically extrudes if not covered completely by conjunctiva [19].

Hyaluronic acid gel injection for lower eyelid retraction was initially described by Goldberg et al. [20] as a temporary alternative to the surgical spacer grafting as discussed above. They noted an improvement in ISS of 1 mm lasting 3–6 months

using hyaluronic acid (Restylane®) injected in the region of the orbital septum and lower lid retractors. A larger particle preparation (Perlane®) has also been described [21]. Similar results have been published by other authors [22], and the technique involves placement of multiple threadlike aliquots of gel posterior to the orbicularis oculi using a 30-gauge needle. Correction typically requires about 1 cc of gel injected per eyelid. The hyaluronic acid gels that are less hydrophilic (e.g., Restylane®, Perlane®, Belotero®) are preferred over those that are more hydrophilic (e.g., Juvéderm®) to avoid the possibility of prolonged superficial edema. Details of these injections will be further discussed in another chapter.

Surgical Techniques

Porous polyethylene and polytetrafluoroethylene implants each require complete coverage by conjunctiva to protect the globe from the implant, and are most successful when implanted via an infraciliary transcutaneous approach. The other xenografts can be successfully implanted via the transconjunctival approach, since conjunctiva will grow over their posterior surfaces in the early postoperative period. Both approaches may be combined with lateral canthal tightening procedures as indicated, and can be accomplished with a local anesthetic mixture such as 1% lidocaine with 1:100,000 epinephrine and 0.75% bupivacaine. Intravenous sedation may be useful in selected patients.

The *transconjunctival approach* is straightforward and can be performed with local anesthetic subconjunctival and subcutaneous infiltration and topical corneal anesthetic such as proparacaine 0.5%. The steps are as follows:

1. Place a traction suture at the lower eyelid margin. This can be accomplished with a suture passed in the coronal plane in the gray line without bolsters (see Fig. 12.1a, b) or as a mattress suture through the skin using a bolster.
2. With the eyelid everted using the traction suture, create a transconjunctival incision 1 mm inferior to the inferior tarsal border and develop a dissection plane anterior to the conjunctiva and capsulopalpebral fascia, but posterior to the orbital fat. Release any scar that prevents upward mobilization of the eyelid, taking care to avoid perforation through the lower eyelid skin.
3. Measure the newly created posterior lamellar defect horizontally and vertically with the eyelid held in a mildly overcorrected position. The typical width will be 20–30 mm, and the typical height will be 7–9 mm.
4. If necessary, hydrate the selected xenograft implant, and trim it to size according to your measurements. The orientation does not matter for acellular cross-linked porcine collagen (Enduragen®) or for fetal bovine acellular dermal matrix (Surgimend®). However, for decellularized porcine-derived membrane (TarSys®), the smooth side should be positioned toward the globe, while for the bilayer matrix (Integra®), the clear polysiloxane layer is placed toward the globe (Fig. 12.2).

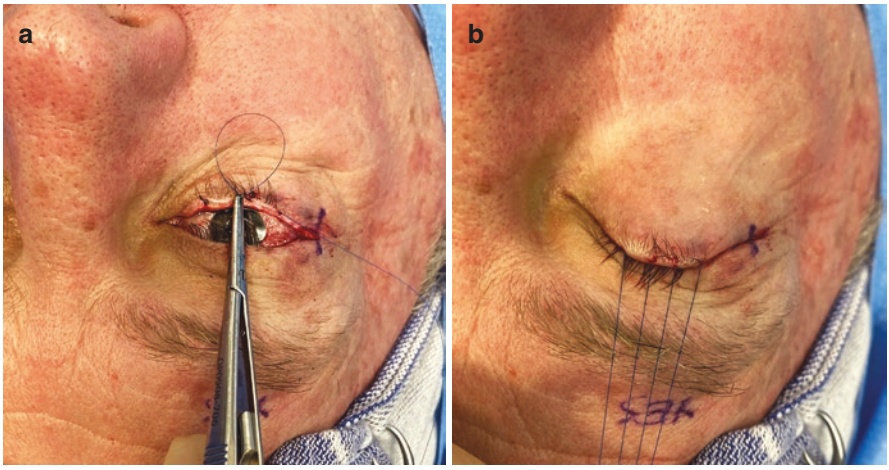

Fig. 12.1 Traction sutures: (**a**) The suture needles can be placed through the eyelid margin gray line, and help place the eyelid on vertical traction when dissecting transcutaneously, (**b**) This double-pass technique for Frost traction sutures has several advantages – intraoperatively, it allows for a wider, more stable eyelid traction, and postoperatively, there is minimal damage to the gray line if pulled out inadvertently, and 5-0 polypropylene is nonreactive for up to a month

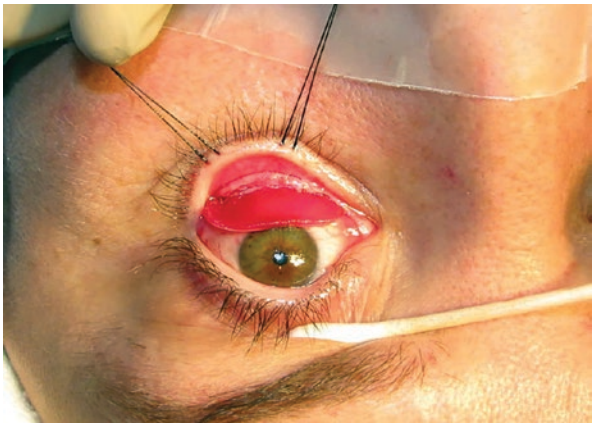

Fig. 12.2 Intraoperative photo of the Integra® graft placed below tarsus and secured to the conjunctival fornix with polyglactin sutures. The temporary silicone layer provides structural support and can be peeled away in clinic after several weeks

5. Secure the superior edge of the xenograft to the inferior border of the tarsus with partial thickness, buried, interrupted, or running 6-0 absorbable suture to avoid corneal irritation (Fig. 12.3). Polyglactin 910 is preferred over chromic or plain gut to provide longer-term fixation.
6. Fixate the inferior edge of the xenograft to the superior edge of the retractors with buried interrupted absorbable sutures.
7. A lateral canthoplasty with tarsal strip or other canthal tightening procedure can be accomplished concomitantly if horizontal laxity is present.

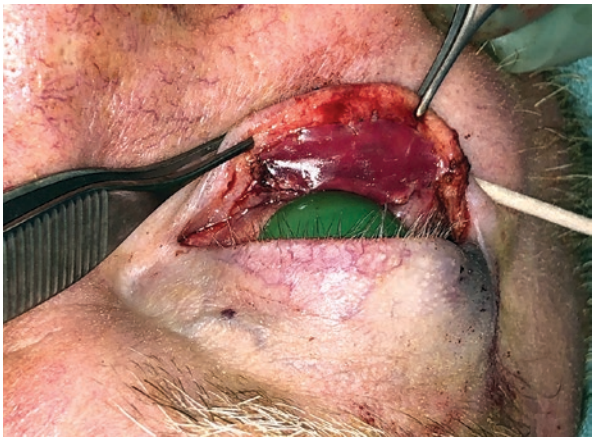

Fig. 12.3 The superior edge of the Integra® graft is secured to the inferior tarsus with partial-thickness, buried 6-0 absorbable sutures. (Image courtesy of Cat N. Burkat, MD FACS)

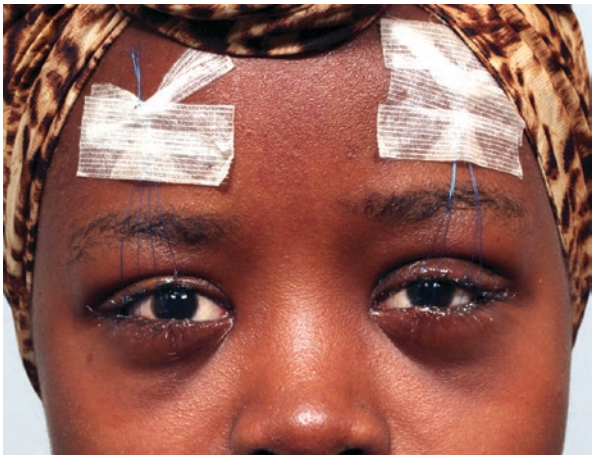

Fig. 12.4 Frost sutures at 1 week: Half-inch steristrips and mastisol provide dependable upward traction for 1 week or more

8. The traction suture can be temporarily secured to the forehead with steri-strips and benzoin as a Frost suture, if desired (Fig. 12.4). For recalcitrant, recurrent cicatrix, longer-term upward postoperative traction can be obtained with suture passage through the upper eyelid margin and fixation to the forehead (Fig. 12.5). Using 2 mattress sutures allows for a wider, more stable eyelid traction by distributing tension, and the 5-0 polypropylene is nonreactive for up to a month.

The *infraciliary, transcutaneous approach* is also straightforward, although it requires more attention to the anatomy, particularly for eyelids with extensive scarring. It can be performed with local anesthetic subconjunctival and subcutaneous infiltration, often with intravenous sedation. The steps are as follows:

1. Mark the intended infraciliary incision. It can be modified slightly depending on the type of planned traction suture.

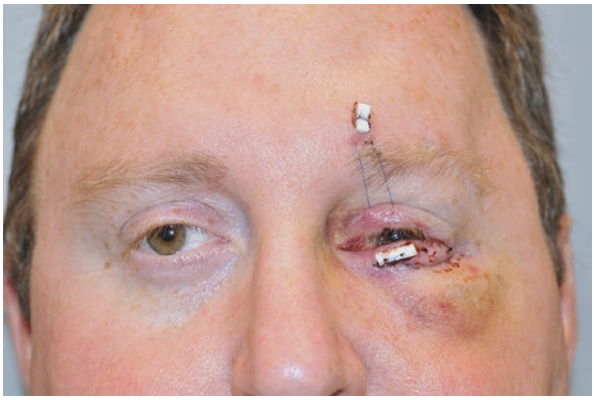

Fig. 12.5 For recalcitrant, recurrent cicatrix, longer-term upward postoperative traction can be obtained with suture passage through the upper eyelid margin and fixation to the forehead

2. Place a traction suture at the lower eyelid margin. This can be accomplished with a suture passed in the coronal plane in the gray line without bolsters (Fig. 12.1a) or as a mattress suture through the skin using a bolster. The eyelid is then pulled upward (Fig. 12.1b).
3. Create the infraciliary incision and dissect inferiorly in the subcutaneous plane, minimizing injury to the pretarsal orbicularis oculi muscle. At approximately 5 mm inferior to the eyelid margin, transition to a dissection plane posterior to the preseptal orbicularis muscle. The orbital septum is typically visible as an avascular, white plane, and with further inferior dissection, fat can be discerned deep to the orbital septum.
4. For porous polyethylene implants, a pocket is created anterior to the septum inferiorly to the orbital rim. The implant is trimmed and the medial and lateral edges bent to avoid anterior winging. It may be soaked in antibiotic solution, and contact with the skin should be avoided. For more rigid support of the lower eyelid, the inferior edge of the implant is secured to the arcus marginalis periosteum at the inferior orbital rim. When less rigidity is required, an incision can be created in the orbital septum just above the orbital rim, permitting the implant to slide posteriorly and inferiorly into the orbit to retain eyelid motility.
5. In either case, the superior edge of the implant is sutured to the inferior tarsal border with absorbable sutures. Polyglactin 910 is preferred over chromic or plain gut to provide longer-term fixation.
6. For polytetrafluoroethylene, the superior septum can be opened transversely and the orbital fat teased away from the capsulopalpebral fascia, located posterior to the fat. The capsulopalpebral fascia is loosely adherent to the palpebral conjunctiva and must be disinserted from the tarsus superiorly and carefully dissected away from the conjunctiva so that it is recessed inferiorly. Assuming that the conjunctiva itself is not scarred, release of these layers should provide upward mobilization of the lower eyelid. The polytetrafluoroethylene spacer may be soaked in antibiotic solution, and contact with the skin should be avoided. It can then be customized to reduce the surgical defect between the intended location of the tarsus and the capsulopalpebral fascia and is secured to each with

absorbable sutures. Polyglactin 910 is preferred over chromic or plain gut to provide longer-term fixation.

7. Closure is then accomplished in two layers, with meticulous repair of the orbicularis muscle using polyglactin 910, and reapproximation of the skin with suture as desired. Lateral canthoplasty with a tarsal strip or other canthal tightening procedure can be accomplished concomitantly, if indicated.
8. The traction suture can be temporarily secure to the forehead with steri-strips and benzoin as a Frost suture, if desired (Figs. 12.4 and 12.5).

Postoperative Care

Postsurgical wound care is similar to other eyelid surgeries. The patient is told to expect swelling and bruising for the first 1–2 weeks, and to apply cold compresses for the first 2 days while awake. Topical ophthalmic antibiotic ointment can be prescribed for use on skin sutures. Topical ophthalmic antibiotic-steroid combination eyedrops can be prescribed for use with conjunctival incisions. Systemic narcotics are usually not necessary.

Initial follow-up can be scheduled for 1 week postoperatively to check on eyelid position, consider removal of Frost sutures if used, and to examine the cornea for possible epithelial injury. Patients are instructed to call for an earlier appointment if persistent foreign body sensation is noted after the first day. The polysiloxane layer of the Integra® graft is usually well tolerated, but corneal abrasions from it or from sutures used with any of the xenografts are possible, and should be treated aggressively to prevent infectious keratitis. Prudent, earlier follow-up may be appropriate, especially for patients with corneal sensory neuropathy or pre-existing epitheliopathy.

For patients with Integra® grafts, follow-up between 3 and 8 weeks should be planned for removal of the polysiloxane layer in the office using topical anesthesia (Fig. 12.6). For all graft types, close follow-up during the first 6 months is advisable

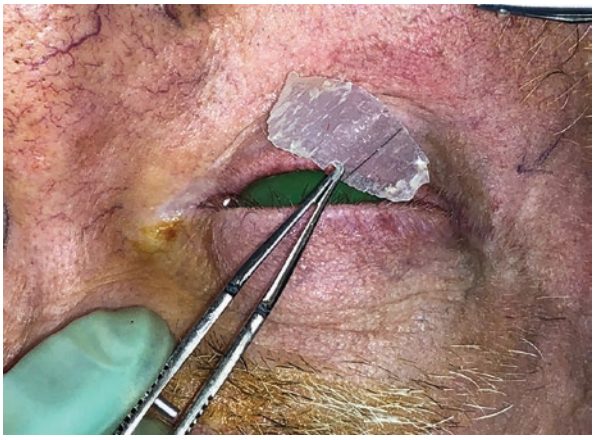

Fig. 12.6 The posterior polysiloxane layer of an Integra® graft can be easily lifted off at 3–8 weeks after surgery. (Image courtesy of Cat N. Burkat, MD FACS)

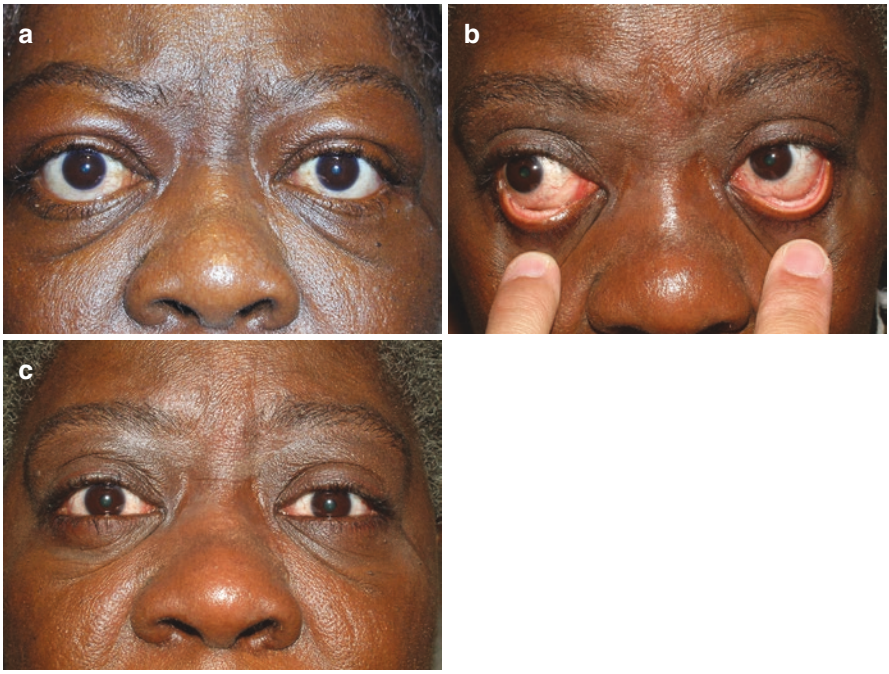

Fig. 12.7 Patient with thyroid eye disease who underwent retraction repair with Enduragen® implants: (**a**) Preoperative lower eyelid retraction and several millimeters of inferior scleral show, (**b**) 1 week postoperatively, with edge of Enduragen® implant visible below tarsus, (**c**) 2 months postoperatively with improved lower eyelid position

to manage complications and to evaluate surgical efficacy. Patients with negative vector orbit, such as proptosis from thyroid eye disease, may often require additional considerations for optimal correction, such as decompression of the orbit, orbital rim implants to decrease negative vector, or implants with more rigidity to vertically support the lower eyelid upwards (Figs. 12.7 and 12.8).

Risks and Informed Consent

In addition to the general risks associated with eyelid surgery such as bleeding, infection, asymmetry, scarring, eyelash loss, pain, ectropion, suture problems, persistent malposition, need for further surgery, ocular injury, diplopia, and blindness, there are specific risks inherent in the use of xenografts. These include risk of disease transmission (not yet reported in the literature), late xenograft extrusion or failure, reduced lower eyelid mobility in downgaze, and inflammatory reactions. Late graft extrusion through the skin has been most commonly observed with porous polyethylene implants in up to 13% of patients [14].

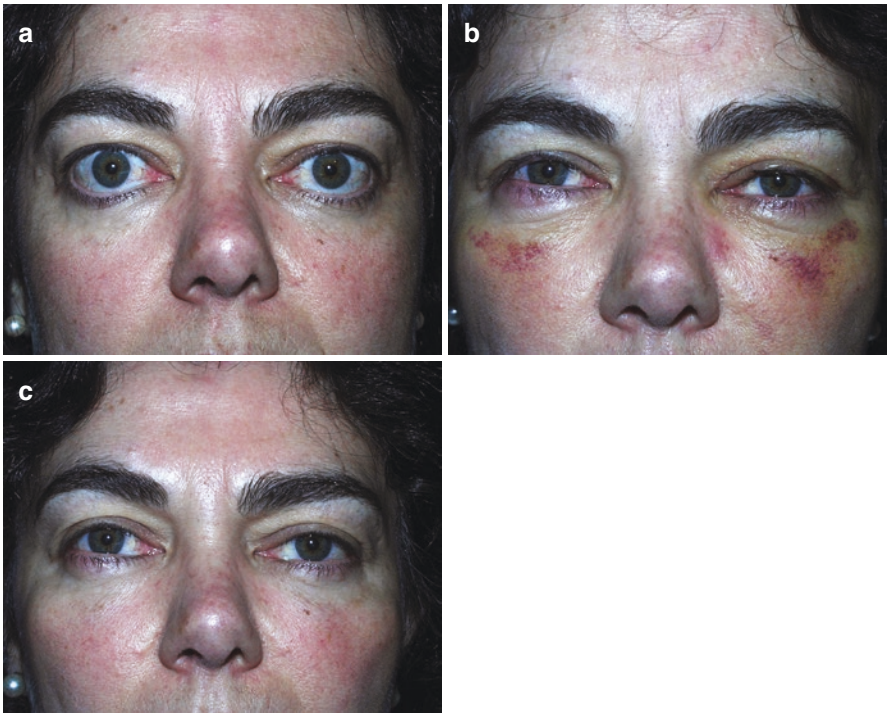

Fig. 12.8 Patient with thyroid eye disease who underwent retraction repair with Enduragen® implants: (**a**) Preoperative lower eyelid retraction and scleral show bilaterally, (**b**) 1 week postoperatively, and (**c**) 4 months after Enduragen® implants

Informed consent discussion with the patient regarding the risks, potential benefits, and alternatives to the use of xenografts is appropriate as part of the preoperative evaluation and surgical planning. Completion of a written or online record of informed consent is always necessary to document the discussion and the patient's agreement to surgery. In rare cases, personal or religious beliefs may limit its use.

Summary/Conclusion

Xenografts can be useful in the surgical management of symptomatic lower eyelid retraction, carry the advantage of no donor site morbidity, and may be considered for use in selected patients. Surgical implantation techniques are similar to those used for correction of lower eyelid retraction with autologous human implants, with adequate scar release of paramount importance. Hyaluronic acid gel can be used for selected patients as a temporary, minimally invasive alternative administered in an office or clinic setting. Details for this technique are considered in the following chapter.

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13 Lower Eyelid Retraction: Middle/Posterior Lamellar Correction Using Fillers and Fat

Morris E. Hartstein

Post-blepharoplasty lower lid retraction remains a challenging problem to treat. Traditionally, procedures to correct lower lid retraction include lateral canthal suspensions, spacer grafts, midface lifting, and frost sutures. Many of these techniques are discussed in the accompanying chapter. However, with the advent of dermal hyaluronic acid fillers, as well as autologous fat transfer, my understanding of the mechanism of lid retraction has evolved as well as my approach to treatment.

We have previously reported on the utility of combining autologous fat grafting with standard lifting techniques for the repair of lower lid retraction. The injected fat corrects the lower lid hollows, as well as pushing/stretching the anterior lamella across the length of the lid (Fig. 13.1). Stem cells from the fat may also play a role

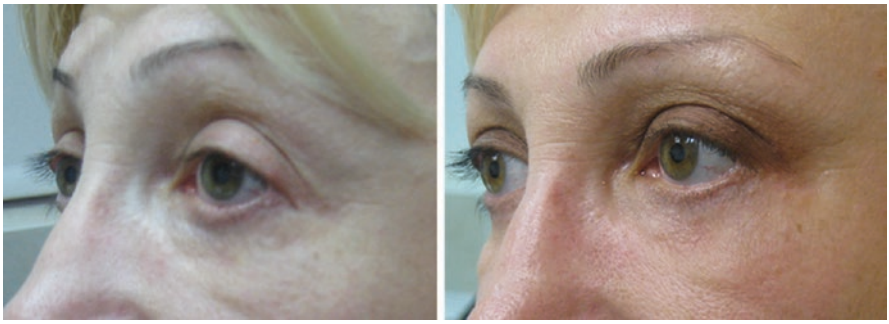

Fig. 13.1 Pre- and post-correction of post-blepharoplasty lid retraction. This patient had undergone several prior attempted repairs, before undergoing lateral canthoplasty, midface lift, and autologous fat transfer with no spacer graft. Note the improved lid position as well as decreased hollowing

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in preventing recurrence of the cicatrix. We have successfully treated post-blepharoplasty lid retraction using standard lifting techniques along with autologous fat transfer. In this series, no spacer grafts were used [1].

We can consider the retracted lower eyelid as having a negative vector, where there is generally a volume deficiency immediately below the pretarsal lower lid and a hollow lower sulcus. Instead of the traditional approach of lid tightening and lifting, we can utilize dermal HA filler to effectively "unfold" the lower eyelid. Utilizing HA filler, one can begin the injections deep, at the inferior orbital rim. Slowly, the injections are placed more superiorly as well as more superficially as one approaches the lid margin. These injections effectively "unfold" the lower lid, pushing the hollow sulcus anteriorly and the lid margin superiorly. At first, this may seem counter-intuitive, that is, adding volume as a counter to gravity in order to elevate the lid (Fig. 13.2). However, if the retracted lower eyelid is viewed as being unfolded, the filler effectively uncoils the lid like a spring, producing the necessary elevation and inward rotation toward the globe [2, 3].

This technique has a high level of both physician and patient satisfaction. It is a much easier and more pleasant experience for both as an in-office procedure versus another trip to the OR, with a fibrosed lid, and long recovery time. It is helpful to perform these injections in stages so as not to produce an edematous lid. As the filler absorbs fluid, this will also help to correct the lid position. Although this technique works best in lids that are retracted/ectropic, without tether, I have had good experience with this technique even in lids with cicatricial changes.

Besides the usual possible complications of any filler injection, there may be prominent edema present as a relatively large volume of filler may be necessary to inject into the small area of the thin skin of the lid. In cases where there is significant edema that is bothersome to the patient, it can be treated with hyaluronidase. However, if several months are allowed to pass until injecting with hyaluronidase,

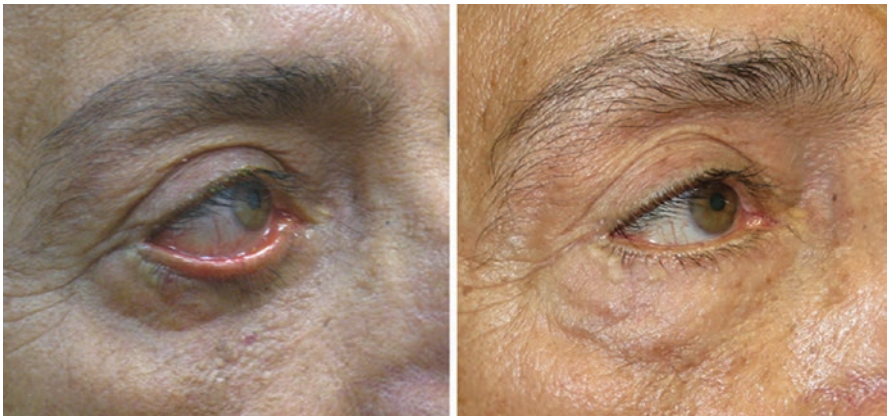

Fig. 13.2 Pre- and post-correction of post-blepharoplasty lid retraction. This patient had undergone previous attempted surgical repairs before undergoing correction solely with HA filler injection. This result has lasted more than 4 years without any additional filler

the lid will often maintain its stable position even after dissolution of the filler due to tissue expansion.

Finally, we have treated several cases of post-blepharoplasty lower lid retraction with combined procedures. That is, first, the negative vector is corrected and the skin expanded with filler. This allows standard tightening and lifting procedures can be more successful.

In summary, the use of autologous fat transfer and dermal HA fillers offer an exciting alternative in the treatment of post-blepharoplasty lid retraction, with a high rate of patient satisfaction. More than just another treatment option, observing the way in which filler corrects the retracted lid has enhanced our understanding of the anatomic changes that have taken place. Further refinements will likely enable us to fine-tune our treatments of this most challenging problem.

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14 Lower Eyelid Retraction: Anterior Lamellar Correction Using Midface Lifting

Allan E. Wulc

Lower eyelid retraction is a common sequel to anterior transcutaneous lower blepharoplasty surgery. Even without the excision of anterior lamellar skin, an incision in the infraciliary crease alone can create the conditions that allow the middle lamella of the lower lid to contract, causing lower eyelid retraction. When the effects are subtle, the patient is unaware of the slight rounding of the lateral aspect of the lower lid. The increased scleral show with the attendant increase in size of the palpebral aperture may actually be aesthetically pleasing to the patient. However, when the effects are less subtle, the eyes appear pulled downward, imparting a sad appearance. The increased exposure can give rise to bowing of the lower eyelid, retraction, ectropion, dry eye symptoms, and exposure keratopathy [1].

Patients who undergo more sophisticated and involved procedures to address the midface or suborbicularis oculi fat (SOOF) via a trans-eyelid approach are even more prone to postoperative lower eyelid issues of this sort. These procedures involve division of the orbital retaining ligament (ORL) and a composite lifting of the orbicularis and malar fat pad with lateral anchoring, either along the orbital rim [2] or more laterally to the temporalis fascia [3]. ORL lysis in isolation with blepharoplasty can give rise to ectropion due to contraction along the middle lamella [4]. The powerful elevation of the midface that is seen intraoperatively creates bunching in the skin that is often resected by the surgeon. In combination with early postoperative orbicularis weakness, and the skin removal, the eyelid sling cannot support the weight of the midface in the absence of the retaining ligaments and severe ectropion can result.

The transtemporal supraperiosteal endoscopic midface lift is a powerful tool to recruit anterior lamellar tissues, both skin and orbicularis, into the lower eyelid and particularly into the lid-cheek junction. Using this technique, the surgeon can avoid a skin excision with the attendant additional scarring and contracture that may

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supervene. The endoscopic technique allows the surgeon to visualize mid-lamellar scarring which is often responsible for the retraction (usually found below the orbicularis at the septal arcus marginalis interface) without the need for an anterior incision which would otherwise promote additional scarring [5]. The scars can also be selectively lysed without fear of mid-lamellar collapse. The lateral canthus can be then addressed, and its attachments lysed if the lateral canthus was displaced downward by the initial surgery, allowing the lateral canthus to be elevated.

Suspension of the malar midface and orbicularis can be carried out using one to two cable sutures per side. Despite the lack of direct interposing edge-to-edge approximation of tissue, the elevation creates a new midface position that appears to remain stable over time [5]. The procedure can be performed with posterior lamellar grafting using spacer materials in the case of severe lower eyelid retraction [6]. Frost sutures are placed in most patients and remain for approximately 1 week.

In the preoperative examination, if midface elevation produces improvement in lower eyelid retraction, and if sufficient midface skin exists, then most patients with lower lid retraction will benefit from this procedure. The procedure also permits the surgeon to address brow ptosis if it exists. A previous forehead lift is not a contraindication to the procedure; however, the surgeon must be prudent in approaching the midface in the vicinity of the temporal branch of the facial nerve, staying deep to it, and the patient must be made aware of the risks.

Requirements

Endoscopic surgery allows the use of a highly magnified field in two dimensions and a tactile sense which is facilitated by the use of a second instrument that is usually passed through an adjacent incision. We have experience with the Karl Storz endoscopic plastic surgery system, a 5 mm, 30-degree forward Hopkins endoscope with a midface sheath. The latter sheath allows the optical pocket formed by the endoscope to be a wide field and can be uses as a dissector. The scope is connected to a camera and monitor.

Additional instruments that are required are a tonsil forceps, an Isse elevator (no longer made) or a Trepsat spoon elevator (Accurate Surgical, Westbury, NY), and a long needle holder.

Procedure

In the preoperative holding area, the patient is identified by the attending surgeon and a brief repeated informed consent is achieved. The patient is again made aware of the risks of surgery. Alternative procedures and surgeries, including doing no surgery, are discussed.

In the preoperative holding area, any additional anticipated modifications in lower lid protuberances (e.g., excess fat or areas of volume loss requiring structural fat grafting) are marked. If festoons are present, these are also marked and addressed simultaneously with fully ablative erbium laser resurfacing.

The patient is now brought to the operating room and placed in the supine position and appropriate OR protocol is observed. Total intravenous anesthesia or laryngeal mask anesthesia can be employed. Tetracaine drops are instilled into both eyes.

A central forehead incision measuring 1.5 cm is outlined immediately posterior to the hairline with a gentian violet marking pen. Paramedian incisions are designed 4.5 cm laterally in each direction of similar length. Temporal incisions are outlined 1.5 cm from the superior temporal crest ligament approximately 1.5 cm from the temporal tufts bilaterally, measuring up to 3 cm.

The lower eyelids and lateral canthi are infiltrated with a local mixture of bupivacaine 0.5% with 1:200,000 epinephrine and 1% lidocaine with 1:100,000 epinephrine in a 50:50 mixture. The marked forehead incisions are also infiltrated with the aforementioned anesthetic solution. Supraorbital, supratrochlear, auriculotemporal, zygomaticofacial temporal, infraorbital, mental, and incisural blocks are also accomplished. The upper eyelids may also be infiltrated if upper lid surgery or brow lifting are contemplated. In total, between 20 and 30 cc of infiltrational and nerve block anesthetic are required.

If liposculpture is being performed, adit sites are marked in the abdomen and infiltrated with this anesthetic solution. The patient is now prepped and draped, keeping the entire face in the field. At this time, 50 mL of a tumescent anesthetic consisting of lidocaine 0.1% with 1:1,000,000 is instilled into the central forehead and temples using a 25 g needle. An additional 25 ml of solution is instilled on each side of the cheeks.

If liposculpture is being performed, at this time, approximately 120 mL of tumescent anesthesia are now administered through two to four adit sites created with #11 blade to the area of intended fat harvest, usually the abdomen or inner thighs, using a Tonnard cannula.

Incisions are made in the central paramedian temporal areas with a #15 blade. The temporal incisions are made down to the superficial portion of the deep temporalis fascia and only elevated under direct nonendoscopic visualization to the temporal tufts. The central incision is made through the periosteum. The paramedian incisions are made with care through the periosteum, avoiding injury to any visualized ramified branches of the supraorbital nerve.

The initial steps of the procedure are identical to those classically described with endoscopic brow lifting. Using a curved Daniel elevator, a subperiosteal dissection is carried out to within 3.5 cm above the superior orbital rim. The two temporal pockets are now joined to the central pocket, from temporal to medial, by using a curved Daniel elevator. A 30-degree 5 mm guarded endoscope is now brought into the paramedian incision site, and the temporal crest ligament is now dissected down below the supraorbital bar. If a brow lift is being performed simultaneously, as is typically performed, the orbital periosteum can be divided over the arcus marginalis to the supraorbital nerves bilaterally and the superior palpebral ligaments can be divided using a Metzenbaum scissors to mobilize the temporal brow fat pad. In the supraorbital nerve corridor, the periosteum can be opened leaving 1 cm of attached periosteum. Dissection is carried down in the supraperiosteal plane to expose the glabellar musculature as far as the radix and the depressor and procerus muscles can be partially or fully myotomized, leaving the corrugators intact to avoid brow elevation and lateral splaying. The temporal dissection for an endoscopic brow lift

classically ends after the sentinel veins are exposed, and it is at this point that the endoscopic midface lift begins (Fig. 14.1).

A network of nerves and vessels are now exposed coursing vertically through the temporalis (Fig. 14.2). Gentle dissection is carried out laterally for approximately 3 cm beyond the medial sentinel vein using a gentle vertical spreading technique with a tonsil forceps (Fig. 14.3). In the roof of this tissue, usually without a fascial

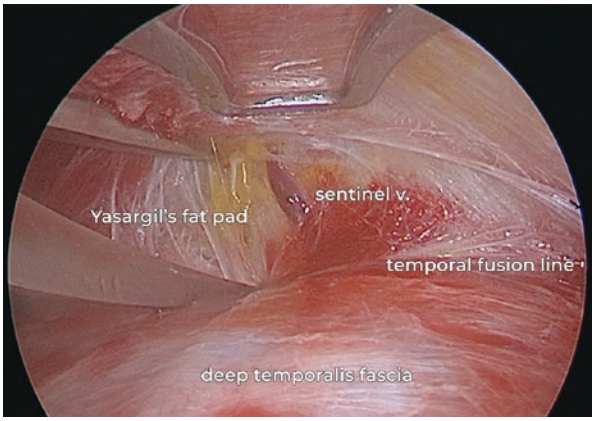

Fig. 14.1 Endoscopic view of the temporalis fossa revealing the vital structures at the inferior extent of the brow lift dissection

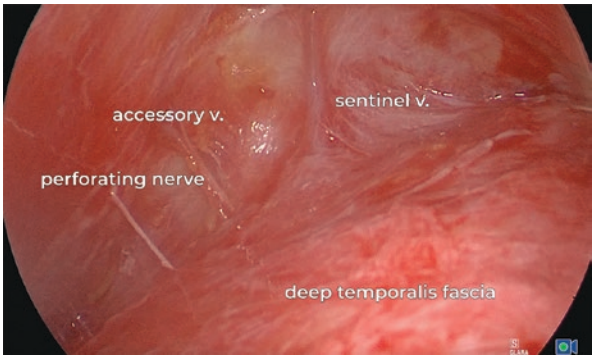

Fig. 14.2 Endoscopic view showing nerves coursing vertically through the temporalis muscle

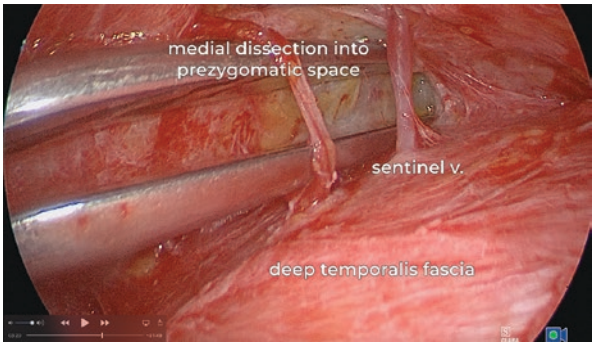

Fig. 14.3 Endoscopic view of the tonsil blunt forceps starting the dissection onto the prezygomatic space to enter the midface

covering, is the temporal branch of the facial nerve, and therefore it is important to stay deep to them and to proceed gently (Fig. 14.4).

Sharp dissection of the anterior attachments of the lateral canthal tendon to the skin is performed medial to the sentinel veins with a Metzenbaum scissor (Fig. 14.5). The surgeon should attempt to elevate the anterior tendon at its attachments to periosteum and to expose the overlying orbicularis muscle, remaining in the supraperiosteal plane.

Dissection of the anterior portion of the lateral canthal tendon facilitates entry to the prezygomatic space which is performed with a spoon-shaped dissecting instrument such as the Isse or Trepsat elevator. At this point, the elevator is passed into the prezygomatic space and the midface can be elevated. The surgeon is above the zygomatic branches of the facial nerve in this location, visualizing SOOF below and orbicularis above.

Once in this space, a curved elevator or spoon elevator can fully open this space to its lateral limit. The strong zygomatic ligaments are firm obstacles to more lateral

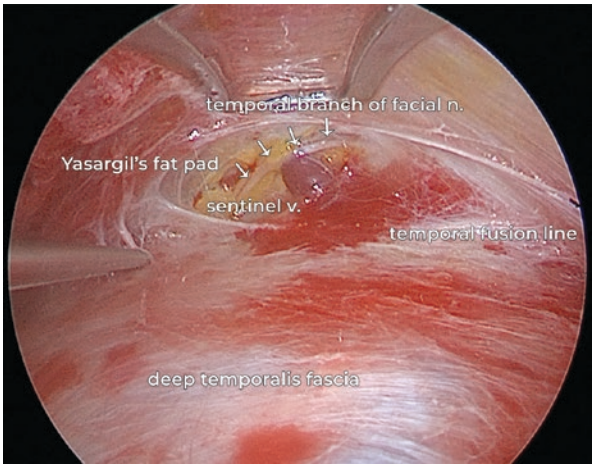

Fig. 14.4 Endoscopic view of the temporal branch of the facial nerve coursing in the superficial temporalis fascia near the sentinel vein

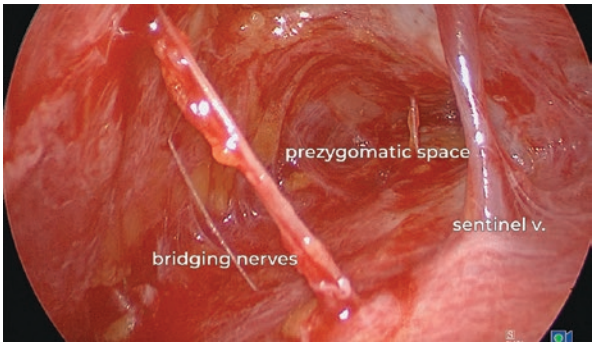

Fig. 14.5 Endoscopic view of the dissection of the prezygomatic space medial to the lateral canthal tendon

midface elevation, and their most medial aspect requires division (Fig. 14.6). The zygomatic ligament is minimally incised with a tonsil forceps using a gentle spreading technique, exposing the malar septum and more completely liberating the midface. The zygomaticus major and minor muscles can often be seen at this time as they course toward the modiolus.

If a change in canthal position is desired, deep attachments of the lateral canthal tendon can be severed with a long sharp curved scissors such as a Metzenbaum scissor under direct endoscopic visualization. The orbital retaining ligament or the arcus marginalis can be selectively lysed. We do not find it necessary to perform this routinely, however. Often, the surgeon will also visualize the zygomaticofacial nerve bundle as it enters the foramen. Immediately below and medial to this, the orbitomalar ligament described by Pessa can be seen [7].

At this time, the midface is suspended using two 3-0 Prolene sutures 3 cm from the lateral canthus in a line from the lateral canthus to the inferior and superior tragal borders, respectively, passed backhand through orbicularis and often engaging superficial malar fat (Fig. 14.7).

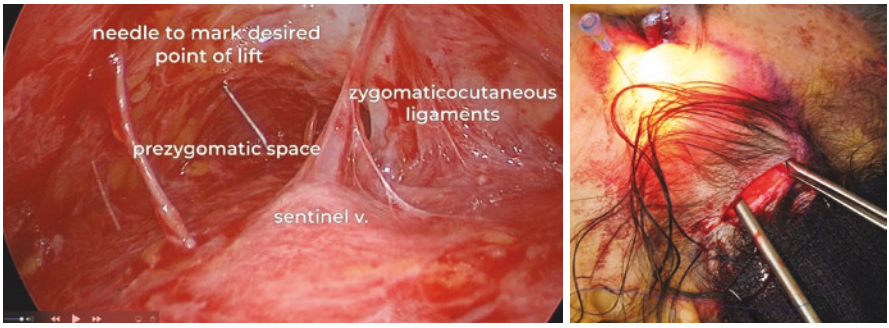

Fig. 14.6 Endoscopic view of the zygomatic ligaments, which are largely left preserved (left). A 25 g needle is used to mark the point of desired lift (right)

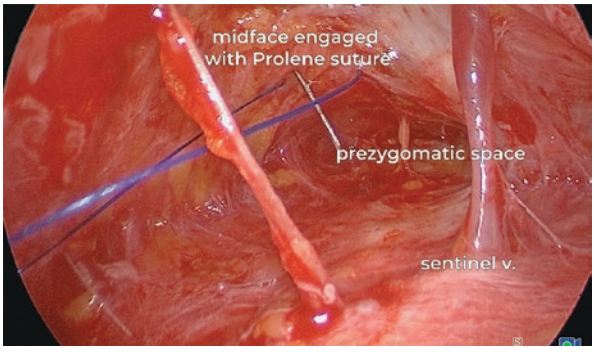

Fig. 14.7 A 3-0 Prolene suture is used to capture the midface and sutured to the deep temporalis fascia in the desired vector

Once these two sutures are placed endoscopically, the OR lights are turned on again, and direct visualization allows the sutures to be attached using a whipstitch (two passes) in a directly vertical fashion and tied under maximal tension while an assistant elevates the cheek manually (Fig. 14.8). A hockey stick can be used to secure the first throw of the knot.

The analogous procedure is performed on the contralateral side, verifying symmetry. The temporoparietal fascia is now closed using two 3-0 PDS sutures attaching them directly to the temporalis fascia. The temporal incisions are now closed using staples.

If indicated, the lateral brow can now be elevated through the paramedian incisions by employing a 4.5 mm J latch drill drilling two adjoining holes through anterior table bone. Through this thoroughly irrigated opening, a 2-0 suture such as PDS is passed and the frontalis is attached directly and securely to the anterior table. Multiple alternatives for fixation exist, including the use of glue, Endotine®, bone tunnels and other suture techniques.

The central and paramedian incisions are now closed meticulously with running and interrupted 5-0 Prolene sutures.

If necessary, transconjunctival placement of a spacer material is performed. Our preference is to use autologous de-epithelized dermis fat because it is hardy and less painful than hard palate at the harvest site. Plastic corneal scleral shields are now placed. The graft can be left to mucosalize or can be covered with conjunctiva if enough redundancy exists.

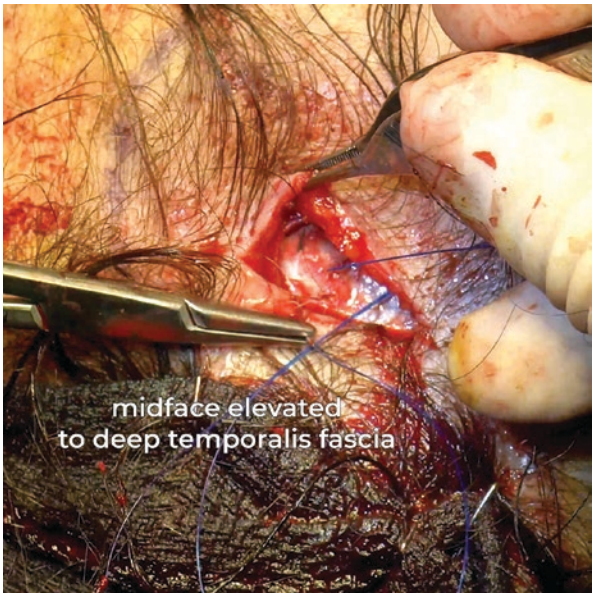

Fig. 14.8 The Prolene suture is tied to the deep temporalis fascia to provide the desired elevation

Two 4-0 silk sutures are employed medial and lateral to the limbus as Frost sutures on each lower eyelid to immobilize the lower eyelid in the early postoperative period and left in place for a week.

If necessary, canthal position can be further altered via a lateral approach, though elevation via the endoscopic approach frees it well in the majority of cases. An orbicularis hammock can also be employed to elevate the preseptal orbicularis as described by Little and Hartstein [2].

At necessary, fat is harvested using a Tonnard cannula through the adit sites that were created with a # 11 blade. The fat is harvested symmetrically using a low vacuum technique through a 10 cc syringe. The fat is processed according to a modified Coleman protocol, centrifuged for 1 minute at 3000 RPM, and placed in the face using two adit sites created with an 18 g needle. A SoftFil 18 g cannula is used to place the fat in quantities specified elsewhere in the medical record through these sites, 1 and 2 cm lateral to the nasolabial fold bilaterally, respectively, using passes of 0.03 cc per pass. Nano-fat is created using the Tulip GEMS filtration system and used to augment the tear trough and fine rhytids as necessary.

At this time, a block consisting of Marcaine 0.5% with 1:200,000 epinephrine is administered to the supraorbital, supratrochlear, auriculotemporal, and lacrimal areas. The lower eyelid blocks are reinforced with infiltrational anesthesia. A sphenopalatine block is accomplished using a Tx360 device. The drapes are removed and the hair is gently shampooed.

If a laser is indicated to treat festooning at the lid cheek junction, additional tetracaine is now instilled OU, metal protective shields are now placed, and aggressive lasering is performed till the festoons are ablated. We use a Sciton dual erbium laser, but other ablative lasers may also be useful. Appropriate laser precautions are taken throughout. The lower eyelids are resurfaced below the festoons, and the festoons are treated with multiple passes using a 4 mm handpiece.

At this time, the metal shields are removed. Antibiotic ointment is instilled into the eyes and onto the wounds and the Frost sutures are taped to the forehead using ¼ inch Steri-Strips. Aquaphor or an appropriate wound dressing is placed on the lower eyelids.

No dressings are employed for the midface.

Postoperatively, pain has greatly diminished with the institution of the sphenopalatine ganglion block proximate to the surgery, and most patients now only require acetaminophen postoperatively.

We have not found that this surgery results in similar complications as to those seen in Chap. 23. The technique is a helpful means of recruiting anterior lamellar skin when there is mild to moderate anterior lamellar skin loss and preserved orbicularis function without the need for an anterior eyelid incision and without the need for skin grafting. Representative pre- and postoperative results are shown in Fig. 14.9.

Fig. 14.9 A 54-year-old female who underwent upper and lower blepharoplasty, endoscopic brow and midfacial lifting, and facial liposculpture before (left) and 6 months after (right) surgery

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Lower Eyelid Retraction: Anterior Lamellar Correction Using Onlay Implants

15

Kenneth Steinsapir

Introduction

The repair of post-blepharoplasty lower eyelid retraction continues to be a vexing clinical issue. This explains why there are many surgical approaches. In this section the author discusses a personal approach that has proven to be highly successful and reliable over a 25-year period in thousands of cases [1].

Vertical and horizontal inadequacy of the lower eyelid commonly presents after transcutaneous lower blepharoplasty with or without lateral canthal resuspension. It is also seen after lower blepharoplasty with laser resurfacing or chemical peeling. It can be present in a variety of congenital syndromes, the most common being the relatively shallow orbit. Patients who have thyroid eye disease, even after successful orbital decompression, can show evidence of vertical and horizontal inadequacy of lower eyelid. Following trauma reconstruction, a variety of complex lower eyelid vertical and horizontal deficiency situations can be encountered. These generally contribute to corneal exposure and dry eye even in the setting of a normal upper eyelid.

Clinicians have conceptual challenges in understanding and addressing these issues. The naive approach often repeatedly performed in a given individual is to only see the problem as a localized lower eyelid issue rather than understanding the lower eyelid issues in the context of the skeletal midface support. Isolated lateral canthal tightening with the goal of addressing vertical and horizontal inadequacy of lower eyelid will generally fail.

The lower eyelid is composed of curved layers of muscle and connective tissue, and an inner liner of palpebral conjunctiva suspended by a ligamentous structure over the spherical surface of the globe. The eyelid margin is stabilized by the tarsus

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with its medial and lateral canthal ligamentous bone insertions. The lower eyelid functions as a muscular hammock. Two-dimensional thinking about postsurgical changes often results in surprising outcomes. Tightening the lower eyelid in this setting forces the lower eyelid margin to a lower horizontal position after surgery [2, 3]. The lower eyelid margin will find the shortest geodesic on the surface of the eye that minimizes tension. This is often a lower rather than a higher position for the lower eyelid margin.

It is the rare compromised lower eyelid that responds to lateral canthal resuspension with recession of the lower eyelid retractors and no other surgical maneuvers [4]. More recently, orbital decompression has been proposed as an approach to address these compromised eyelids [5], which may improve the topological relationships described above but is a technically demanding procedure. For this reason, successful eyelid reconstruction more commonly involves the use of spacer graft material and the recruitment of soft tissue into the eyelid space. The majority of these lower eyelids will not be successfully repaired unless a number of issues are addressed simultaneously.

The goal is to restore the hammock function of the lower eyelid. The lower eyelid margin needs to just reach corneal limbus centrally. Laterally the lid margin needs to rise in a soft parabolic curve to the lateral canthus. Earlier investigators emphasized the need to position the lateral canthal angle at least 2 mm higher than the medial canthus [6]. This often results in a lateral upsweep of the lower eyelid, a distinctly unnatural effect. The truth is that individuals do better aesthetically if the lateral canthal angle is placed at approximately the same height as the medial canthal angle or slightly above it. The canthal angle itself should, as much as it is practical, extend to the bony orbital rim to allow for the widest horizontal palpebral fissure. It also needs to hug the curvature of the eye surface. That necessitates a posterior vector of insertion laterally. Rather than take a dogmatic stand on where the lateral canthal angle should be positioned, it is far better to assess the patient intraoperatively and judge the effect of lateral canthal repositioning. If the angle is too high, too low, or not sufficiently posterior, it must be repositioned.

To accomplish this, surgery is best performed under intravenous sedation making it possible to lighten the sedation sufficiently so that the patient can follow commands intraoperatively to open and close the eyes while sitting up. This type of finesse is simply not possible when the patient is under general anesthesia. Repairing these eyelids requires mobilization of the lid margin with the recruitment of cheek soft tissue. Without that soft tissue, no amount of force on the eyelid margin will overcome the soft tissue deficit – not even a so-called drill-hole canthoplasty [7]. In some cases a skin graft can provide this mobilization. However, that can create an undesirable cosmetic outcome. Aesthetically, it is much better to mobilize the midface soft tissue from the orbital rim and midface bones to permit a vertical lift of the cheek. This will be described below. To permanently support this advanced soft tissue, internally it is necessary to fix the elevated cheek to the orbital rim. The periosteum here is not adequate for this purpose. Consequently, a hand-carved orbital rim implant is fabricated during surgery from ePFTE (polytetrafluoroethylene). This material is available commercially in blocks of convenient size (Surgiform

Technology, Ltd., Columbia, South Carolina). The rim implant does provide a limited amount of volume, but more importantly it functions as a felting material to permanently hold the sutured cheek soft tissue.

A final step is needed in the definitive repair of the midface, i.e., controlling the shape of the lower eyelid margin. This is best accomplished with a hard palate graft to the posterior surface of the lower eyelid. The hard palate graft surgery described by Shorr represented a significant advance from the reconstructive techniques available at that time [8]. The goal of course is a lower eyelid that functions normally and appears aesthetically acceptable.

Many surgical methods provide inferior outcomes in exchange for technically less-challenging procedures. Unfortunately, this compromise uses up resources necessary for a satisfactory outcome. Patients who fail compromise repair methods can present with unfixable eyelids due to a lack of resources. Surgeons should never satisfy themselves with an outcome where the patient does not have both a functional outcome and the best possible aesthetic outcome. Many of these methods lack the power to recruit sufficient soft tissue and skin into the compromised lower eyelid. This includes both preperiosteal and subperiosteal approaches. For example, methods that rely on suturing to the diaphanous arcus marginalis are often subject to long-term failure. This structure simply lacks the integrity to support the weight of the cheek. The goal of surgery must be to permanently recruit sufficient skin and soft tissue into the lower eyelid and control its shape. What follows is the author's method for using hard palate graft and an orbital rim implant to accomplish this goal.

Surgical Considerations

Surgery is performed under local anesthesia plus intravenous sedation. This permits the patient to be cooperative when asked to open and close the eyelids. This is critical for judging the position of the resuspended lateral canthal angle.

After the patient is prepped and draped, a cotton tip applicator is used to identify the orbital rim (see Video 2 (Steinsapir Midface Surgery) from Appendix). This is marked with a methylene blue skin marker (Fig. 15.1). An inferior mark is made,

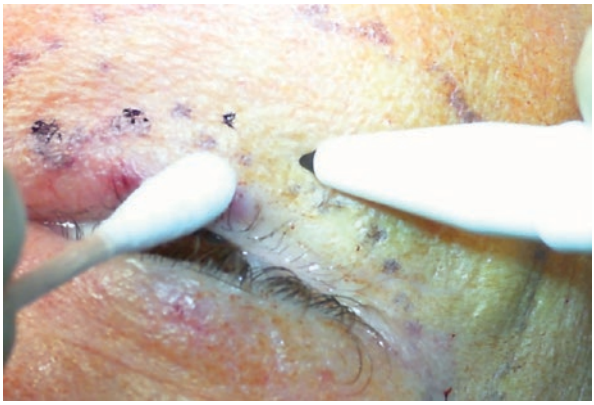

Fig. 15.1 The cotton tip applicator is used to blot the bony orbital rim and then the location is marked with a methylene blue marking pen. Doing this along the orbital rim locates the orbital rim, the upper limit of the orbital rim implant

which indicates the inferior edge of the planned orbital rim implant. These marks are transferred on sterile paper (usually glove wrapper) to a block of ePTFE (expanded polytetrafluoroethylene) (Surgiform Technology, LTD, Columbia, South Carolina, USA). A block measuring 3 × 6 × 0.5 cm is sufficient to make a rim implant (Fig. 15.2). The shape is outlined on the block, which is then appropriately thinned and carved to make the desired shape (see Video 2 from Appendix). It is generally best to make this implant relatively thin (2.5 mm). Too much bulk can be unacceptable. Modifying the implant in the future requires additional surgery, whereas augmenting the volume using hyaluronic acid fillers is straightforward. The carved implant is soaked in a tobramycin solution for later use in the case.

At the start of the case, the hard palate is infiltrated with local anesthetic. The outline of the strip of hard palate mucoperiosteum to be used during the case is made with a sterile marking pen. A no. 15 blade is used to partially incise the mucoperiosteum (Fig. 15.3). Sharp dissection under the periosteum is continued using a

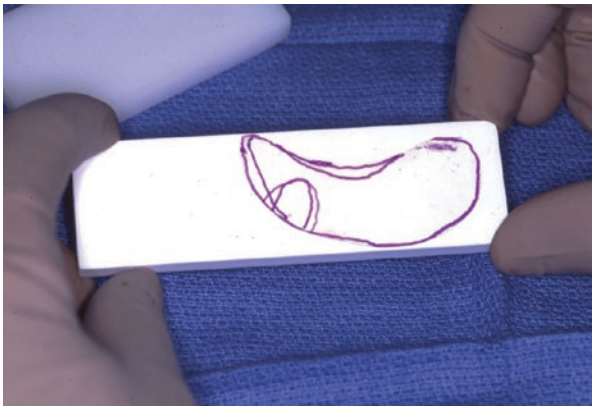

Fig. 15.2 The outline of the implant is transferred using a template to a block of ePTFE and the implant is then carved to the desired shape and thickness

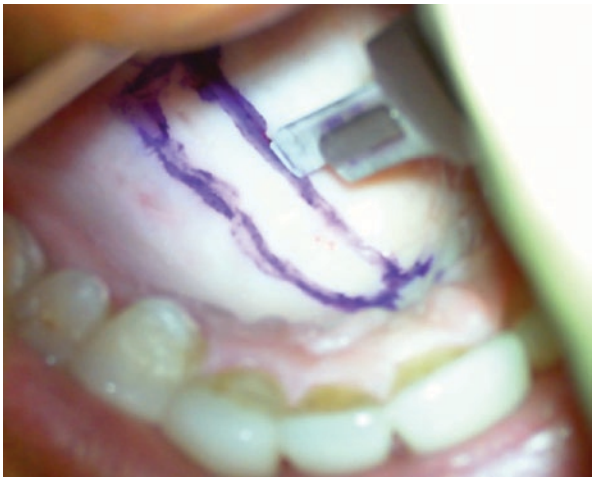

Fig. 15.3 The hard palate strip is marked on the hard palate and incised with a no. 15 blade

combination of the no. 15 blade, palate knives, and scissors until the palate graft is excised (Fig. 15.4). Hemostasis is obtained with cautery. The defect is fitted with a small piece of hemostatic cellulose. An acrylic palate stent, fabricated for the patient by their dentist prior to surgery, is soaked in povidone-iodine solution, rinsed, and positioned to cover the hard palate including the donor site. The palate graft is carefully wrapped in saline- soaked gauze and set aside for later use in the case.

The midface is approached through a swinging eyelid incision with a lateral canthotomy and inferior cantholysis on the affected side. The canthotomy skin incision should not be more than 5 mm in length on the skin just lateral to the lateral canthal angle (Fig. 15.5). There is no rational reason to make a longer skin incision here. Longer incisions make a visible skin incision and can damage motor nerves supplying the upper eyelid platform. The balance of the dissection is then performed

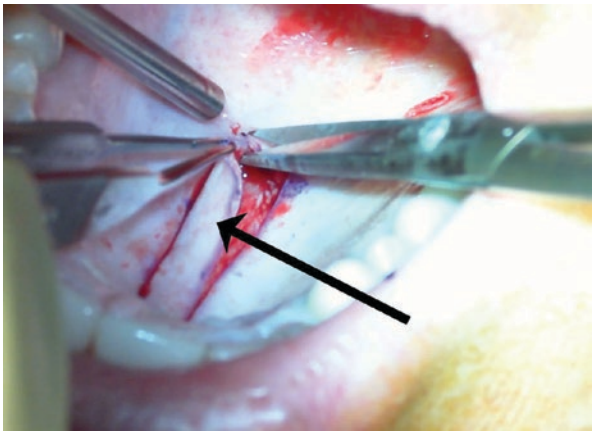

Fig. 15.4 The hard palate graft is pendant shaped (arrow). Here the caudal end of the graft is excised with a scissors

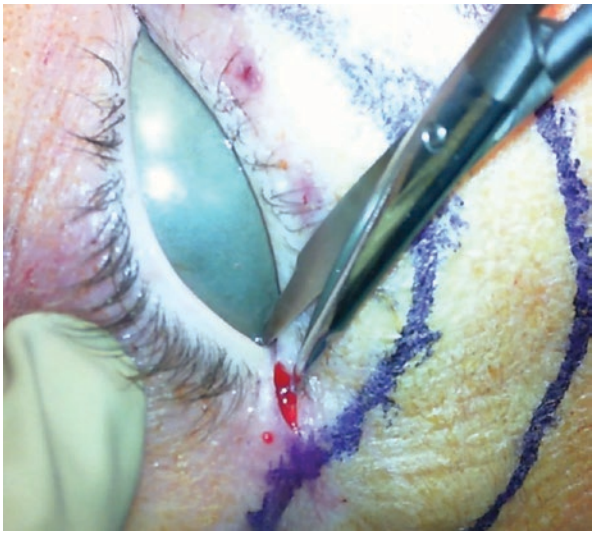

Fig. 15.5 The skin in the lateral canthus is incised with a no. 15 blade and the lateral canthotomy completed with a curved tenotomy scissors

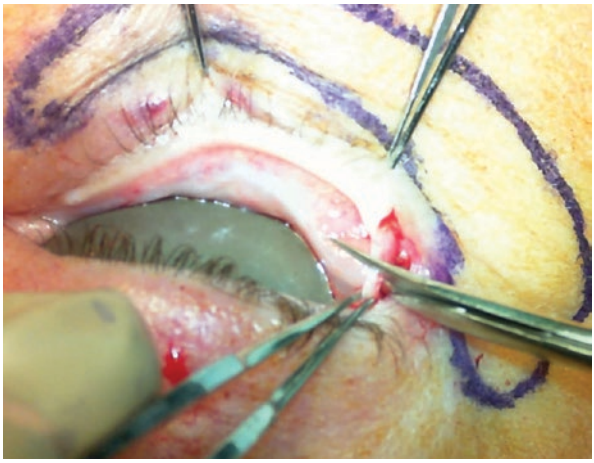

Fig. 15.6 Once the lateral canthotomy and inferior cantholysis are performed, the lower eyelid can be everted with two forceps. A transconjunctiva and lower eyelid retractor incision is made from the lateral canthus laterally to the caruncle medially just below the level of the lower eyelid tarsus

through a transconjunctival/lower eyelid retractor incision behind the eyelid (Fig. 15.6). The level of the incision should be just below the lower eyelid tarsus from the lateral canthus laterally to the caruncle medially.

The canthotomy should be completed with a tenotomy scissors to the periosteum. The lateral canthal ligament inferior retinaculum is also severed from its insertion on the orbital rim. Some clinicians have emphasized that the vertical and horizontal deficiency in these lower eyelids is not solely from mid-lamellar scarring of the orbital septum and that deficiencies of the skin and muscle, orbicularis oculi paralysis, and loss of orbital fat also contribute [9]. Nevertheless, middle lamellar septal scarring is a significant feature of these eyelids, and this contracted plane must be dissected and mobilized.

Dissection in the eyelid follows the septal plane, anterior to the inferior orbital fat and posterior to the orbicularis oculi muscle. Normally there is a layer of loose areolar connective tissue in this plane, but in these eyelids, that will generally be obliterated by a contracted layer of dense connective tissue that in fact represents the middle lamellar scar. Dissection through this plane leads to the orbital rim. There is insufficient space in this chapter to discuss the merits of the preperiosteal plane versus the subperiosteal plane. The author favors the subperiosteal plane. At the orbital rim, the periosteum in incised with cautery from as far medial to as far lateral as possible (Fig. 15.7), and the subperiosteal plane is then developed. Care is taken to avoid exposing the infraorbital neurovascular bundle. More laterally, the zygomatic facial and zygomatic temporal nerves will be encountered, and these can be taken down without loss of cutaneous sensation. Laterally, the dissection is carried out over the zygomatic arch and when necessary into the temporal fossa at the level of Yasargil's fat pad. This dissection is deep to the frontal branch of the facial nerve. The dissection is carried down over the masseter fascia and to just above the vestibule of the canine fossa. Dissection medial to the infraorbital neurovascular bundle is carried out along the edge of the piriform aperture. With this complete, a needle cautery under direct visualization is used to incise the exposed periosteum in the subperiosteal space over the zygomatic bone (see Video 2 from Appendix). A Gillies

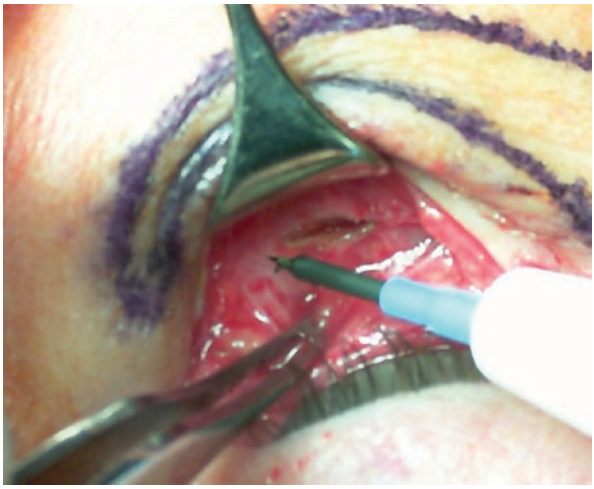

Fig. 15.7 The periosteum is incised at the orbital rim and the dissection is continued subperiosteally. Care is taken to avoid traumatizing the infraorbital neurovascular bundle

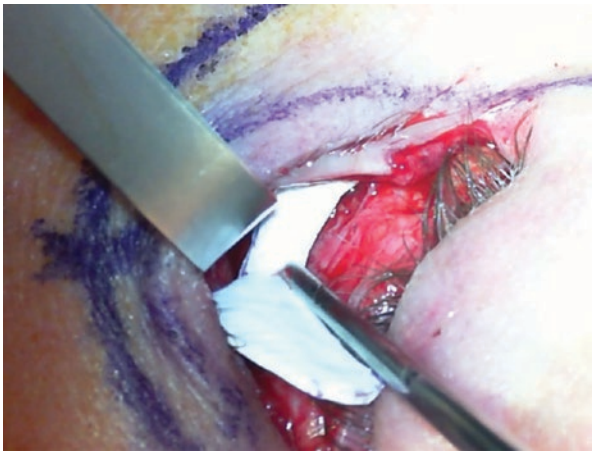

Fig. 15.8 With the subperiosteal pocket fully developed, the ePTFE orbital rim implant is positioned into the dissected pocket

malar elevator or similar elevator is used to elevate the mobilized malar soft tissue mass.

The ePTFE rim implant is removed from the antibiotic solution and positioned along the orbital rim (Fig. 15.8). Three titanium self-drilling, self-tapping microscrews are inserted medially, centrally, and laterally along the orbital rim through the ePTFE rim implant (Fig. 15.9). This permanently fixes the implant to the inferior orbital rim. A 1.5 by 5 mm microscrew works well for this purpose. The cheek soft tissue is lifted onto the orbital rim using three interrupted horizontal mattress sutures at each of these microscrews (see Video 2 from Appendix). These sutures engage and lift this entire midface soft tissue mass. In placing these sutures, it is important that sufficient scar in the lower eyelid is dissected so that suturing the cheek mass to the top of the orbital rim does not inadvertently tether the lower eyelid margin. The lift achieved has an effect on the cheek all the way down to the jawline. Effectively this produces a vertical facelift effect. This

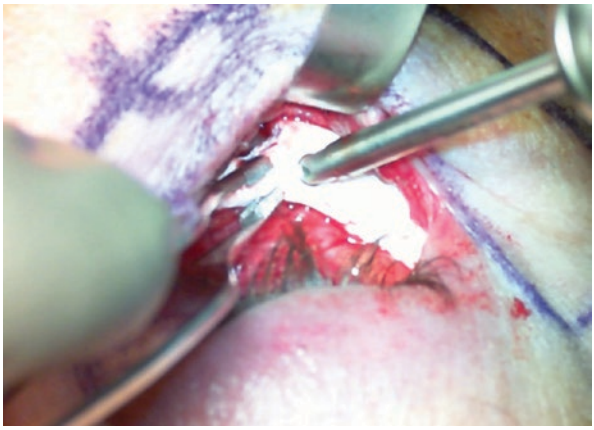

Fig. 15.9 The implant is fixed to the orbital rim with three self-drilled/self-tapping microscrews

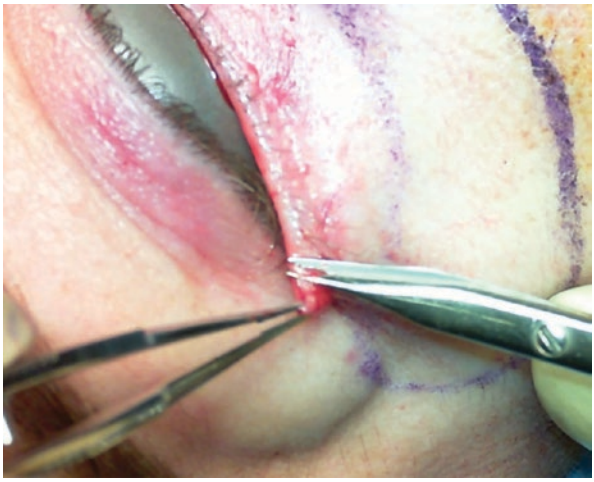

Fig. 15.10 A small tarsal strip is developed by denuding 3 mm of epithelium from the lateral eyelid margin

improved jawline is a side benefit of this reconstructive method for compromised lower eyelid.

With the cheek mass lifted to the top of the orbital rim implant, attention is turned to completing the lower eyelid reconstruction. A small lateral tarsal strip is fashioned. Generally, no more than 3 mm of the eyelid margin should be denuded of epithelium (Fig. 15.10). A double-armed, permanent suture is passed at the lateral cut edge of the eyelid to engage the lateral aspect of the tarsus. The author prefers the use of a permanent suture on a spatulated, semicircular needle. The lower eyelid is resuspended to the lateral orbital rim (see Video 2 from Appendix). The description of this is beyond the scope of this chapter [10]. Before permanently tying the lateral canthal resuspension suture, the lower eyelid is everted and a spacer graft is sutured into the back of the lower eyelid. Hard palate graft continues to be the best choice of materials for this purpose. The mucosal side of the graft is oriented to the conjunctiva. These grafts should be harvested in the size and shape needed for the actual graft size. This conserves the hard palate and also reduces the recovery time at the donor site. It is not

necessary to strip the periosteum off the bone. It is best to leave the periosteum with its supporting vascular connective tissue and take a thinner hard palate graft. Typically, these are 25–30 mm in length and pendant shaped. These vary in dimensions depending on the lower eyelid vertical compromise. The medial aspect might be 1–2 mm in height. Laterally there is generally more vertical deficit in the eyelid with the lateral graft heights reaching 4–6 mm. The hard palate graft contracts very little, in contrast to allograft material such as cadaveric dermis which is eventually completely reabsorbed. The graft material is sutured in place with gut suture (Fig. 15.11). The soft tissue lateral canthus is reformed using a buried horizontal mattress suture, and the lateral canthal resuspension suture is permanently tied (Fig. 15.12). The skin is closed with a gut suture. The eyelid margin is immobilized on three Frost sutures for 1 week. The need to fully immobilize the eyelids means that bilateral reconstructions should

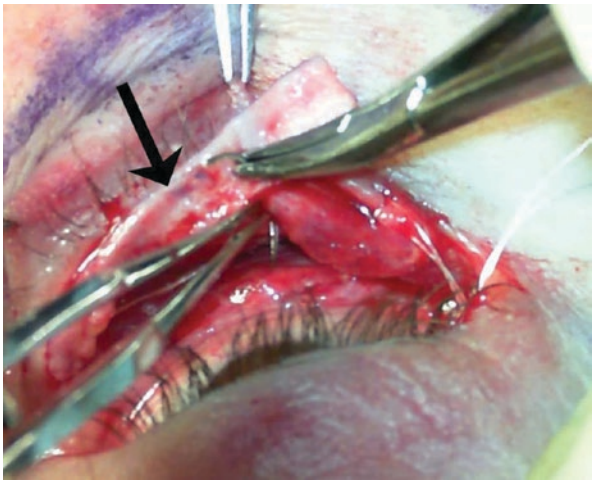

Fig. 15.11 The lower eyelid is everted and the hard palate graft (arrow) is sutured to the cut edge of the lower eyelid tarsus

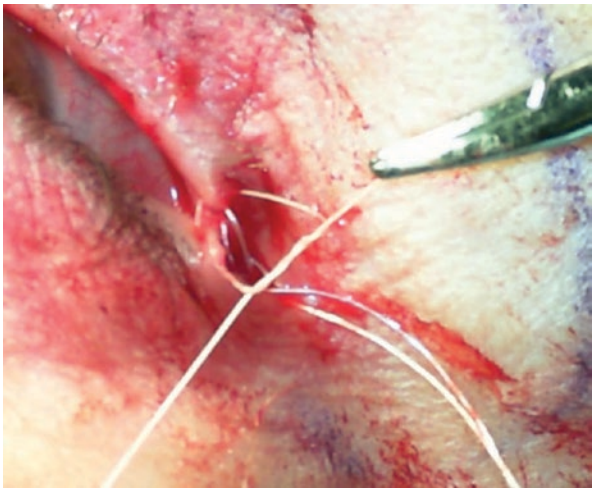

Fig. 15.12 A horizontal mattress suture of 5-0 irradiated polyglactin is used to reform the soft tissue lateral canthal angle

be done as staged surgery with one side performed followed by the second side 1 week later.

Postoperative Care and Concerns

After surgery, the eye is left patched for 6 days. A therapeutic contact lens, placed at the time of surgery, reduces the possibility of a postoperative corneal abrasion. The Frost sutures are tied on a shoestring so it is possible to loosen them, examine and treat the eye, and then retie the Frost sutures. The use of a contact lens has significantly reduced the incidence of postsurgical corneal abrasion. On day 6, when the contact lens is removed, one will observe mild corneal edema, which resolves after 24 hours.

Initially the reconstructed lower eyelid is quite stiff and lacks the normal gentle parabolic shape associated with the lower eyelid. As the eyelid heals and swelling resolves, these eyelids pick up this curvature. The goal is to place the lower eyelid at the inferior limbus. Earlier writing emphasized that the lateral canthus should be placed 1–2 mm higher than the medial canthus. This often resulted in a long-term overcorrection of the lower eyelid. For that reason, a neutral to slight elevation of the lateral canthus relative to the medial canthus provides more acceptable aesthetic results. Figures 15.13 and 15.14 depict typical before and after results with 6–12 months of healing.

The function of the orbital rim implant is primarily to create a place to sew the lifted cheek soft tissue to the orbital rim. The periosteum at the orbital rim lacks the

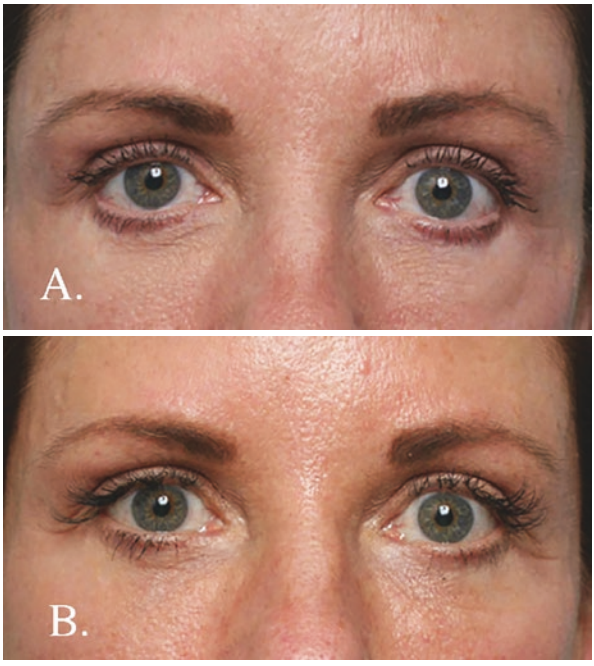

Fig. 15.13 (**a**) A 57-year-old woman with compromised lower eyelids following quadrilateral blepharoplasty. (**b**) Six-month-status post-bilateral midface lift with ePTFE rim implant and hard palate graft. (Copyright Kenneth Steinsapir, 2019)

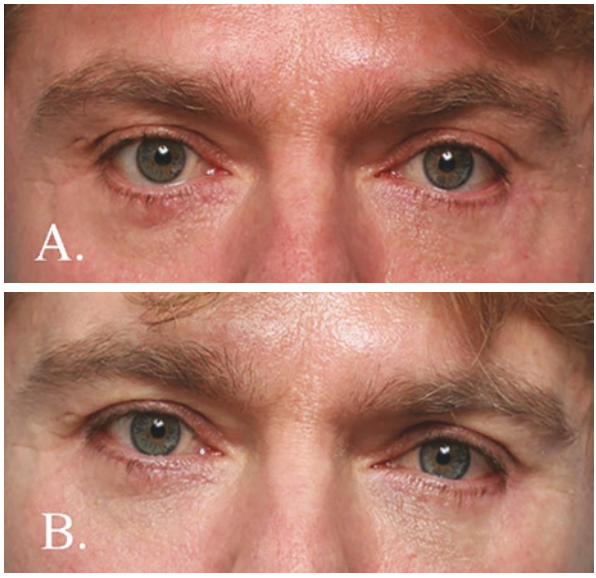

Fig. 15.14 (**a**) A 53-year-old man with compromised lower eyelids following quadrilateral blepharoplasty. (**b**) One-year-status post-bilateral midface lift with ePTFE rim implant and hard palate graft. (Copyright Kenneth Steinsapir, 2017)

structural integrity to hold any weight. This is also true of the inferior orbital septum. For this reason, implants such as the silicone Flowers tear trough implant do not provide the structural integrity provided by the ePTFE implant that is hand-carved for a given patient and fixed to the orbital rim with three microscrews. There are a series of porous polyethylene implants intended to provide volume at this location. However, they primarily seem to be designed to augment volume rather than function as felting material to hold the vertically elevated cheek. This material is physically very hard making it challenging to sew to it. It is also prone to late infections in this location, which may be related to the relative poor soft tissue coverage at this location. It is the experience of the author that late infection has not been a problem with the ePTFE implants. Of course, the ePTFE implant can also be used to augment volume at the orbital rim. Caution is advised. A thin orbital rim implant can be augmented by injecting hyaluronic acid filler, whereas an ePTFE rim implant that is too large will require revisional surgery for modification.

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Lower Eyelid Retraction: Anterior Lamellar Correction Using Skin Grafting

16

Aliza Epstein, Tanuj Nakra, and Marie Somogyi

Lower eyelid retraction describes an inferior displacement of the lower eyelid, for which anterior lamellar deficiency is a common cause. The anterior lamella of the eyelid includes both the skin and orbicularis oculi muscle, and deficiency can result from actinic damage, thermal or chemical burns, trauma, or iatrogenic causes following cosmetic lower eyelid blepharoplasty, laser resurfacing, chemical peel, or the aggressive use of retinoids [1]. In addition to lower eyelid retraction and inferior scleral show, careful examination of these patients may reveal UV-related skin changes, which can contribute to a cicatricial ectropion in which the eyelid is distracted away from the globe (Fig. 16.1). Additional contributing factors include middle lamellar contracture, posterior lamella shortening, lateral canthal tendon laxity, and weakened orbicularis tone [2]. Lower eyelid retraction may cause significant ocular comorbidities such as dry eye, tearing, conjunctival erythema and keratinization, exposure keratopathy, corneal ulceration, and globe perforation. Furthermore, lower eyelid malposition results in an unsatisfactory aesthetic appearance.

Treatment for lower eyelid retraction due to anterior lamellar deficiency should be targeted to each patient's condition. Patients with mild retraction due to a dermatitis-related skin condition can be initially managed conservatively with a topical steroid [3]. In these patients, it is imperative to monitor the patient's intraocular pressure (IOP) in the event that the steroid results in elevation of the IOP. One nonsurgical option involves hyaluronic acid filler injected into the lower eyelid to serve as a tissue expander [4]. However, in patients with more severe retraction, adequate elevation of

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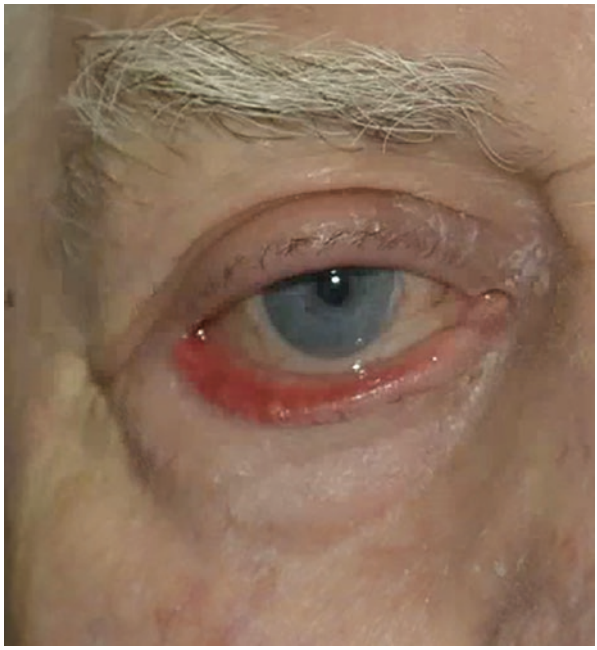

Fig. 16.1 Pre-op photo of patient with lower eyelid retraction due to anterior lamellar deficiency

the lower eyelid into proper anatomic position requires surgical correction. Surgical repair ultimately addresses the vertical shortening of skin. The options for addressing anterior lamellar deficiency include a full-thickness skin graft, local myocutaneous flap, or a midface lift. A full-thickness skin graft can be used in this clinical scenario due to the availability of excess skin and ease of harvest; however, a full-thickness skin graft does not carry its own blood supply and has a potential higher rate for necrosis and infection. Alternatively, a local myocutaneous flap brings its own blood supply to the lower eyelid, which can be useful in an area of prior irradiation or trauma when the local blood supply may be compromised.

Two examples of commonly used local myocutaneous flaps include the Tripier flap and Fricke flap. The Tripier flap was first described by Tripier in 1890 as a bipedicle flap involving the skin and orbicularis oculi muscle isolated from the upper eyelid and transposed to the lower eyelid [5] (Fig. 16.2). Excess upper eyelid skin is required in order to execute this flap. The pedicles may be severed in a staged procedure, but can also be incorporated into the lower eyelid defect in order to avoid the need for a second procedure [6]. Variants of this flap have been described addressing the medial or lateral eyelid with a single pedicle, although the size of eyelid defect must be a consideration in surgical planning as a unipedicle flap may be limited by its blood supply. Alternatively, the Fricke flap was first described in 1829 as a temporal forehead unipedicle flap transposed to the upper eyelid or lower eyelid [7] (Fig. 16.3). Due to the unipedicle nature of this flap, it may be limited in its extension to the medial lower eyelid. In order to avoid distal necrosis and flap failure, the length to width ratio should not exceed 4:1 [8]. Both of these flaps can lead to asymmetry,

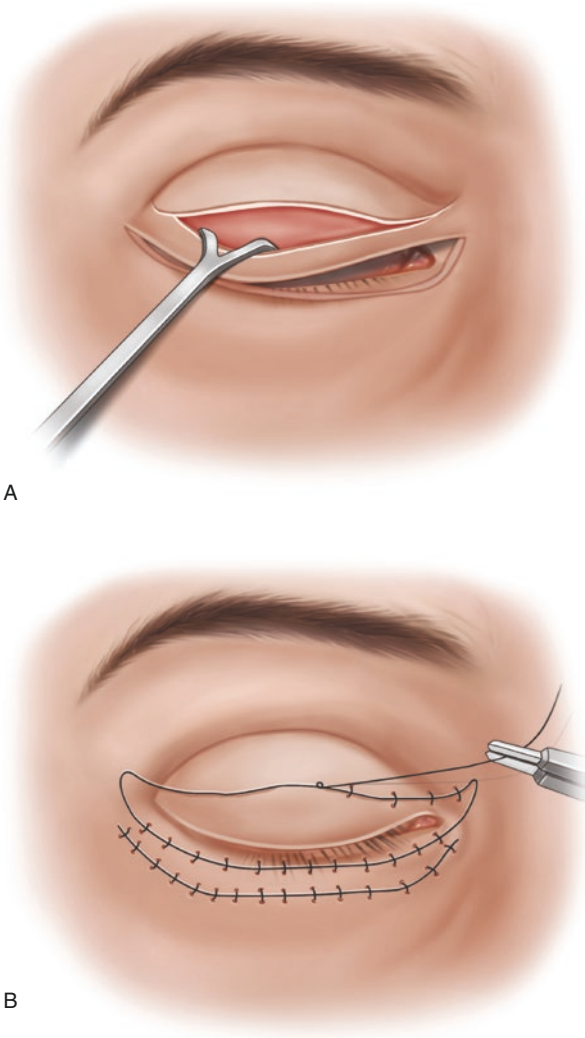

Fig. 16.2 The Tripier flap is a bipedicle myocutaneous flap transposed from the upper eyelid to the lower eyelid

as can be seen in upper eyelid position with the use of the Tripier flap or the eyebrow height when using the Fricke flap. Similar to a full-thickness skin graft, intact posterior lamella is needed with the use of both of these myocutaneous flaps.

Surgical planning for a flap must involve assessment of surrounding tissue laxity and ease of tissue mobility without causing secondary retraction. In some cases the area of retraction may be localized to the medial or lateral lower eyelid due to focal cicatricial forces. There are a variety of localized rotational flap designs that may be utilized. The nasojugal flap involves a flap adjacent to the nasojugal fold rotated superiorly to the lower eyelid [9]. The rhomboid flap is rotated around a pivot point into the lower eyelid defect [10]. A vertical V-Y advancement flap has been described as a simple and effective option in burn patients [11]. When tissue cannot be

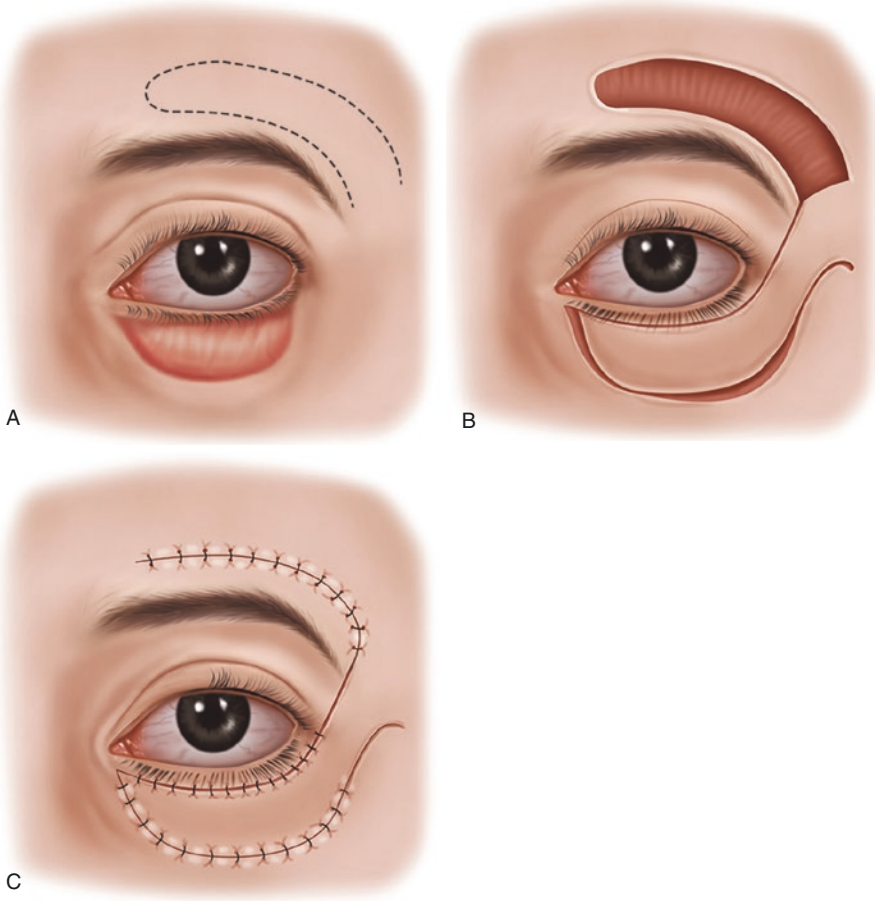

Fig. 16.3 The Fricke flap incorporates a temporal forehead unipedicle flap transposed to the lower eyelid

mobilized from immediate surrounding tissue due to extensive eyelid pathology, a paramedian forehead flap centered around the supratrochlear artery is an option [12].

In some cases, the regional tissue is not suitable for flap rotation. Another surgical approach to addressing lower eyelid retraction is a midface or cheek lift. This technique involves releasing the deep facial ligaments, allowing upward mobilization of the overlying soft tissue with an improved elevated position of the lower eyelid. One technique that has proven successful involves lateral canthoplasty, transconjunctival orbicularis-retaining ligament release, transcutaneous superficial muscular aponeurotic system elevation, and orbicularis contouring [13]. Besides addressing the functional issues associated with lower eyelid retraction, the midface lift also targets common facial changes associated with aging leading to a rejuvenated and aesthetically desirable result. This surgical approach is more technically challenging

compared to a graft or flap creation, and careful dissection must be employed to avoid branches of the facial nerve. Despite robust midface lifting, in some patients the anterior lamellar deficiency is so significant that a flap or graft is required to address the skin shortage.

Surgical planning for a lower eyelid skin graft must take into account the thickness, skin quality, and hairless nature of the lower eyelids in order to find a donor site that most closely matches. Several locations provide an excellent match for the lower eyelid that will optimize the aesthetic result. Redundant upper eyelid skin is an ideal graft as it most closely resembles the thin lower eyelid skin. The next best option includes postauricular or preauricular skin. This skin in this location is thin and may receive similar sun exposure to the lower eyelid. Other donor sites include the supraclavicular area, inner upper arm, inguinal area, or inframammary fold [14]. Lateral canthal tendon laxity should be addressed concurrently, if needed, with the use of one of a variety of techniques available to properly tighten the canthus [15, 16].

Below are the key steps in performing a full-thickness skin graft to the lower eyelid for anterior lamella deficiency:

- Perform a lateral canthoplasty if required.
- Place a Frost suture tarsorrhaphy to put the lower eyelid on vertical tension.
- Make a subciliary incision across the length of the lower eyelid.
- Release the cicatricial attachments and prepare the recipient bed for a skin graft.
- Measure the area required for a full-thickness skin graft.
- Harvest the full-thickness skin graft.
- Suture the full-thickness skin graft in place.
- Apply a pressure dressing to the wound.

Surgical Technique

Marking the Skin

Topical anesthetic drops are instilled into the eyes and the skin is cleaned with an alcohol wipe. The skin is marked approximately 2–5 mm below the eyelid margin horizontally along the length of the margin and can extend beyond the lateral canthus approximately 5 mm.

Anesthesia

The lower eyelid and donor skin sites are injected subcutaneously with local anesthetic consisting of 2% lidocaine with 1:100,000 epinephrine mixed 50:50 with 0.75% bupivacaine and hyaluronidase. The patient is then prepped and draped in the usual sterile manner for surgery.

Incision

Two Prolene or silk sutures (5-0 or 6-0) are passed through the gray line of the upper and lower eyelid and secured over bolsters to the eyebrow to place the lower eyelid on vertical stretch. Using a #15 Bard-Parker blade, a subciliary incision is made along the skin marking.

Releasing Cicatricial Forces

A #15 Bard-Parker blade or Westcott scissors are used to release the subcutaneous attachments and allow the anterior lamella to recess. This is performed until the lower eyelid elevates into an anatomically acceptable position without retraction (Fig. 16.4).

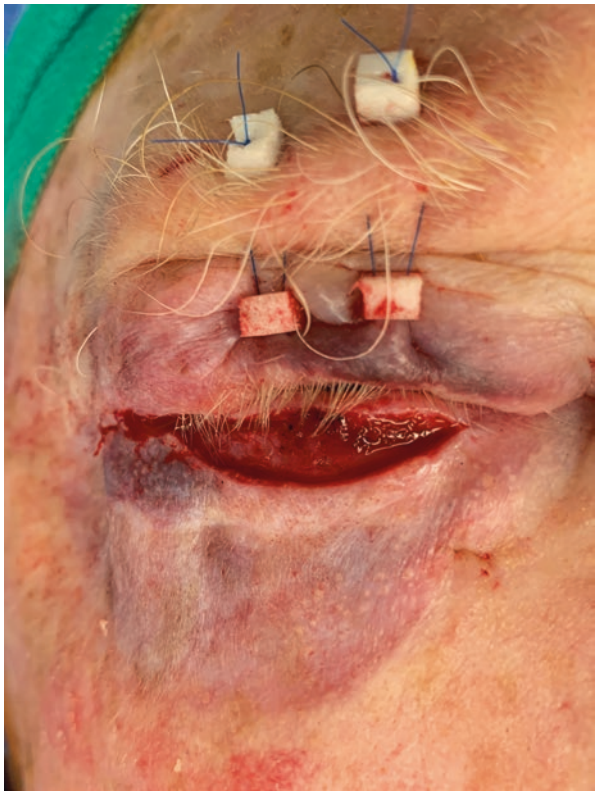

Fig. 16.4 Lower lid defect to be covered with skin graft

Harvesting of Skin Graft

The size and shape of the defect in the lower eyelid must be measured with a ruler or calipers. One technique involves using either clear surgical drape or Telfa pad to trace the defect. The pad is pressed against the defect and the blood will mark the borders and size of the area. This template is cut and then traced on the donor skin site using a marking pen. The marked-out outline of the graft should be slightly larger than the defect to allow for adjustment to the recipient bed and to account for skin graft contracture, as a full-thickness skin graft will shrink by an average of 12% [17]. Using a #15 Bard-Parker blade, the donor skin is cut along the measured marking (Fig. 16.5). The skin edge is elevated with forceps, and the dissection proceeds between the dermis and the subcutaneous fat using Westcott scissors. Closure of the donor site is based on the location. The upper eyelid donor site can be closed with 6-0 Prolene or plain gut suture, whereas a pre- or postauricular donor site is typically closed using deep, buried 4-0 Vicryl, Monocryl, or PDS suture. The skin is closed with 5-0 Prolene or plain gut suture in a running or subcuticular fashion.

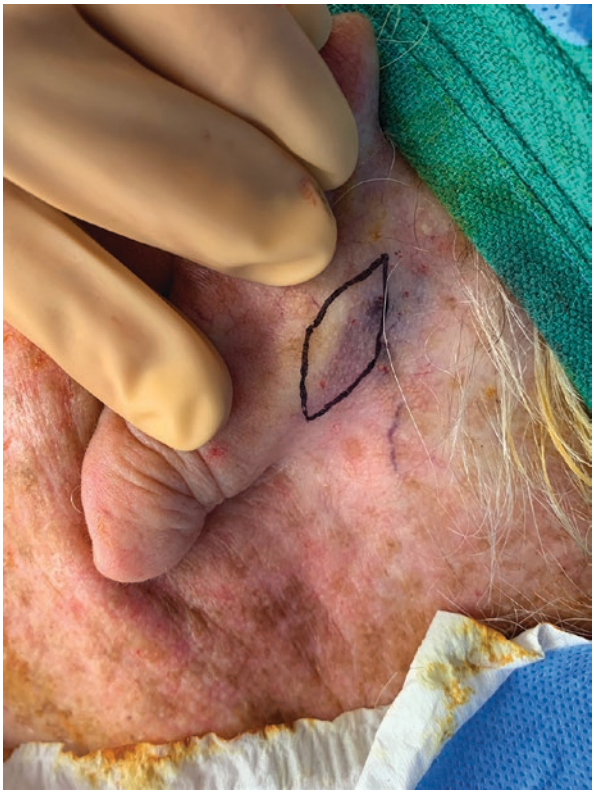

Fig. 16.5 Outline of donor skin graft from postauricular skin

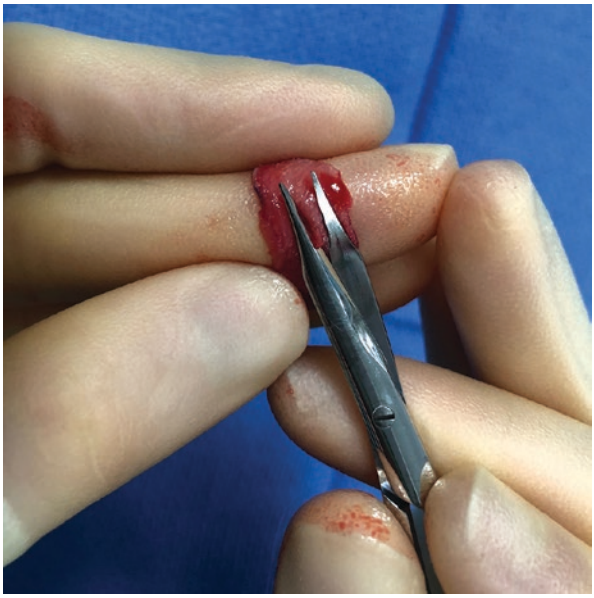

Fig. 16.6 Preparation of donor skin graft

The skin graft should be carefully examined prior to placement in the recipient bed. Any subcutaneous fat should be gently dissected off the posterior surface of the graft using Westcott scissors. The skin graft can be stretched over the surgeon's finger to provide tension while properly thinning the graft (Fig. 16.6).

Placement of Skin Graft

The skin graft is placed within the lower eyelid defect and the graft edges are cut as needed to achieve a proper fit. As mentioned, the graft should be slightly oversized to allow for contracture. Equally spaced-out cardinal sutures are first placed with 6-0 silk in order to anchor the graft to the recipient bed (Fig. 16.7). The graft is further secured in place using 6-0 fast absorbing gut suture in an interrupted or running fashion depending on the size of the graft. Antibiotic ointment is applied over the graft.

Pressure Dressing Over the Skin Graft

Antibiotic ophthalmic ointment is placed over the skin graft and into the eye. Cotton balls soaked in mineral oil and telfa are then placed over the skin graft for compression. The eye is then patched in order to maximize contact between the graft and recipient bed. Skin adhesive, such as Mastisol® Liquid Adhesive (Eloquest Healthcare, Michigan), can be used on the skin to improve pressure patch integrity.

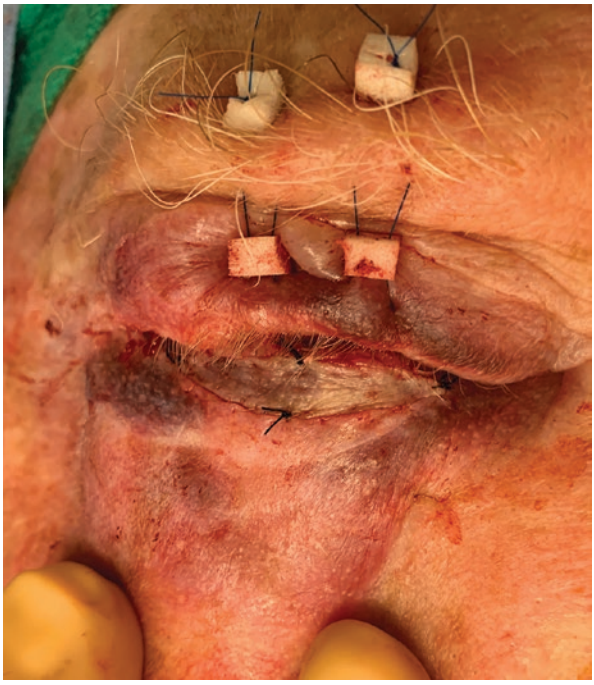

Fig. 16.7 Donor skin graft sutured in place

Postoperative Care

The bolster and patch are left in place for 7 days. Nonabsorbable sutures are removed at 1 week. Applying ointment to the graft is recommended for the first 2 weeks in order to keep it lubricated. The graft may appear darker than normal initially after surgery, but will usually return to normal color about 3–4 months after surgery. Massage of the lower eyelid may be initiated 2 weeks after surgery in order to prevent the graft from shrinking and to break mechanical contracture (Fig. 16.8).

As with all surgical procedures, there are potential complications with placing a skin graft in the lower eyelid, which include graft contracture, hypertrophy, infection, ischemia, necrosis, and lastly graft failure [18]. Hematoma and seroma formation are possible in the immediate postoperative period. These complications must be addressed immediately as a physical separation of the graft from its recipient bed compromises blood flow to the graft and may eventually lead to graft failure. Typical signs of graft infection include pain, tenderness, erythema, edema, and discharge, which warrant antibiotic treatment initiation and close observation. A dark or dusky appearing graft suggests early ischemia, which also must be closely monitored. Examples of treatments targeted at promoting oxygenation to an ischemic graft include hyperbaric oxygen therapy and nitroglycerin paste or ointment, which acts as a vasodilator to increase blood flow to the graft. Graft scarring or hypertrophy can be managed conservatively with observation, massage, topical steroids, or topical

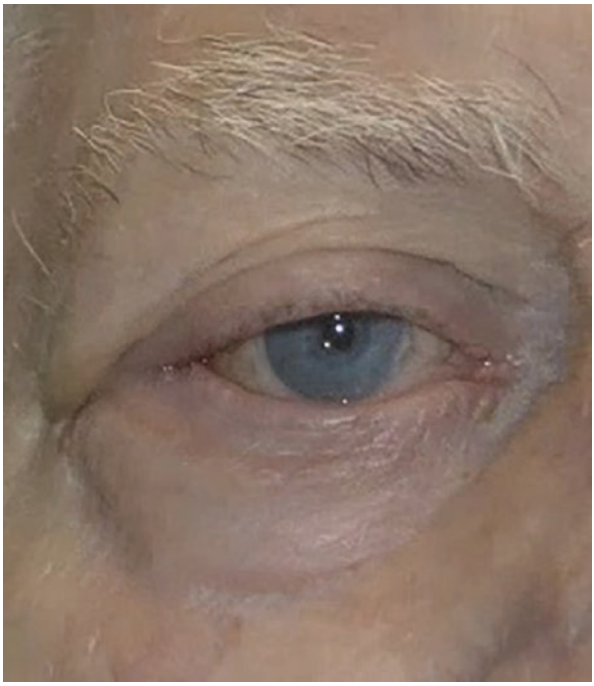

Fig. 16.8 Post-op photo of patient with full thickness skin graft

silicone. Injections with 5-fluorouracil (5-FU) or a combination of 5-FU with low-dose steroid can be used during the wound healing process to mitigate scar formation [19]. Dermabrasion, microneedling, or CO2 laser resurfacing can be useful for optimizing aesthetic outcome. Pigment abnormalities can be addressed with topical hydroquinone and noninvasive pulsed light or laser therapy.

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Lower Eyelid Retraction: Correction Using Orbital Decompression

17

Allan C. Pieroni Goncalves and Jaqueline Silva de Rezende

The lower eyelid can be divided anatomically into the anterior (skin and orbicularis oculi muscle), middle (orbital septum and orbital fat), and posterior lamellae (tarsus, conjunctiva, and lower eyelid retractors).

The normal lower eyelid margin remains tangential to the corneal limbus at the 6 o'clock meridian. Lower eyelid retraction (LER) is diagnosed when the sclera is visible above the lower eyelid margin, a phenomenon sometimes referred to as "scleral show," but diagnosis should also include contour abnormalities such as retraction of the lateral third of the eyelid, even when the central area appears normal.

This eyelid malposition is usually cause for functional and cosmetic concern. Functionally, exposure of the infracorneal bulbar conjunctiva can cause dry eye, exposure keratitis, and even corneal ulcer. While conservative treatment (e.g., artificial tears) may be effective in patients with mild to moderate symptoms, surgery is required in severe cases. Cosmetically, LER seriously compromises facial appearance—a particularly relevant concern for patients receiving cosmetic care.

The position of the lower eyelid depends on the balance between a set of factors, including the tension of the horizontal canthal ligaments, lower eyelid length and tonicity, the distensibility of the vertical lower eyelid retractors, the adequacy of the fornix and palpebral conjunctivae, the location of the canthal ligament, the tension of the orbicularis oculi, and the degree of eye prominence [1].

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The degree of prominence is determined by globe position relative to the bony orbit. The protrusion of the most anterior aspect of the globe past the malar eminence creates a disproportion between the bony support, the soft tissues, and the eye, defined as a "negative vector" relationship [2]. This occurs mainly by shallow orbit and midfacial flattening associated with maxilla/zygoma hypoplasia. Prominence tends to worsen with age, with deflation and descent of the deep supporting midface soft tissues coupled with a decreased maxillary angle and increased pyriform aperture due to bony resorption [3].

Prominent eyes increase the risk of complications associated with lower eyelid blepharoplasty and LER. The balance between the structures and forces responsible for lower eyelid function is so tenuous that even small changes (e.g., fibrosis of the medial lamellae, loosening of the horizontal ligaments, or altered orbicularis oculi muscle tonus) can induce LER.

Thus, patients with a "negative vector" relationship are at greater risk for complications following standard lower eyelid blepharoplasty and may require adjustments in surgical technique. Hertel exophthalmometry can help identify patients at risk [4]. Hirmand and coworkers developed a classification system based on this measuring technique [2]. Based on this system, Fig. 17.1 illustrates four classes of eye position relative to the bone orbit and the corresponding exophthalmometry (class I, deep-set eyes; class II, normal position; class III, moderately prominent eyes; class IV, very prominent eyes). The "negative vector" relationship described above is observed in classes III and IV. The most common cause of LER is thyroid eye disease (TED) or Graves' orbitopathy. In TED patients, exophthalmos or proptosis (eyeball protrusion) is caused by augmented orbital soft tissue associated with fibrosis of the vertical retractors. Fortunately, many of the techniques developed for this patient population can be employed in the treatment of LER from other causes. The second-most common cause of LER is complications from blepharoplasty, although patients in this subgroup tend to have prominent eyes as well.

Surgical correction of LER usually involves the soft tissues of the face (eyelids and cheeks) and requires vertical elongation, with or without grafting, potentially combined with lateral canthal tightening. The decision of whether to use grafts is based on LER severity, and surgical procedures may vary based on etiology and severity. Mild LER can be corrected without grafting. In patients with severe LER measuring >2 mm, spacer grafts are used to push the lower eyelid margin upward and support it from below [1].

However, scleral show in patients with highly prominent eyes is best treated by reducing the prominence. From a mechanistic perspective, a change in the axial position of the globe is likely to affect the position of the lower eyelid in relation to the globe surface. Put simply, the curved surface of the globe tends to push the lid forward, widening the palpebral fissure and exposing the sclera. By the same reasoning, proptosis correction should be enough to reverse LER [5].

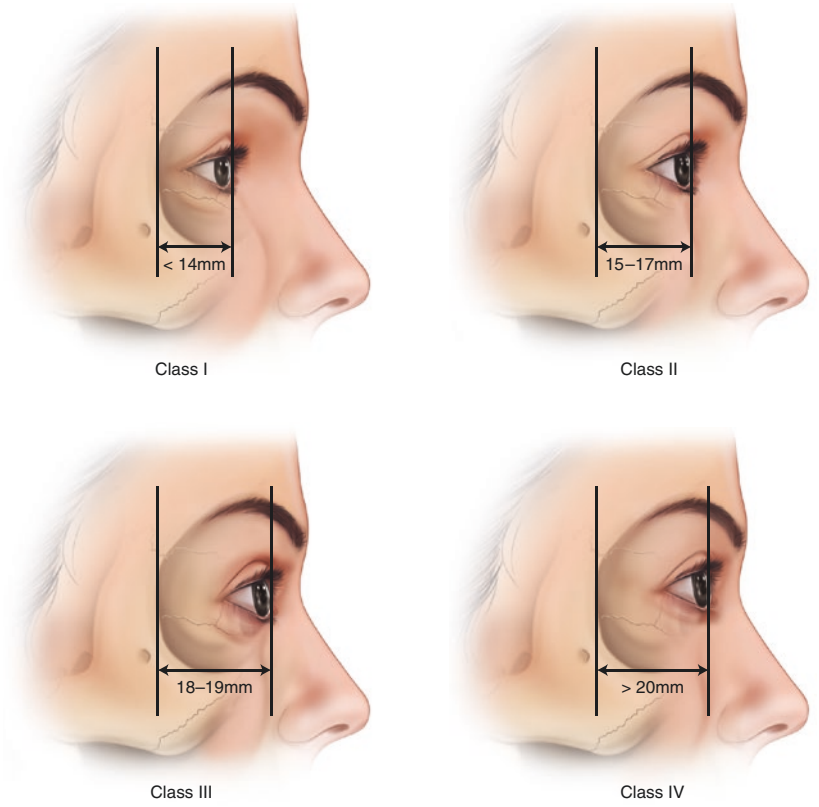

Fig. 17.1 Diagrammatic representation of osseous and soft tissues structures classes I through IV of Hirmand's classification of eye prominence. Demonstrates the position of the globe relative to the bony orbit and the corresponding exophthalmometry measurements in millimeters

As observed in patients with exophthalmos secondary to TED, eyelid masquerade techniques that treat only soft tissues (e.g., lateral canthoplasty, LER surgery, orbital rim onlay implants) may be used to camouflage prominent eyes, but are more likely to fail if the underlying globe/orbit dystopia is not corrected, and are suboptimal compared to careful repositioning of the globe in the orbital space [6].

Rajabi et al. demonstrated a correlation between proptosis and LER in patients with TED [7]. Other authors have reported statistically significant correlations between surgical proptosis reduction and improvement in LER [5, 8, 9].

Orbital decompression removes or thins the orbital bones and sometimes the fat around the eyes. This surgical procedure is typically performed for exophthalmos secondary to TED. Most, but not all, cases of proptosis are secondary to TED. Other

possible causes include severe myopia, congenital shallow orbit, inflammatory orbitopathy, and orbital tumor. Orbital decompression techniques have advanced substantially since their introduction, yielding better results with minimally invasive approaches [10].

Orbital decompression tends to be easier in non-TED-related cases. First, healthy orbits with normal extraocular muscles (as opposed to unhealthy orbits in TED, with fibrotic extraocular muscles and fat) are less prone to ocular misalignment. Second, healthy orbits (as opposed to fibrotic orbits in TED patients) provide more flexibility and room to maneuver, reducing the risk of complications. Third, novel techniques and concepts have improved our ability to grade decompression, potentially preventing otherwise frequent complications like hypoglobus and strabismus [6, 8]. Complications from facial anesthesia (bleeding, infection, vision loss, cerebrospinal fluid leakage) are rare.

Orbital decompression is currently the safest and most effective way to reduce prominence and may be indicated for patients with LER and protruding eyes (sufficiently distressing to affect social interaction) after an ample discussion on treatment goals, limitations, and complications, including the possibility of psychological repercussions [6].

Fat decompression is a good option for TED patients, in whom this tissue is augmented, but is not recommended for non-TED patients. Bony decompression may involve single or multiple walls of the orbit, depending on the desired outcome (e.g., proptosis reduction or globe displacement). The targeted walls include the:

- Lateral orbital wall (zygomatic basin, superior lateral area, and deep sphenoid bone)
- Medial orbital wall
- Inferior wall (orbital floor) [8]

The inferior wall is usually the last choice due to the higher incidence of postoperative diplopia and inferior dystopia caused by floor decompression-induced inferior globe displacement. This is particularly a risk if the inferomedial strut at the junction of the maxillary and the ethmoid sinuses is compromised/removed.

Medial wall decompression is fast to perform, leaves no visible scar (whether the approach is endoscopic or transcaruncular), and can potentially reduce proptosis by approximately 2 mm [8].

The minimally invasive deep lateral wall surgery technique developed by Goldberg et al. [11] makes it possible to operate on deep orbital bone surfaces which were previously only accessible with neurosurgical techniques. In this

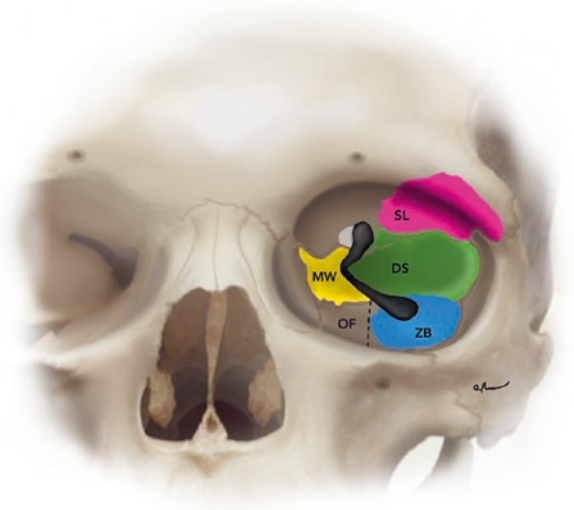

Fig. 17.2 Orbital model demonstrating anatomic targets for decompression surgery. DS deep sphenoid bone, MW medial orbital wall, OF orbital floor, SL superior lateral, ZB zygomatic basin

approach, deep lateral wall decompression provides orbital volume expansion from three conceptual areas: the lacrimal "keyhole" (lateral superior), the sphenoid door jamb (deep sphenoid), and the basin (zygomatic basin) of the inferior orbital fissure. While reduction of axial proptosis remains the main treatment goal, other orbital areas may be treated to lower the eyelid position, improving surgical outcomes. Furthermore, the effect appears to be greater in patients with targeted removal of the basin during lateral wall decompression. Basin decompression is accompanied by significant vertical globe displacement, potentially improving scleral show [8, 11]. Figure 17.2 illustrates the anatomic areas of orbital osseous decompression.

In summary, patients with prominent eyes, i.e., Hirmand class III and IV orbits [2], and post-blepharoplasty scleral show may benefit from orbital decompression. Medial wall decompression is a good option for patients with large ethmoid sinuses and can reduce exophthalmometry by approximately 2-3 mm (enough for most patients with prominent eyes). However, the lateral wall is usually the first option, especially in minimally invasive approaches, due to the lower risk and the possibility of outcome customization. For instance, in cases with scleral show >2 mm, lateral wall decompression should typically include the basin (Fig. 17.3).

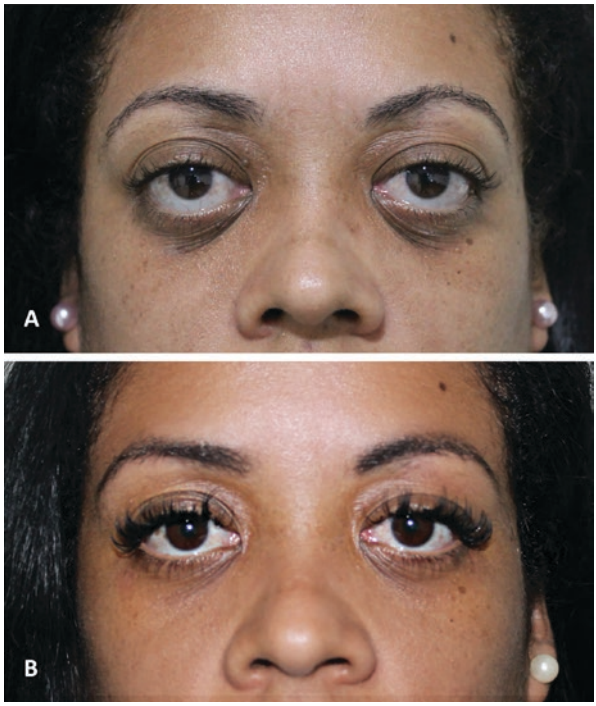

Fig. 17.3 Pre- (**a**) and post-images (**b**) of orbital decompression, showing the inferior scleral show improvement

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Lateral Canthal Complications

18

Natalie Homer, Tanuj Nakra, and Marie Somogyi

Relevant Anatomy

The lateral canthus is a critical structure that serves to stabilize the lower eyelid and maintain horizontal eyelid tension. Anatomically, the deep limb of the lateral canthus anchors the lateral tarsus to the lateral orbital tubercle (i.e., Whitnall's tubercle), located approximately 5 millimeters (mm) posterior to the lateral orbital rim and 1 centimeter (cm) inferior to the frontozygomatic suture (Fig. 18.1) [1], whereas the superficial limb interdigitates with the lateral raphé of the orbicularis oculi muscle and fuses with the orbital retaining ligament, the arcus marginalis and the conjoint tendon [2]. Furthermore, the lateral canthus is supraplaced approximately 2 mm relative to the medial canthus in most ethnicities [3]. In addition to the lateral canthus, the lower eyelid is further supported by the medial canthal tendon, the tarsus, the lower eyelid retractors, and the orbicularis oculi muscle [4].

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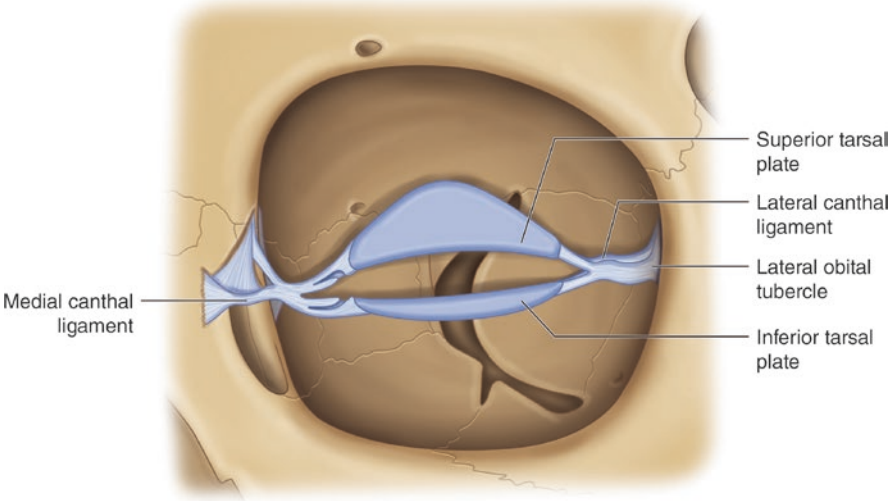

Fig. 18.1 Lateral canthal anatomy

Prevention

There are many etiologies for lateral canthal dystopia, including trauma, chemical or thermal burns, actinic skin changes, or negligence and mismanagement of preoperative lower eyelid laxity, which is the focus of this chapter. Operative mismanagement of the lower eyelid and canthus may result in canthal malposition, lateral canthal rounding, or worsening of eyelid laxity. In order to prevent postoperative lateral canthal dystopia after canthal surgery or blepharoplasty, the surgeon must thoroughly assess the baseline tone and integrity of the lateral canthus as part of the preoperative assessment [1]. On physical exam, lateral canthal rounding and an increased lateral canthal angle distance from the bony lateral rim are both suggestive of tendon dehiscence. Lower eyelid laxity should also be assessed via a snapback test and an eyelid distraction test (Fig. 18.2a, b). During the snapback test, laxity of the lower eyelid tarso-ligamentous sling is evaluated by manually pulling the eyelid away from the globe and observing its speed at recoil to an anatomic position upon release. Decreased eyelid recoil indicates excess laxity [5]. When performing the eyelid distraction test, if the lower eyelid can be manually distracted more than 6 mm away from the ocular surface, the eyelid is also considered excessively lax. Increased age is known to be associated with tarso-ligamentous sling laxity [5]. When significant eyelid laxity is detected, lower eyelid tightening should be performed at the time of any lower eyelid blepharoplasty as a preventive maneuver against postoperative eyelid malposition [6, 7]. Preoperative evaluation for floppy eyelid syndrome, reduced orbicularis tone, and globe position should also guide the patient's surgical plan.

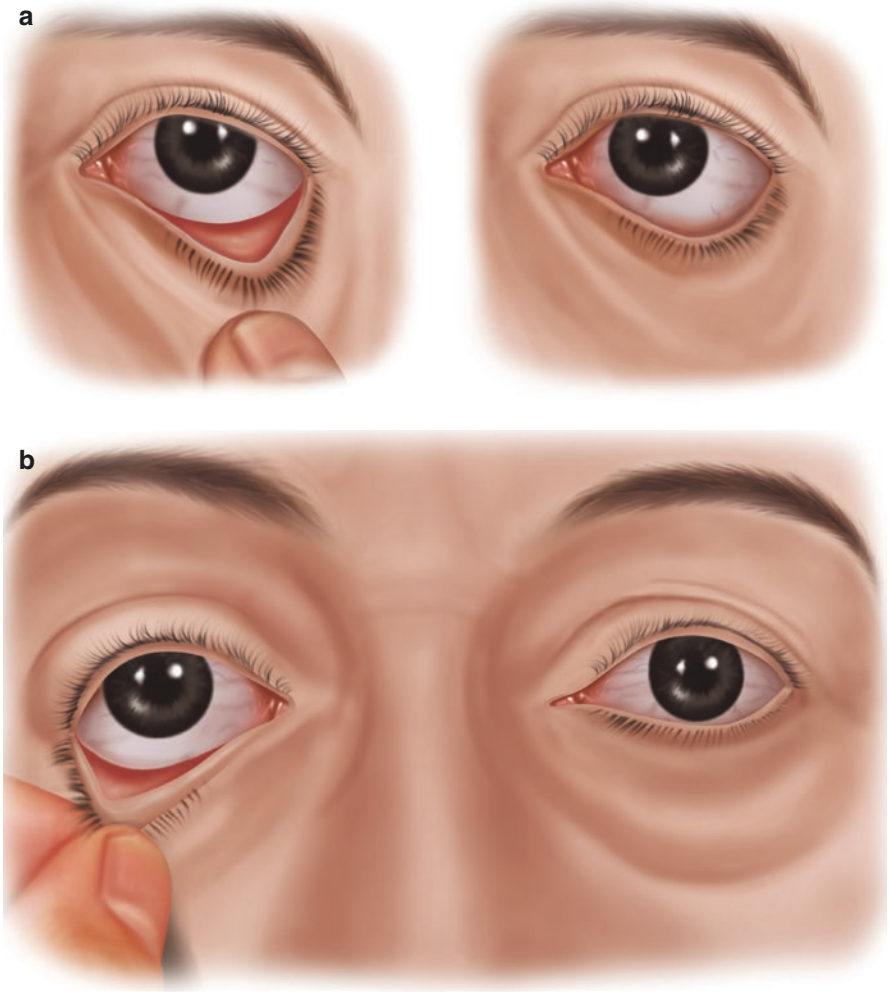

Fig. 18.2 (**a**, **b**) Schematic demonstrating a (**a**) positive snapback test and (**b**) lower eyelid distraction test

Improper inadequate placement of the lateral canthal tendon inside the lateral orbital rim may result in lateral canthal rounding [8]. Overaggressive resection of the anterior lamella, or scarring of the middle lamella (i.e., septum) to the inferior orbital rim, may result in cicatricial lower eyelid retraction [9]. Hester et al. recommended avoiding any dissection between the orbicularis muscle and the orbital septum to decrease septal trauma and the resultant postoperative eyelid retraction [8]. Additionally, medial orbicularis oculi trauma may injure the recurrent zygomatic motor nerve branches, which travel via intermuscular and submuscular planes to innervate the medial lower and upper eyelids [10]. Lower eyelid malposition may be accompanied by inferior scleral show, which is a finding that is both functionally unacceptable leading to ocular surface exposure, and can also be aesthetically displeasing.

Clinical Assessment

Postoperative lateral canthal dystopia can result in a variety of exam findings, including lower eyelid retraction and lateral canthal angle disruption. Lower eyelid retraction is the most common eyelid malposition observed following periorbital surgery, which is defined as an inferior malposition of the lower eyelid margin without eyelid eversion (Fig. 18.3a) [4]. This may result in ocular surface exposure with symptomatic tearing, photophobia, and discomfort. Lower eyelid retraction is believed to most commonly result from unaddressed preoperative lower eyelid laxity, which allows for unopposed downward contraction of the eyelid margin during the healing process [4]. Additional iatrogenic causes include anterior lamella (skin and/or orbicularis oculi) deficiency, mid-lamellar scarring between the orbital septum and lower eyelid retractors, orbicularis compromise, or lack of midface support allowing for descent of the intimately located lower eyelid [11]. A lower eyelid forced upward traction test should be performed to assess for anterior lamellar deficiency (Fig. 18.3b). This involves attempting to manually elevate the lateral lower eyelid into a corrected position at the inferior corneal limbus. The inability to fully lift the eyelid into this position, or the presence of vertical striae of the lower lid upon attempt, indicates insufficient skin and/or orbicularis oculi muscle of the lower eyelid, which may require an anterior lamellar full-thickness skin graft for adequate repair [4]. If manual eyelid repositioning requires digital elevation of the malar eminence, more extensive malar fat pad or subperiosteal midface suspension may be required [4]. In a large review of patients undergoing endoscope-assisted lower lid and midface rejuvenation, Roderick et al. found that patients with enophthalmic orbits, significant horizontal lower lid laxity, and history of previous lower eyelid surgical manipulation were at particularly high risk of postoperative lower lid malposition [8]. As a result, it was reinforced the necessity for judicious preoperative identification of eyelid laxity along with intraoperative lateral canthal tendon tightening to minimize risk [8].

Other lateral canthal postoperative complications include lateral canthal webbing, rounding of the angle, and phimosis. Lateral canthal webbing may occur following overzealous skin resection (Fig. 18.4a). Patients of Asian descent, those with a low-set eyelid crease, and individuals with brow ptosis are at elevated risk of canthal webbing [12]. A

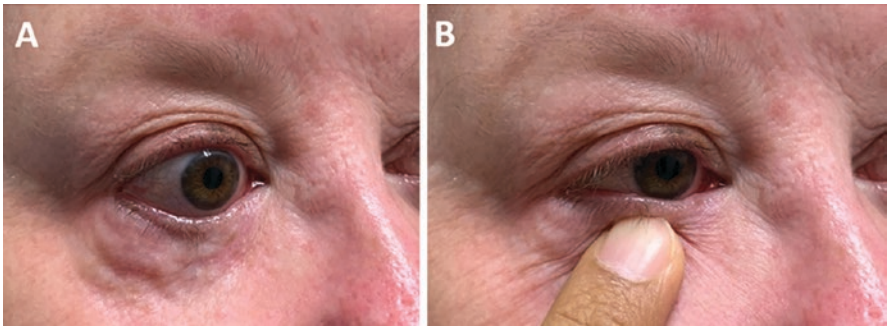

Fig. 18.3 (**a**, **b**) Patient photograph demonstrating (**a**) lower eyelid retraction, with anterior lamellar assessment via a (**b**) forced upward traction test

rounded lateral canthal angle can be seen in insufficient lateral canthal tendon attachment to the lateral orbital rim (Fig. 18.4b) [8]. Canthal phimosis (i.e., shortening of the horizontal aperture) or dystopia (Fig. 18.5) may result from excessive horizontal eyelid excision (Fig. 18.4c) [13]. Lateral canthal trichiasis may result from posterior rotation of the lateral lid margin. Placement of a horizontal mattress absorbable suture through the lateral upper and lower margin gray line may prevent postoperative trichiasis. Over-elevation of the lateral canthus may also be seen following robust temporal brow lifting.

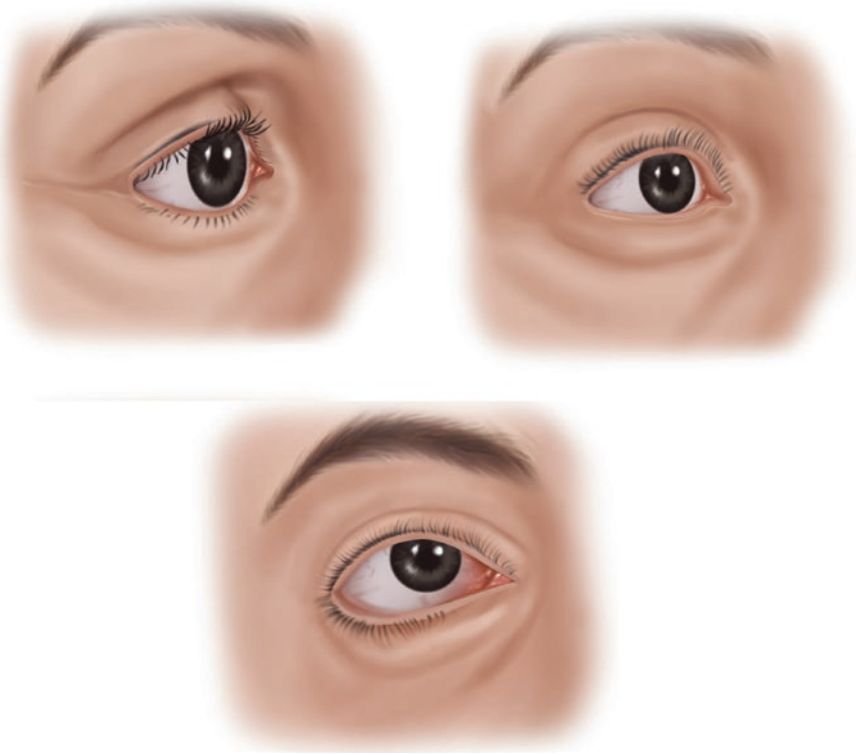

Fig. 18.4 Side-by-side comparisons of lateral canthal webbing, rounding, and dystopia

Fig. 18.5 Lower eyelid dystopia resulting from excessive horizontal eyelid excision

Management

In the initial postoperative period, management of lateral canthal dystopia or retraction with ocular surface vulnerability should be treated with frequent eye lubrication, including nightly ophthalmic ointment (Table 18.1). Topical steroids should be utilized to alleviate any component of downward eyelid traction due to conjunctival chemosis (Fig. 18.6); however, diligent monitoring of the intraocular pressure is strongly advocated to avoid ocular hypertension [14]. In our experience, upward lower eyelid massage may also successfully mitigate wound contraction during the initial healing phase. In cases of suspected hypertrophic healing, topical steroid, including over-the-counter 1% hydrocortisone or prescription desonide cream, may be of benefit. More significant scarring may benefit from injection of antifibrotic agents, such as 5-fluorouracil, with or without the addition of steroids [15].

McCord et al. proposed a stepwise approach toward the surgical rehabilitation of iatrogenic lower eyelid retraction (Table 18.2). The necessary corrective procedures are largely dictated by amount of anterior or middle lamellar deficiency and degree of globe proptosis [17]. Thorough assessment for evidence of each of anterior, middle, and posterior lamellar deficiency must be performed in order to appropriately customize treatment. Simplistic algorithms have been proposed to guide this assessment [14].

Mild cases of eyelid retraction may be corrected by lateral canthal tightening alone. Additional vertical recruitment of midfacial skin should be performed in

Table 18.1 Conservative management of lower eyelid retraction

Eye lubrication
Lid massage
Steroid (topical)
Steroid (injection)

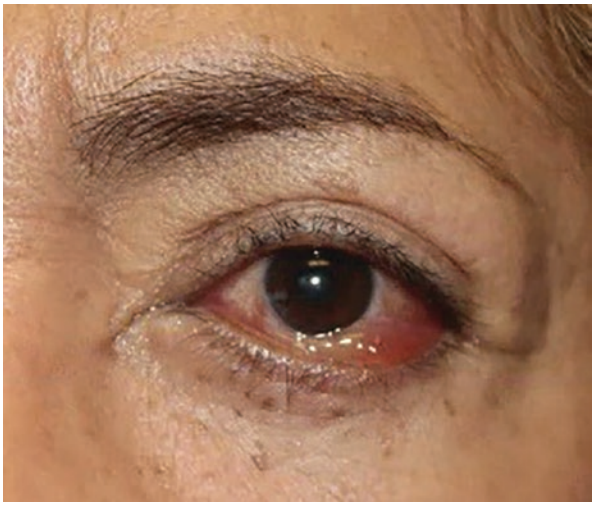

Fig. 18.6 Postoperative temporal conjunctival chemosis with inferior lid displacement

Table 18.2 Postoperative eyelid retraction management

	Cause	Clinical findings	Treatment
Lateral canthal angle rounding	Lateral canthal tendon dehiscence Excessive lower eyelid skin resection	Abnormal snapback test	Lateral canthoplasty
Lateral canthal tendon laxity	Under-recognized preoperative laxity	Abnormal snapback test Positive eyelid distraction test	Lateral canthal tightening (canthoplasty or lateral canthal strip)
Anterior lamellar deficiency	Excessive skin resection	Positive forced eyelid traction test	Midface elevation Full-thickness skin graft
Middle lamellar scar/deficiency	Orbital septal trauma	Fixed lower lid retracted position	Lysis of cicatrix Midface elevation

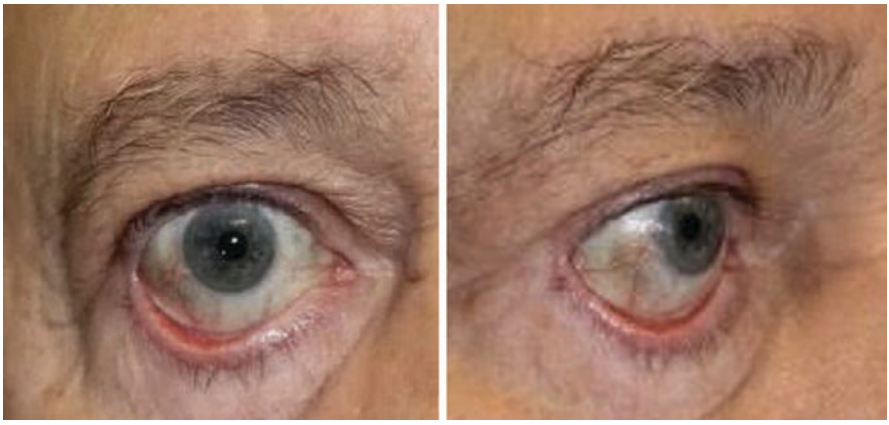

Fig. 18.7 Lower eyelid laxity and retraction in the setting of a negative vector and anterior lamellar shortage

cases of anterior lamellar shortening. This can vary in degree from vertical orbicularis suspension to a full subperiosteal malar dissection and release. Spacer grafts may be required in the most severe cases of retraction, particularly in patients with proptosis and more severe skin shortage (Fig. 18.7). Detailed surgical options are discussed in other chapters.

Lateral canthal tightening can be performed in numerous ways. Moderate-to-significant laxity requires a lateral tarsal strip, which is the workhorse for lateral canthal repositioning. This procedure may be performed under local anesthesia infiltrated into the lateral canthal area and along the anterior lateral orbital wall. A lateral canthal incision is made and the lateral orbital rim periosteum exposed. The lateral canthal tendon is released. The anterior and posterior lamellae of the lateral lower eyelid margin are divided, and the anterior surface of the posterior lamella is gently denuded of epithelium. The tendon is then shortened as necessary and secured to the lateral orbital rim periosteum in a slightly supraplaced position using permanent

double-armed suture. An additional absorbable suture may be used to reform the lateral canthal angle and the lateral canthal skin closed. In cases of limited or weak periosteum, the tendon may be secured to a bone tunnel through the lateral orbital rim, through a metal plate, or via a specialized suture with bone anchors.

In the case of middle lamellar deficiency and scarring, a mid-lamellar release and/or spacer graft should be utilized (Fig. 18.8). Following lateral canthal release, a transconjunctival incision is made at the inferior border of the tarsus across the length of the lower eyelid. The lower eyelid retractors are carefully released from the inferior tarsal border, and a meticulous dissection is performed between the conjunctiva and lower eyelid retractors to isolate and recess the retractors (Fig. 18.8a). In some cases, the retractors are extirpated and, in others, are allowed to recess based on surgeon preferences. Alternatively, "en glove" lysis of the retractors may be performed by bluntly releasing the retractors from the conjunctiva and anterior attachments, followed by retractor transection [16]. Scar tissue between the lower eyelid retractors and orbital septum is lysed. The residual middle lamellar defect is assessed, and a spacer graft is measured to fit the defect to aid in vertical suspension of the tarsus of the lower eyelid. The options for spacer graft material include hard palate, autogenous nasal or auricular cartilage grafts, autologous tarsus

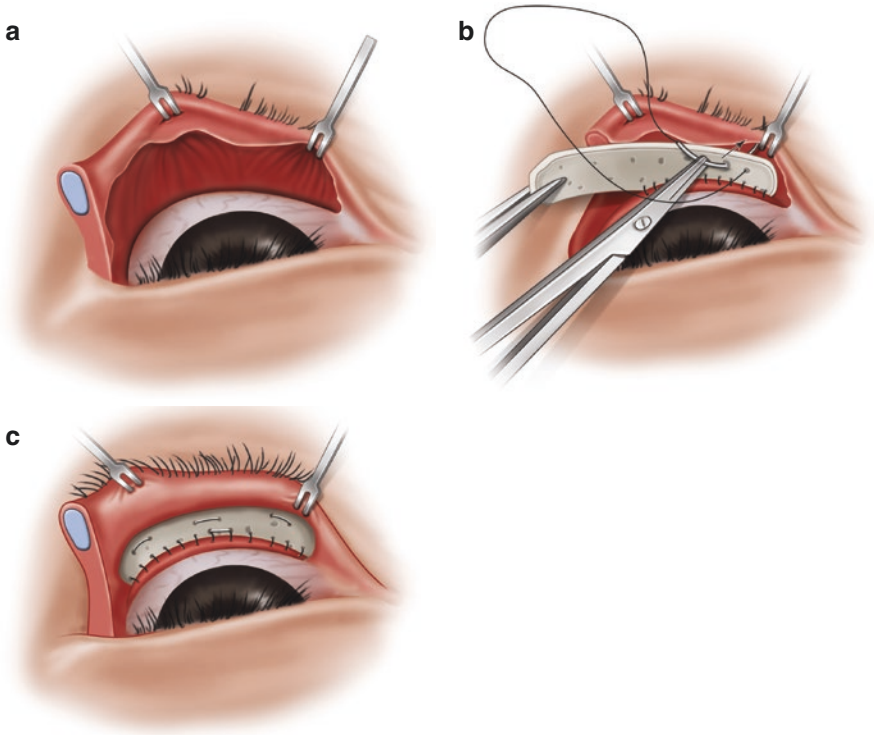

Fig. 18.8 Steps for the spacer graft placement. (**a**) Release of lower eyelid retractors from inferior tarsal border. (**b**) Spacer graft positioned between the inferior tarsal border and superior border of released lower eyelid retractors. (**c**) Sutures externalized and tied over bolsters

grafts, autologous dermal grafts, acellular dermal grafts (AlloDerm) with alloplastic material, or donor-banked sclera [4]. The graft can be secured to the inferior border of the tarsus and superior border of the released conjunctiva and lower eyelid retractors using partial-thickness bites through the graft with either an absorbable or nonabsorbable suture based on surgeon preference (Fig. 18.8b). In the case of nonabsorbable suture (i.e., 6-0 Prolene suture), the suture is placed over a foam bolster medially and laterally; it is imperative to pass the suture at a 45-degree angle along the superior and inferior border of the graft to aid in removal of the suture 1 week later (Fig. 18.8c). Following lateral canthal tightening, we strongly recommended utilizing a Frost suture tarsorrhaphy to maintain upward traction of the lateral lower eyelid for 1 week postoperatively [4]. The periorbital area is pressure patched for 1–7 days postoperatively, customized based on surgical technique.

Anterior lamellar deficiency following periorbital surgery is a difficult problem, particularly in the cosmetically oriented patient. Anterior lamellar grafting is the historic gold standard for repair [17]. Graft tissue is most commonly harvested from non-hair-bearing skin of the upper eyelid, pre- or postauricular areas, supraclavicular area, or sub-mammary fold. The evaluation for defect size should be performed after the lower eyelid is placed on upward vertical stretch using a traction suture through the lower eyelid margin. A subciliary incision is then made approximately 2 mm below the lash line (Fig. 18.9). The dissection is carefully performed to

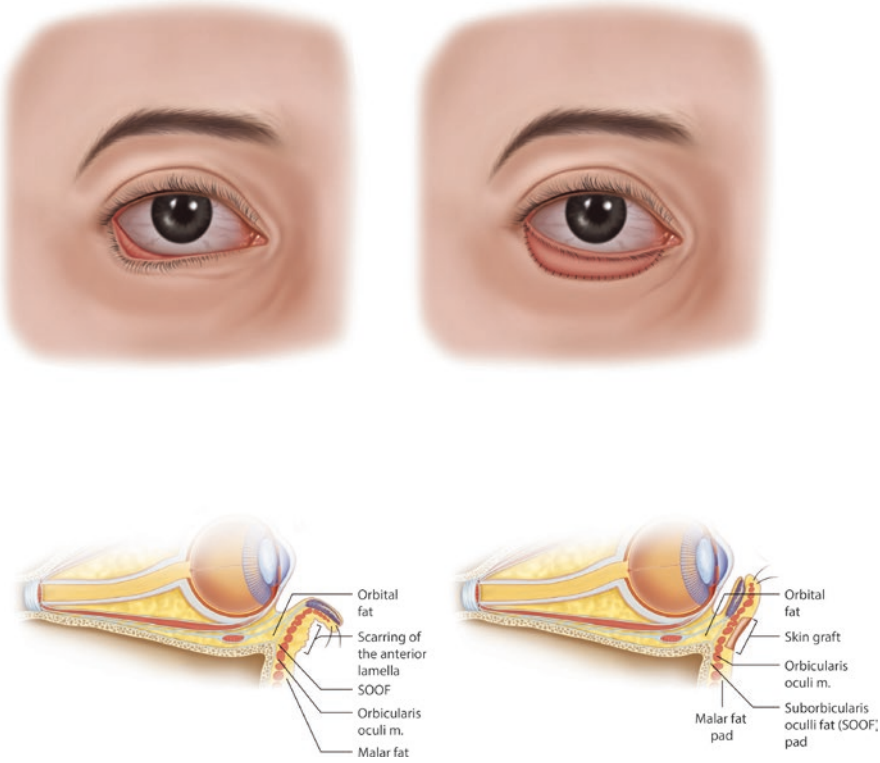

Fig. 18.9 Anterior lamellar deficiency repair with full-thickness skin graft

separate the skin from the underlying orbicularis muscle and cicatrix, taking great care to preserve the orbicularis oculi muscle for the proper postoperative functioning of the lower eyelid. The anterior lamellar defect can be adequately assessed and measured in preparation for a full-thickness skin graft. The graft should be oversized by several millimeters given inevitable tissue shrinkage. The graft should be thinned of all subcutaneous tissue to enhance graft vascularization and aid in optimizing the resultant cosmetic appearance. The graft is secured into place using either absorbable or nonabsorbable sutures based on surgeon preference. Many surgeons utilize the placement of a bolster over the graft during the initial postoperative week, using a dental roll or mineral oil-soaked cotton pads. A Frost suture tarsorrhaphy is also advocated to maintain the lower eyelid on upward stretch. Strict icing restrictions should be reviewed with the patient to avoid vasoconstriction as the skin graft is undergoing angiogenesis.

Midface elevation may serve as an adjunct or substitute to recruit additional anterior lamella when deficiency exists. In Shorr et al.'s "Madame Butterfly" procedure, following lateral canthal release and lysis of middle lamellar cicatrix, a subperiosteal dissection is carried across the anterior face of the maxilla until the lower eyelid can be pulled to a height 2 mm superior to the inferior limbus [9]. The deep cheek soft tissues are then secured to the periosteum adjacent to the lateral canthal angle using absorbable 4-0 suture in a horizontal mattress, over-elevating the lateral canthus approximately 2 mm superior to its natural position. The deep cheek soft tissues may also be secured along the inferior orbital rim (Fig. 18.10).

Variations of midface elevation for anterior lamellar augmentation have been proposed. The malar fat pad can be accessed through a transconjunctival incision. Dissection is carried down to expose the inferior orbital rim and continued along a subperiosteal plane to expose the anterior maxillary face. The zygomaticofacial nerve should be identified and preserved. The orbital and malar retaining ligaments must be released. The malar fat pad can be elevated and secured superiorly at the lateral orbital rim periosteum and/or deep temporalis fascia in the temple using 4-0

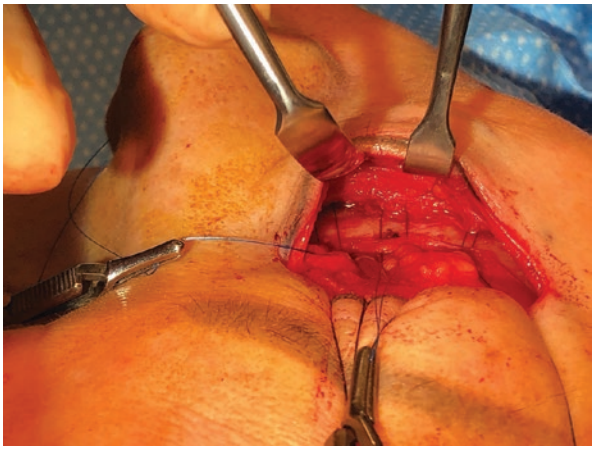

Fig. 18.10 Intraoperative photo displaying suture fixation of the deep cheek soft tissues to the posterior remnant of the inferior orbital rim periosteum

Vicryl or Monocryl sutures. Alternatively, a larger subperiosteal cheek release may be performed and secured to the deep temporalis fascia in a similar fashion [18]. A Frost suture tarsorrhaphy is again recommended for the first postoperative week.

Conclusions

Lateral canthal dystopia and retraction are feared complications of periorbital surgery. A thorough preoperative assessment for baseline lateral canthal tendon integrity is essential to prevent postoperative malposition. A graded surgical rehabilitation of lower eyelid complications is guided by the extent of eyelid injury and may involve a combination of lateral canthal tendon tightening, midface elevation, and spacer grafts.

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Asian Upper Eyelid Complications

19

Cat Nguyen Burkat

In terms of upper eyelid surgery, Asian blepharoplasty, also known as "double eyelid" or eyelid crease fixation surgery, is one of the most popular cosmetic procedures in Asia and is also performed for visually obstructing dermatochalasis. The majority of Southeast Asians (range 40–90%) possess "single eyelids," also known as monolid, with an absent or poorly defined eyelid crease. While upper eyelid blepharoplasty in the Asian patient incorporates the basic techniques and principles of blepharoplasty surgery, failure to understand and recognize significant anatomic eyelid differences between Caucasian and Asian eyes will likely yield poor outcomes. In addition, there are subtle anatomic differences and diverse cultural concepts of beauty even among the various Asian ethnicities that should be discussed in detail with the patient preoperatively. Major differences seen in Asian eyelids include the presence of subcutaneous or submuscularis fat which manifests as puffier eyelids, an epicanthal fold, and the lower fusion of the orbital septum on the levator aponeurosis which results commonly in an absent/lower eyelid crease.

Recognizing Anatomic Differences in the Asian Eyelid

Anatomy of the upper eyelids in individuals of Asian descent may differ in several aspects compared to Caucasian eyelids. Preoperative office examination should carefully document:

- Location of eyelid crease, shape, and height on both sides
- Presence or absence of a medial epicanthal fold
- Eyelid skinfold
- Tarsal platform visibility

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- Eyebrow position and shape, brow fat fullness
- Measurement of eyelid skin from margin to eyebrow skin
- Superior sulcus fullness/orbital fat prominence
- Pretarsal fullness (subcutaneous fat), not normally seen in Caucasian eyelids
- Eyelash ptosis
- Preexisting asymmetries

Several distinct portions of the medial, central, and lateral eyelid should be appreciated during the preoperative evaluation to avoid upper blepharoplasty complications in the Asian patient.

Medial Eyelid

The medial eyelid should be evaluated for the presence and severity of the epicanthal fold. Medially, the eyelid crease typically blends downward into a skinfold that tapers into the medial canthal angle, and sometimes even into the lower lid, referred to as the epicanthal fold (Fig. 19.1). This creates the distinctive appearance to most Asian eyelids. Any incision should be precisely placed into the epicanthal fold, in order to avoid postoperative eyelid crease complications, such as double folds, webbing, multiple or bifid creases. The epicanthal fold also typically contains more subcutaneous fat and does not tuck posteriorly to create the medial canthal depression normally seen.

Central Eyelid

The central eyelid should be assessed for eyelid crease type and presence of asymmetric margin reflex distances (MRD_1) that would suggest underlying blepharoptosis. The eyelid crease in Asians can be subcategorized into several main types: single (monolid) eyelid, partial eyelid crease, and double eyelid (defined crease). Approximately 40–90% of Asians lack a distinct upper eyelid crease, referred to as a single eyelid (or monolid), that appears as a smooth single eyelid surface from the

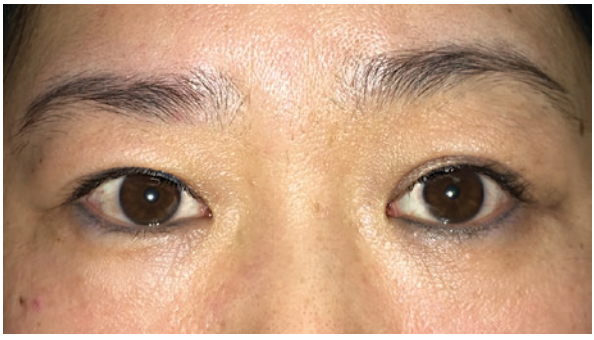

Fig. 19.1 An epicanthal fold is a characteristic finding in the medial eyelid

eyebrow to the eyelid margin without an intervening crease or depression (Fig. 19.2a, b). Patients may complain of having smaller palpebral fissures or appearing tired.

When an eyelid crease is present, it may be further described as continuous, discontinuous, incomplete (the crease starts medially but disappears partway toward the central or lateral eyelid), or multiple. In some patients, a single crease may be seen on one eyelid and multiple creases on the contralateral upper eyelid.

In the Asian eyelid, the orbital septum typically attaches to the levator aponeurosis at a lower level, frequently several millimeters below the superior tarsal border, in contrast to 2–5 mm above the superior tarsal border in Caucasian eyelids. Because of this lower junction, this allows for more anterior and inferior positioning of the preaponeurotic fat pad in the eyelid, resulting in a fuller sulcus appearance and "single eyelid" in Asians (Fig. 19.3).

In addition, the vertical height of the upper tarsus is approximately 5–8 mm in Asian eyelids, compared to 8–11 mm in the Caucasian eyelid. Therefore, placement of the Asian blepharoplasty incision should always be lower at approximately 4–7 mm above the margin, in order to preserve the natural ethnic appearance. Rarely, however, some patients are now trending toward slightly higher creases to simulate a more Westernized eyelid appearance.

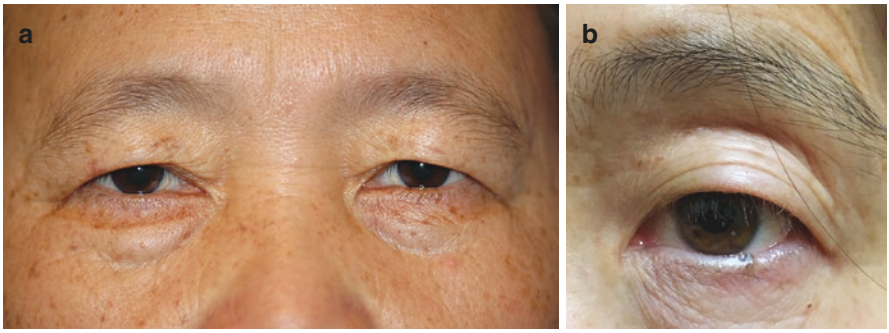

Fig. 19.2 (**a**, **b**) Monolid, or single eyelid, without an eyelid crease: The skinfold may rest on or over the eyelashes and cause eyelash ptosis in an eyelid with a low or absent crease

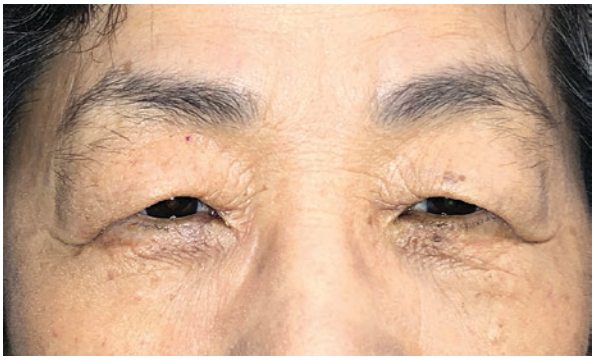

Fig. 19.3 A lower junction of the orbital septum to the levator complex allows more anterior and inferior descent of the preaponeurotic fat pad, resulting in a fuller sulcus appearance and "single eyelid" in Asians

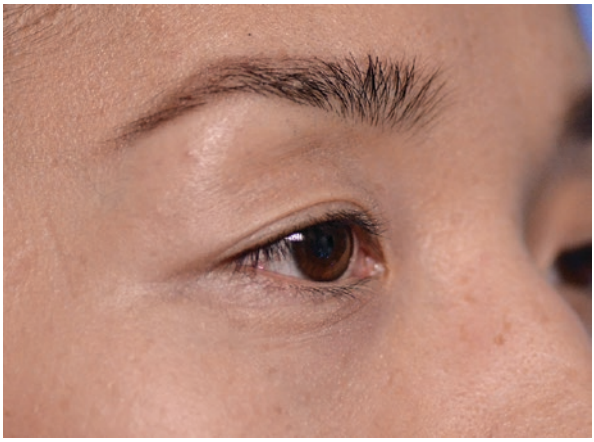

Fig. 19.4 The eyelid crease is often lower (at 4–7 mm) and flatter in contour in the Asian patient. A highly curved eyelid crease can lessen the Asian appearance

The upper crease is generally less defined or even completely absent. Anatomically, this is due to the lower resting position of the orbital fat that disrupts the terminal anterior fibers of the levator aponeurosis from attaching to the pretarsal orbicularis oculi muscle to create the crease. The skinfold may rest on or even over the eyelashes, causing eyelash ptosis, and the crease configuration is typically flatter (parallel to the margin) rather than rounded (Fig. 19.4).

Lateral Eyelid

The lateral crease typically stays parallel to, or slopes slightly farther from, the eyelid margin toward the outer canthus. This results in a flatter or mildly flared crease, rather than semilunar. The lateral canthal angle rests 2 mm or more above the level of the medial canthal angle.

Complications

In general, suboptimal aesthetic results may lead the patient to pursue additional surgery. It is recommended that 3–6 months of observation prior to revisions can allow for wound maturation. In addition, Asian eyelids often have more prolonged pretarsal edema due to dissection in a lower level over the tarsal plate. The surgeon and patient should be realistic with regard to the expected outcome of revisional surgery, as improvement but not complete correction may sometimes occur.

Common patient concerns after Asian blepharoplasty or double eyelid surgery include:

I. Asymmetric or multiple eyelid creases (Fig. 19.5)
II. High eyelid crease (Westernized eyelid appearance)
III. Bifid (forked, Y-shaped, multiple) creases

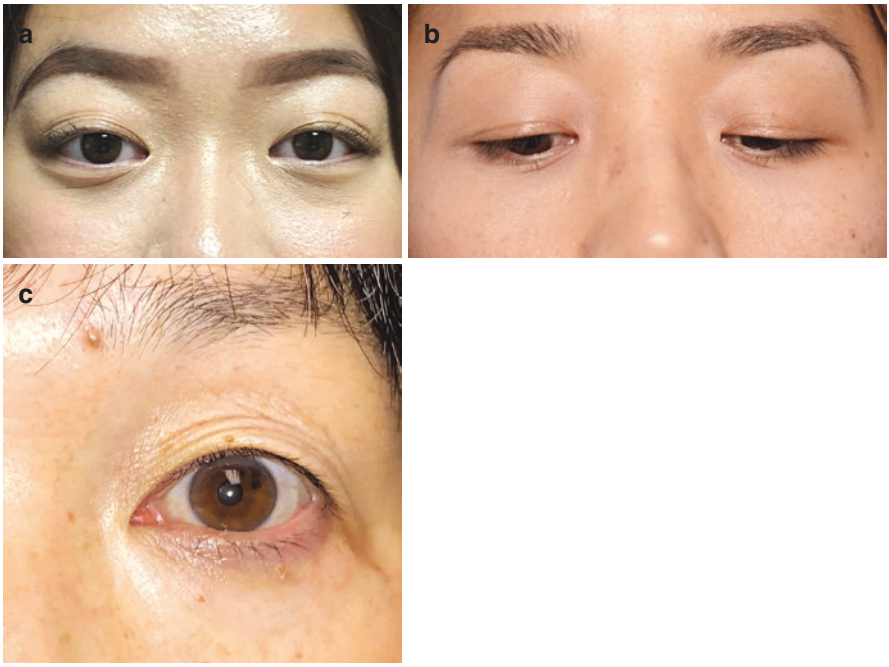

Fig. 19.5 (**a**–**c**) Preexisting multiple eyelid creases

IV. Hollowed superior sulcus deformity
V. Hypertrophic or poor scarring
VI. Poor eyelid crease definition
VII. Lagophthalmos
VIII. Unrecognized blepharoptosis or eyebrow ptosis
IX. Eyelash eversion and margin ectropion

I. Asymmetric Eyelid Creases

Asymmetric eyelid creases most often result from asymmetric skin markings (Fig. 19.6a, b). Even very subtle differences after surgery can create undue stress and seem more bothersome to the patient, even if asymmetries were present preoperatively. In some instances, similar but not necessarily identical, eye appearances can be expected after surgery.

- Minimizing asymmetric eyelid creases:
  - As mentioned previously, preoperative evaluation should include a thorough discussion with the patient regarding the desired surgical outcome, using photos for illustration, as well as demonstrating the result with a mirror. Using a

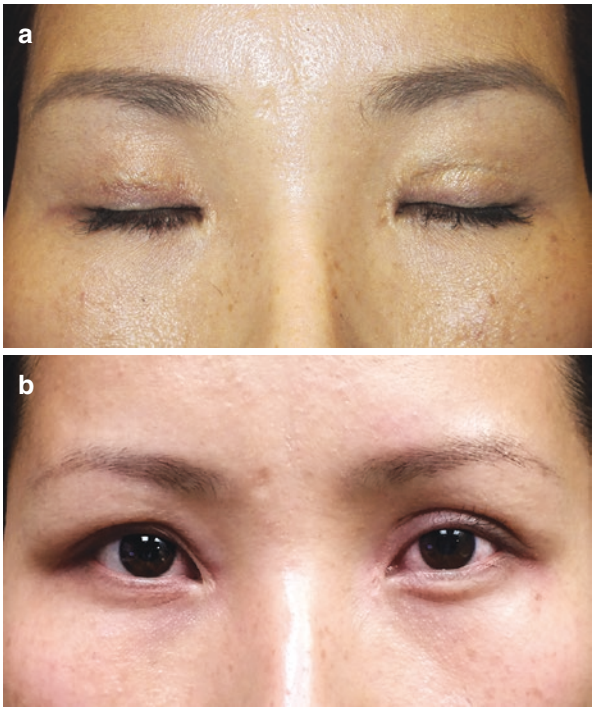

Fig. 19.6 (**a**) Asymmetric eyelid creases after surgery, with the left crease much higher than normally located at 4–7 mm in the Asian eyelid. Left crease is also atrophic rather than hypertrophic; (**b**) asymmetric higher left crease with more tarsal platform visibility, loss of epicanthal fold, and alteration of the Asian appearance

cotton tip applicator or other small instrument to simulate the eyelid crease height and contour of the skinfold during the evaluation can be very helpful for the patient to visualize the outcome. It is critical to clarify if the patient wants a natural crease height for Asian eyelids or an elevated crease.

- To optimize symmetry at surgery, carefully measure the height of each eyelid crease, and mark equal crease locations. Note that some patients may have preexisting crease asymmetry, but are not aware of this until after surgery; therefore, the creases should be placed at the same height despite unequal natural creases. If possible, use the lower crease height, as using the higher crease may result in a double crease on the side with the lower crease.
- Skin markings are most accurate if made prior to local anesthesia, with typical creases at 4–7 mm from the eyelid margin. Upward traction on the skin when measuring should be gentle and equal to avoid unevenly measuring the eyelid creases. For instance, if the skin is pulled tightly on one side during the measurement and pulled less taut on the contralateral side, the presumed crease markings may not be precisely symmetric.
- Use a fine-tip marker in order to avoid widened crease markings that can make it difficult to be precise when incising the skin. The eyelid crease incision should blend into the epicanthal fold to avoid asymmetric or abnormal medial creases.
- Asymmetric creases after surgery may also occur if an underlying involutional ptosis is unmasked after blepharoplasty.

- Surgical correction of asymmetric eyelid creases:
  - Intraoperative bleeding and uneven ecchymosis from surgery may also cause the appearance of asymmetric eyelid creases initially, which should improve with resolution of edema and hematoma.
  - After an appropriate period for normal scar healing, asymmetric creases are best addressed by lowering the higher crease. Measure the crease heights carefully, and if the lower crease is at a reasonable height of 4–7 mm from the margin, then the side with the higher crease can be marked to equal that side. Incise the skin with a 15-blade scalpel or scissors, and remove the thin horizontal strip of pretarsal tissue intervening between the new crease and the higher eyelid crease. Any thickened scar tissue in this area should also be removed so that the new crease can be tacked to posterior tissues for definition and longevity.
  - Correction for multiple creases is similar, in which the desired crease is selected and marked with the excised tissue crescent incorporating the accessory creases.

II. High Eyelid Crease (Westernized Eyelid Appearance)

Each ethnic group in the South Asian population has its own unique facial characteristics, and it is generally accepted that significant transformation to a Caucasian/Westernized eyelid would result in an unnatural appearance (Fig. 19.7). Therefore, the traditional "double eyelid surgery" approach that created a high semilunar crease is now less favored. Interestingly, some patients are more recently trending toward higher eyelid creases and lessening of the epicanthal fold to simulate a more Westernized eyelid appearance. This expectation should be approached with caution.

- Minimizing high eyelid crease (Westernized eyelid appearance):
  - If a higher than natural eyelid crease is desired by the patient to make the eyes look wider and more defined, a very careful discussion and review of multiple photographs are necessary to be certain the patient is aware of how this will

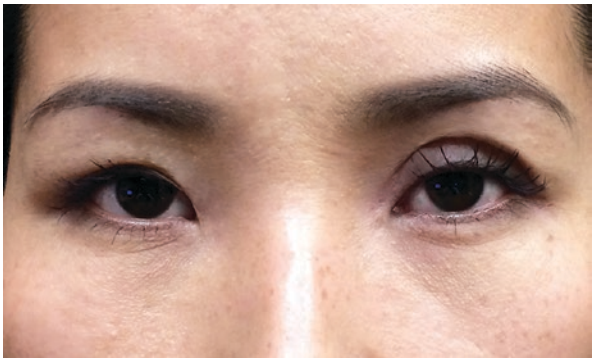

Fig. 19.7 High eyelid creases result in a Westernized eyelid appearance that is typically undesirable. The increased tarsal platform now visible may also cause the patient to look drowsy or ptotic

lessen the Asian appearance. In general, it is discouraged to create very high eyelid creases (Fig. 19.8). Similarly, a significant epicanthoplasty will change the ethnic eyelid and is very difficult to correct (Fig. 19.9).

– On marking the incisions at surgery, keep the crease height at approximately 4–7 mm above the eyelid margin and in agreement with the desired height as discussed with the patient preoperatively. The crease contour should be relatively flat and parallel to the margin (Fig. 19.10).
– Minimally invasive, suture fixation double eyelid techniques are best in patients without excess skin or fullness, and they are performed by folding up

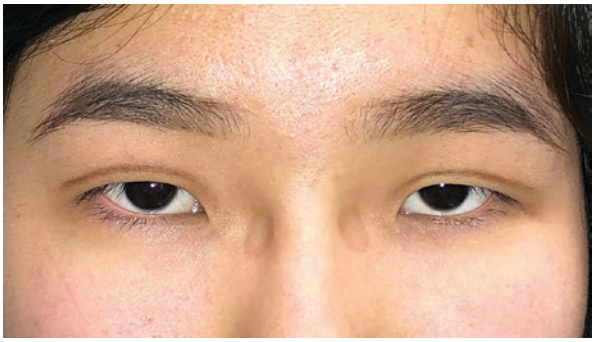

Fig. 19.8 This patient with an absent eyelid crease (single eyelid, monolid) simulated very high creases at 14 mm from the margin using dark eyeliner daily

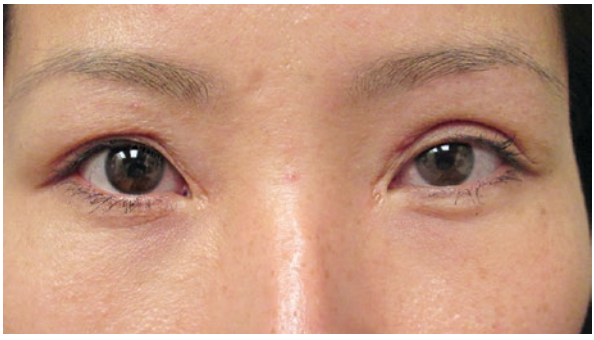

Fig. 19.9 A significant epicanthoplasty may change the ethnic eyelid. A poor scar is also noted in the medial eyelid due to extension of the incision too far past the upper punctum level and canthal angle

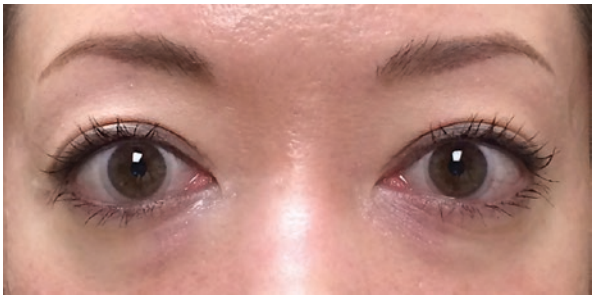

Fig. 19.10 The eyelid crease is low and flat and parallel with the eyelid margin. The patient also desired epicanthoplasty to minimize the medial skinfold

the skin without removal. If performed, avoid placing the fixation sutures higher than normal to compensate for the redundant skin, which would result in abnormally high creases. If it appears that the fixation sutures need to be higher than the superior tarsus, then skin excision should be considered instead.

– Imprecise skin marking is also a common cause of high creases and is usually due to unequal or lack of stretching of the skin during the marking process. Ideally, the skin should be pulled enough to gently smooth out the redundant skin prior to marking, but not too much such that the pretarsal skin appears taut or the eyelashes start to rotate upward. Particularly in older patients with significant skin wrinkles and laxity (Fig. 19.11), failure to gently stretch the upper eyelid skin upward during the marking process may result in an eyelid crease that is too high once the pretarsal skin stretches with eyelid crease fixation.

- Surgical correction of high eyelid crease (Westernized eyelid appearance):
  A postoperative elevated crease in an Asian eyelid can be very challenging to correct, and therefore avoidance is optimal.
  – It is important to note that the eyelid creases often appear slightly higher in the initial postoperative period due to prominent pretarsal edema. This pretarsal edema occurs due to the lower dissection and excision of a strip of muscle and subcutaneous tissue from the inferior incision that is performed to establish an eyelid crease (Fig. 19.12). With resolution of edema over several months, the creases will often relax to the desired height (Fig. 19.13a, b).
  – If the high eyelid crease is secondary to an underlying blepharoptosis that is now unmasked, this can be managed by the appropriate ptosis surgical procedure.
  – If postoperative ptosis is new, one should evaluate for clinical signs of iatrogenic levator compromise. In some cases, iatrogenic ptosis may occur from placement of high eyelid crease fixation sutures that compromise the levator muscle/aponeurosis excursion in the gliding zone [1, 2]. Similarly, thick fibrosis in the area of the sutures may limit levator movement. Excessively

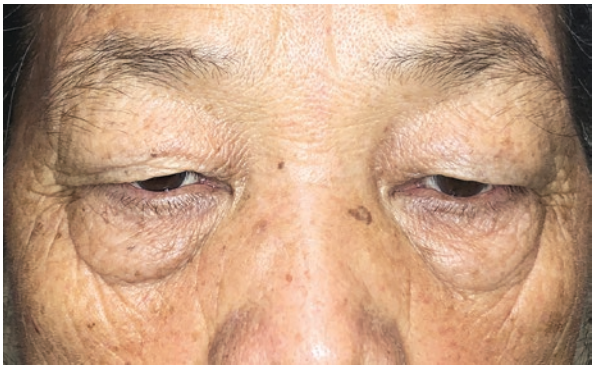

Fig. 19.11 Older patients with significant skin wrinkles and laxity may be more difficult to mark the incisions. Asymmetric creases, or creases that are too high, can occur if the eyelid skin is not stretched upward equally during marking

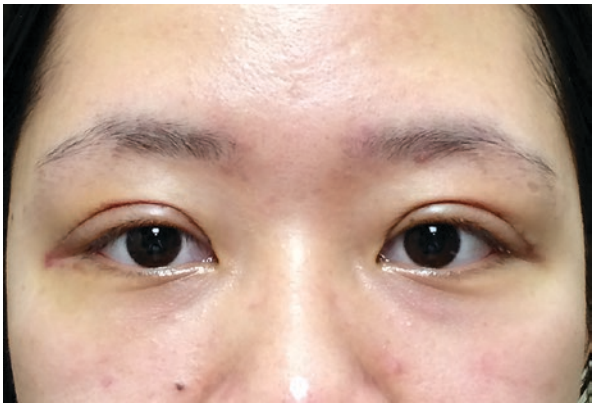

Fig. 19.12 Eyelid creases may appear higher in the initial postoperative period due to significant pretarsal edema

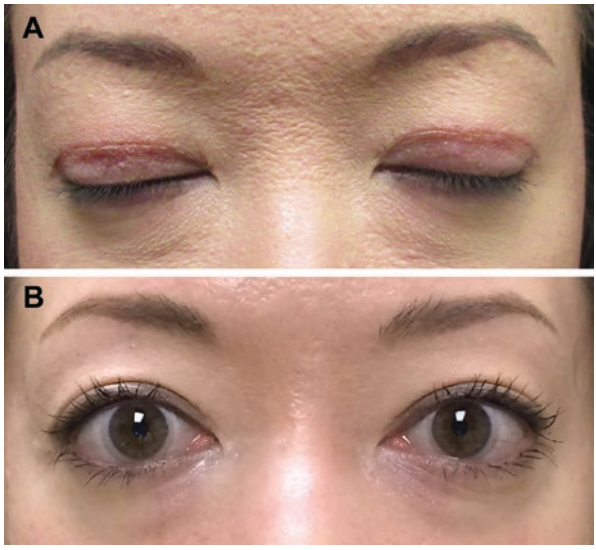

Fig. 19.13 (**a**) Eyelid creases often appear slightly higher in the initial postoperative period due to prominent pretarsal edema; (**b**) creases settle down into a more natural location after resolution of edema

high crease fixation can also result in scar formation between the levator aponeurosis and skin, which may potentially limit the gliding zone and change the vertical vector force of the levator complex to the tarsus to a horizontal vector toward the skin (Fig. 19.14a, b). Signs of levator compromise may include eyelid retraction on downgaze, inability to pinch the eyelid skin up from the eyelid, and lagophthalmos (in the setting of adequate skin preservation).

– Allow at least 3–6 months of adequate healing prior to considering surgical revision.
– If a higher eyelid crease is present with normal MRD_1 and no skin levator adherence, a lower eyelid crease can be achieved by marking the desired lower crease and removing the intervening tissue (Fig. 19.15). The desired

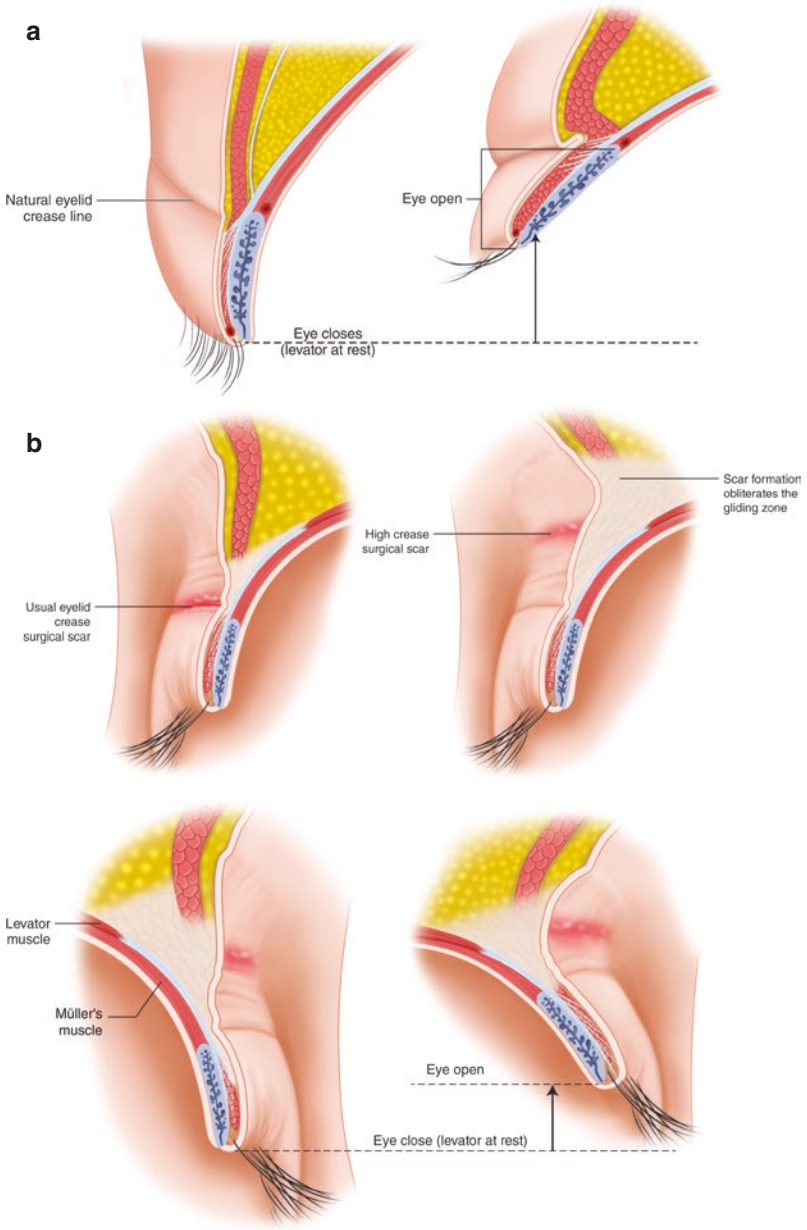

Fig. 19.14 High suture fixation-induced ptosis: (**a**) Preaponeurotic fat creates a zone for the levator muscle and aponeurosis to move and glide freely. When the levator muscle contracts, the levator aponeurosis distal fibers pull on the pretarsal skin to form the eyelid crease and elevate the tarsus; (**b**) an excessively high crease fixation can also result in significant scar formation between the levator muscle/aponeurosis and skin, which may potentially limit the gliding zone and change the vertical vector force of the levator complex toward the skin

Fig. 19.15 (**a**–**e**) Correcting a high crease deformity: (**a**) Schematic illustration of high left upper eyelid crease after surgery; (**b**) marking the desired lower eyelid crease symmetric to the contralateral side and removing the intervening tissue; (**c**) patient with high left upper eyelid crease after Asian blepharoplasty; (**d**) lower crease is measured and marked; (**e**) intervening tissue including the high crease scar is removed, taking care to avoid lagophthalmos

eyelid crease is carefully marked, making sure it is a natural height for the Asian eyelid and also symmetric to the contralateral side. The thin crescent of the skin to be removed is marked, with the superior marking incorporating the previous high surgical scar and the inferior line being the new eyelid crease. Markings should be drawn prior to local anesthetic infiltration to avoid tissue distortion.

- It is critical that the amount of residual skin from the central eyelid margin to eyebrow measures at least 15 mm in order to avoid lagophthalmos. Therefore, lowering a high eyelid crease is only possible if sufficient laxity of the subbrow skin exists to allow for excision of additional tissue between the high crease and the level of the desired crease. In a young patient with very little skin redundancy, or an older patient with skin shortage from prior aggressive skin removal, revisional surgery may be therefore limited. It may be unsafe to excise the intervening anterior lamella between the old and new creases to lower a high eyelid crease. Potential options to minimize lagophthalmos may be frequent downward eyelid massages to stretch the skin or placing the new crease not as low as would be desired.
- Revision is more complex if clinical signs of levator compromise are noted postoperatively. Correction would typically involve scar lysis/excision, levator advancement, and possible tissue grafting over the levator complex to prevent readhesion. The initial steps of tissue excision between the high and desired lower crease are performed as above, with care to remove only skin and superficial scar tissue to avoid injury to the underlying levator. Next, Westcott scissors are used to meticulously release the levator aponeurosis from any adhesions to the overlying septum, orbicularis muscle, or skin. The entire length of the levator complex must be released up to Whitnall's ligament, as failure to separate all adhesions may result in an unresolved high crease and/or multiple eyelid creases.
- Complete lysis of scar can be confirmed by asking the patient to look up and down while pulling the upper eyelid skin inferiorly. Additional scar release is indicated if levator excursion is limited or if there is visible transmission of an upward pull to the skin.
- Once adhesions to the levator complex are adequately released, the new lower eyelid crease is created by multiple posterior fixation, or tacking, sutures. As normally performed, gentle elevation to smooth the pretarsal tissue guides the placement height of these sutures; the inferior incision is then sutured to the tarsus or levator aponeurosis just above tarsus.
- It is critical to recreate the gliding movement of the dissected levator complex, so that it can glide freely in excursion (Fig. 19.14a, b). Ideally, if the residual preaponeurotic fat is sufficient to allow for inferior transposition over

the levator complex, it is brought downward as a pedicle and sutured to subcutaneous tissue at the skin edge. If the preaponeurotic fat is insufficient to cover the levator, then placement of a tissue graft (such as dermis fat, fascia lata, temporalis fascia) in the plane between the levator complex and overlying orbicularis and skin may be necessary to prevent readhesion.

III. Bifid Crease

A bifid, or Y-shaped, eyelid crease may occur at both the medial and lateral canthus and is typically the result of imprecise marking on the epicanthal fold that causes a forked crease (Figs. 19.16 and 19.17). Laterally, many Asians prefer a subtle flare to the lateral crease to give the illusion of wider eyes, and a bifid crease can occur if the posterior fixation sutures do not respect this natural crease flare (Fig. 19.18).

- Minimizing a bifid crease:
  - It is critical to taper the medial skin marking into the epicanthal fold. With the patient supine, gently push upward on the eyelid margin to visualize where the epicanthal fold is most prominent, and place the desired crease marking directly on the edge of the skinfold. If inaccurately marked and slightly off the fold by a couple millimeters, undesirable bifid creases may occur. A fine-tip marker should be used to mark the skin and the skin blotted frequently to prevent the markings from widening that may make precision difficult.
  - Once the crease is marked, ask the patient to open the eyes to confirm that the medial apex of the blepharoplasty crescent blends smoothly into the epicanthal fold without creating a second branching fold.

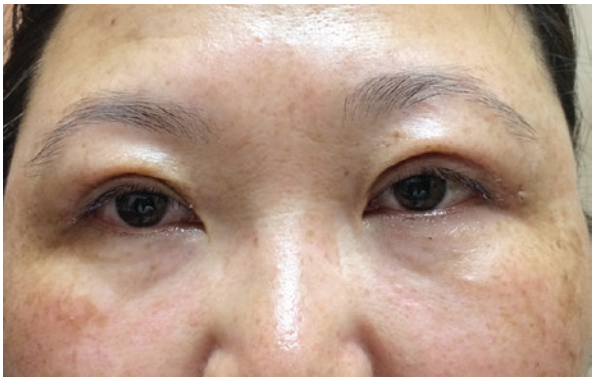

Fig. 19.16 A very subtle bifid, or Y-shaped, eyelid crease on the left medial crease is noted and is the result of imprecise marking on the epicanthal fold

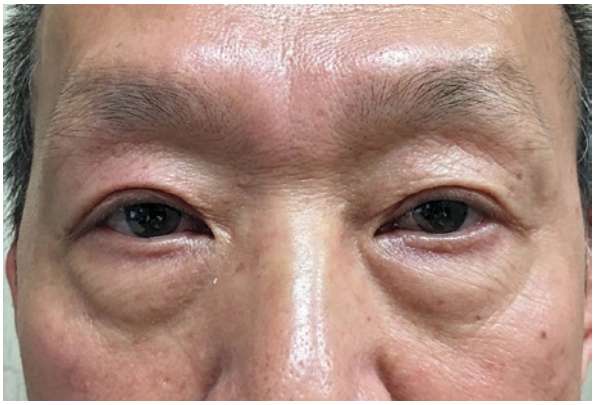

Fig. 19.17 This patient has more significant bifid creases on the left and right medial eyelid incisions

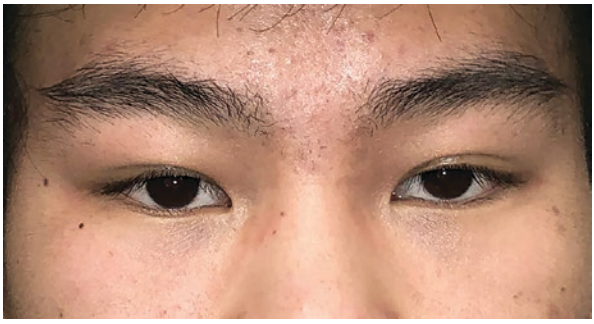

Fig. 19.18 Laterally, many Asians may have a subtle flare to the lateral crease which can give the illusion of wider eyes

- In older patients with severe skin laxity, bifid creases may be more common due to challenging skin markings in the setting of significant wrinkles. Medial skin excision should be conservative and more removed if necessary to avoid multiple creases after the fixation sutures have been placed.
- In younger patients without skin redundancy, some surgeons may consider the small-incision or suture fixation double eyelid technique to minimize bifid crease complications.
- Eyelid eversion can be performed to check the tarsal plate shape. Although most Asian eyelids have a triangular-shaped tarsal plate, with a tapered medial and lateral end, the eyelid can be everted to confirm the shape. If the eyelid crease suture is fixated along the superior tarsus, this will result in a semilunar crease that tapers both medially and laterally. Therefore, if the patient prefers to maintain the slight lateral flare of the eyelid crease postoperatively, the lateral crease fixation suture should be placed ideally close to the central suture, rather than along the lower lateral tarsus, to maintain the crease flare as well as to avoid a lateral bifid crease.

- Surgical correction of a bifid crease:
  - Persistent bifid crease requires surgical revision that can be performed in the office. During the skin marking, blend the incision precisely into the desired crease. The posterior fixation sutures must be properly positioned prior to excision of redundant tissue. Most often, very little skin needs to be removed once the fixation sutures are adjusted.
  - Prior to closure, ask the patient to look up and down to confirm that the bifid crease has been obliterated properly.

IV. Hollowed Superior Sulcus Deformity

Correcting a hollowed superior sulcus is extremely challenging and often results in partial improvement at best. Therefore, avoidance of this complication is critical.

- Minimizing a hollowed superior sulcus deformity:
  - Although patients often ask for removal of fat, it is important to recognize that the Asian eyelid characteristically has more fullness to the sulcus (Fig. 19.19), and therefore, aggressive excision of preaponeurotic and medial fat pads will look unnatural in an Asian individual (Fig. 19.20). Significant fat debulking would result in flattening of the preseptal space and an abnormal supratarsal depression or additional crease(s) above the surgical crease (Figs. 19.20 and 19.21).
  - Perform minimal debulking of medial fat, as a medial depressed sulcus will appear more aged and also risk bifid creases.
  - Gentle thermal cautery of the fat pads can often result in optimal aesthetic improvement without creating a hollowed superior sulcus.
- Surgical correction of a hollowed superior sulcus deformity:
  - Soft tissue dermal fillers have been considered by some surgeons to improve a hollowed sulcus. Typically, a hyaluronic acid filler would be injected

Fig. 19.19 The eyelid characteristically has more fullness to the superior sulcus in Asian individuals. Therefore, fat removal should be extremely conservative

Fig. 19.20 Aggressive excision of preaponeurotic and medial fat pads will look unnatural and aging in an Asian patient

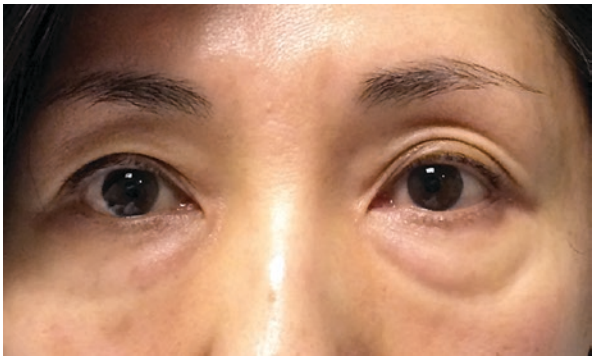

Fig. 19.21 Significant fat debulking can result in flattening of the preseptal space and an abnormal supratarsal depression or additional creases above the surgical crease

carefully in a submuscular or preseptal tissue plane starting from above the orbital rim and slowly moving inferiorly with additional horizontal passes. Injecting into the deepest portion of the hollowed sulcus is often less effective. Risks are significant and include lumps and irregularity, ecchymosis, edema, Tyndall effect, and injury to the levator complex or globe (Fig. 19.22a–c).

- Autologous fat injections can similarly be used as volume augmentation, and dermis fat grafts have also been utilized with limited success. However, in general, the patient should be aware that any filler material often yields suboptimal correction of the superior sulcus deformity.
- It is also important to keep in mind that volume augmentation in the superior sulcus, while potentially improving the deep sulcus appearance, may also contribute to eyelid ptosis either from mechanical loading of the eyelid or inadvertent injury/fibrosis to the levator complex.

V. Hypertrophic or Poor Scarring

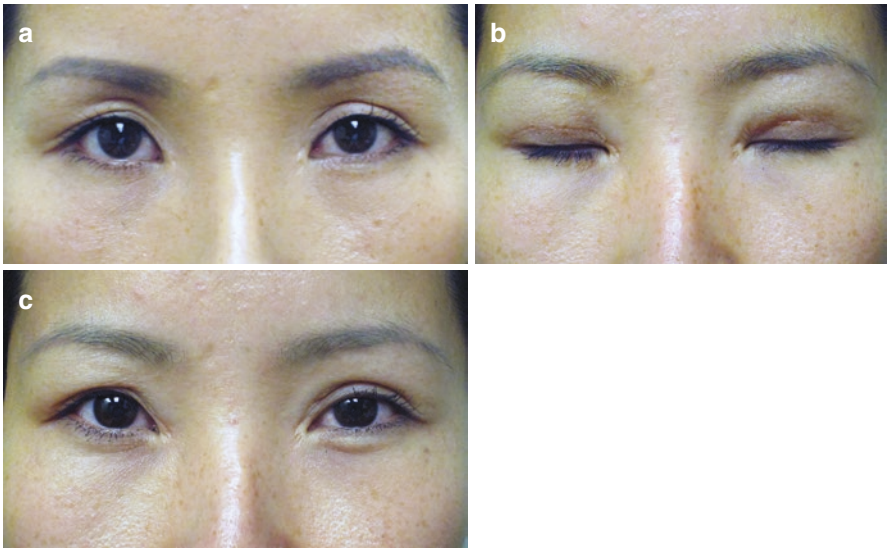

Fig. 19.22 Injection of soft tissue fillers into the preseptal plane can result in lumps, irregularity, ecchymosis, edema, and Tyndall effect. (**a**) Severe hollowed sulcus deformity on both sides; (**b**) immediately following injections; (**c**) improvement, although not complete correction, of hollowed sulcus and asymmetry at 6 weeks

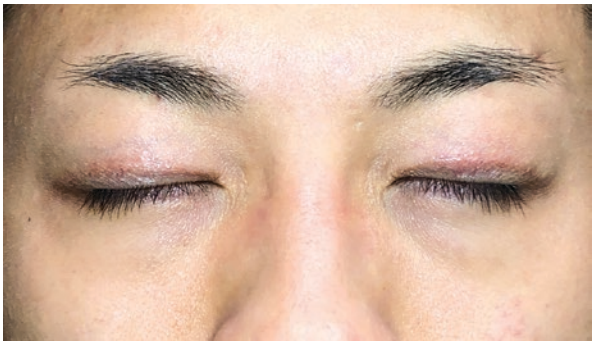

Fig. 19.23 Normal scar formation is often initially hyperpigmented, followed by gradual fading of color and softening of the induration

An incisional scar is to be expected with any surgery, and the thin upper eyelid skin typically heals well without significant visibility. However, in Asians or patients with more pigmented skin, the scar can often be more noticeable with prolonged induration and erythema for 6–8 weeks postoperatively. Normal scar formation in the Asian eyelid is often initially hyperpigmented, followed by gradual fading of color and softening of induration (Fig. 19.23). The patient should be aware that complete wound healing and scar maturation can take up to 6–12 months. Excessive upper eyelid massages or topical treatments for scarring are typically not recommended, as the skin can become increasingly lax with repeated manipulation and

pulling. Even with good surgical technique and complete scar healing, hypertrophic and atrophic scars can still occur. These are most often in the medial and lateral canthal areas due to the presence of thicker skin (Fig. 19.24). A true keloid on the eyelid is extremely rare and is usually a hypertrophic (white or slightly indurated) scar of the incision line.

- Minimizing hypertrophic or poor scarring:
  - To decrease the risk of suboptimal scar formation, meticulous wound closure is critical. Ideally, the orbicularis oculi and subcutaneous layers between the upper and lower incision should be properly reapproximated with buried sutures (such as 6-0 or 7-0 polyglactin), which therefore minimizes tension on the skin layer. There should be no tension on the wound edges in order to avoid hypertrophic scarring.
  - Eversion of the wound and gentle reapposition of the skin edges, rather than tight pulling of the suture that results in a ropelike or bumpy incision, also minimize scarring.
  - Laterally, the incision should never cross the level of the lateral canthal angle and instead incorporate a slight winging upward starting several millimeters above the angle, if needed, to remove temporal skin hooding (Fig. 19.25). The

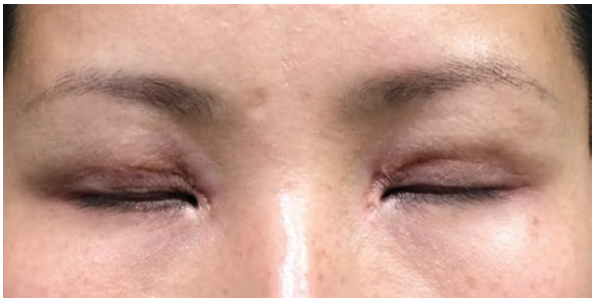

Fig. 19.24 Poor scar healing is more common in the thicker medial or lateral canthal skin. The medial atrophic (depressed) scarring could also have been avoided by not crossing the level of the canthal angle, as well as proper wound edge eversion

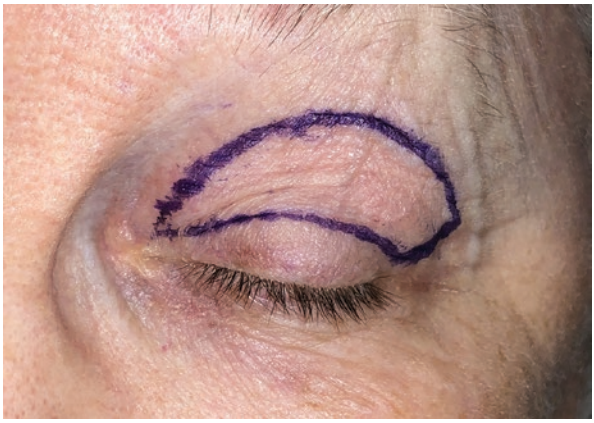

Fig. 19.25 Laterally, the incision should never cross the level of the lateral canthal angle and instead curve slightly upward starting just above the angle, to remove any temporal skin hooding

angled portion of the lateral incision can often be blended into a lateral orbicularis rhytid ("crow's feet"). Although this technique helps to decrease the temporal skin excess, avoid extending it too far laterally into the lateral canthal area as the thicker skin will result in more scarring.
  - Thermal trauma to the skin edges can also cause iatrogenic hypertrophic scarring; therefore, using a 15-blade scalpel or scissors to incise the skin flap, rather than monopolar cautery, can decrease the inflammatory response and fibrotic deposition. Likewise, judicious cautery to the skin edges or subcutaneous tissue for hemostasis is also beneficial.
  - Cold compresses for 48–72 hours after surgery will minimize postoperative swelling and thus decrease tension on the skin edges during early healing.
  - Suture choice also has an effect on scar formation. Compared to lighter-skinned individuals in whom both absorbable and nonabsorbable sutures are acceptable for skin closure, Asians or darker skin patients can develop more hypertrophic scarring with absorbable sutures. Therefore, using a 6-0 or 7-0 monofilament nonabsorbable suture (nylon or polypropylene) is preferred to incite less skin inflammation. Nonabsorbable sutures are typically removed in 5–10 days to avoid prolonged inflammation and suture tracts. However, in patients who prefer to avoid suture removal, a 6-0 or 7-0 fast-absorbing suture can be acceptable.
- Surgical correction of hypertrophic or poor scarring:
  - As mentioned previously, scars undergo a lengthy healing process and typically require 6 months to fade in color. In some patients, scar maturation and softening may take even up to 1 year or more. Scar hyperpigmentation can be treated with topical kojic acid or hydroquinone, although care should be taken to avoid ocular surface contact with these agents. Rarely, if scar discoloration remains despite adequate observation, intense pulsed light treatments using 515–560 micron filters can decrease both scar erythema and dark pigmentation. However, use of light therapy in the periocular region carries significant risk of intraocular uveal injury, and careful eye protection is necessary during the procedure.
  - For scars that are initially more indurated and/or hypertrophic, significant improvement can be seen with 4–6 months of observation alone. Some surgeons have advocated monthly intralesional steroid (0.1–0.4 ml of 40 mg/ml triamcinolone), starting 1 month postoperatively, or 5-fluorouracil injections to be effective. However, current literature does not yet demonstrate that these injections result in a superior long-term result compared to observation alone. In addition, steroid injections in the thin eyelid tissue can cause skin necrosis, fat atrophy, yellowish deposits, and, rarely, vascular emboli. Ablative laser resurfacing has also been shown to result in flattening of elevated hypertrophic scars, but should be performed with extreme caution as additional inflammation and hyperpigmentation/hypopigmentation can occur.
  - Despite these options, the most prudent recommendation is adequate observation for 4–6 months without intervention in order to avoid additional inflammation and scarring.

– In contrast, atrophic or depressed scars usually occur due to the lack of wound edge eversion on surgical closure (Figs. 19.6a and 19.24). When bothersome to the patient, these atrophic scars can be excised as a thin strip using a blade and careful wound edge eversion. In some instances, soft tissue filler augmentation may help elevate a depressed scar, but may also need ablative laser treatments to resurface the discolored or irregular surface scarring.

VI. Poor Eyelid Crease Definition

Asian eyelids often lack definition of the crease, which is partially due to the anatomic differences in the orbital septal fusion to the levator aponeurosis, as well as the distal levator fiber attachments to the subcutaneous orbicularis muscle bundles. However, this is a critical aspect of the procedure and can greatly influence the success or failure of surgery as perceived by the patient (Fig. 19.26). Ideally, both eyelid creases should be symmetric, but have similar depth and visibility to the crease line. The creases should "tuck in" posteriorly to the deeper tissues so that the overlying skinfold can be accentuated (Fig. 19.27).

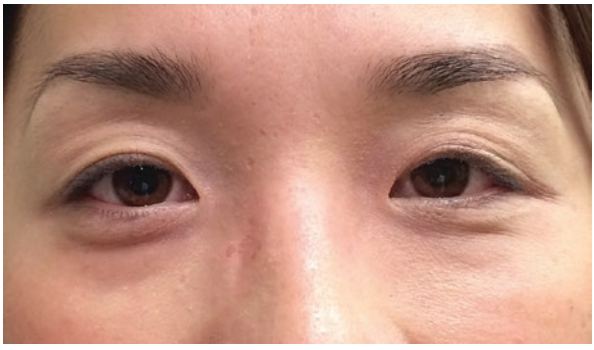

Fig. 19.26 Loss of eyelid crease definition in the left upper eyelid following blepharoplasty

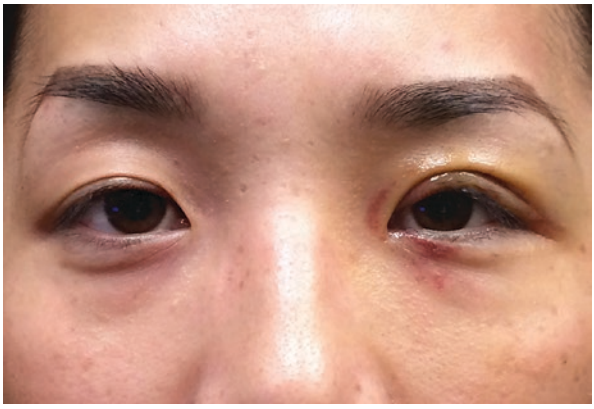

Fig. 19.27 Following revision, the left upper eyelid crease is tucked posteriorly to deeper structures to create definition to the crease and an overlying skinfold

- Minimizing poor eyelid crease definition:
  - Poor patient selection may lead to poor crease definition. This may occur after small-incision or suture fixation double eyelid surgery techniques that fold up tissue without skin removal. These are therefore not suitable for patients with excess skin and should be reserved for younger patients without skin redundancy or puffy eyelids; however, even in these patients, temporary improvement, as well as uneven or poor crease definition, is not uncommon. In some patients, the crease may also be more tucked posteriorly in the areas of each suture, but the intervening spaces demonstrate less crease definition resulting in an irregularly puckered crease line.
  - Minimize the use of cautery along the edges of the superior and inferior subcutaneous tissues, as excessive subdermal scarring from inflammation can prohibit crease formation.
  - Due to the presence of subcutaneous/suborbicularis fat in the pretarsal region, a critical step of Asian blepharoplasty is to remove a 2–3 mm horizontal strip of pretarsal orbicularis muscle and suborbicularis fat from the inferior incision edge (Fig. 19.28). This creates a slight depression in the subcutaneous tissues at the crease level, so that the eyelid crease can be tucked posteriorly to create more adhesion to underlying structures.
  - Make sure to clear all pretarsal orbicularis muscle along the inferior incision uniformly, as segmental removal will result in a discontinuous crease that will not form well and/or lack permanence.
- Surgical correction of poor eyelid crease definition:
  - As mentioned, removal of a horizontal strip of pretarsal orbicularis muscle and suborbicularis fat from the inferior skin incision edge should be performed prior to closure. This pretarsal excision should extend from the medial to lateral aspects of the incision to create a slight depression in the subcutaneous tissues at the crease level (Fig. 19.28).
  - Check that all scar tissue is trimmed from the region between the skin, distal levator aponeurosis, and upper tarsal border.

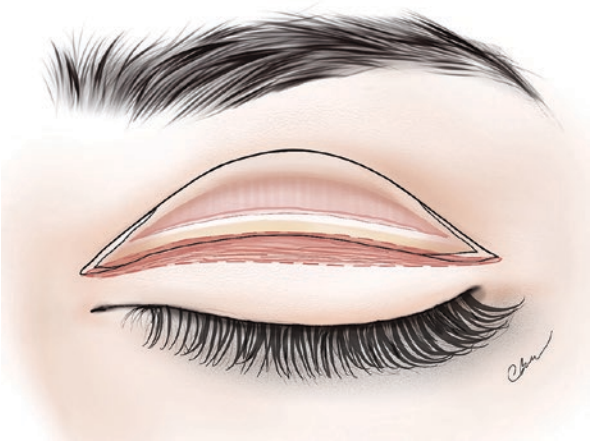

Fig. 19.28 Due to the presence of pretarsal subcutaneous/suborbicularis fat, a 2–3 mm horizontal strip of pretarsal orbicularis muscle and suborbicularis fat should be removed from the inferior incision edge, so that the eyelid crease can be tucked posteriorly to create more adhesion to underlying structures

- If there is scarring or thick preseptal orbicularis muscle along the superior incision edge, a similar horizontal strip of orbicularis muscle and subcutaneous tissue can be excised from below the superior skin edge. This can be removed as a rectangular or beveled excision, preserving the skin, which can then be in more direct contact with the underlying tarsus.
- Posterior fixation, or "tacking," sutures are critical to creating a defined crease. The inferior skin edge is gently lifted superiorly to smooth the pretarsal skin, and where the superior edge reaches is where the posterior fixation sutures should be placed. This typically rests at the superior tarsus, or, in some patients with shorter vertical tarsal plates, at the inferior levator aponeurosis. If the inferior edge is not adequately elevated, or the fixation suture not properly placed at the correct height, the eyelid crease will be lower than desired and the pretarsal skin will also fold on itself and possibly over the eyelash roots. In contrast, over-elevation of the inferior skin may result in eyelash eversion or margin ectropion.
- A nonabsorbable monofilament (i.e., silk or nylon) or 6.0 polyglactin suture is passed through the inferior edge subcutaneous tissue and then through corresponding levator aponeurosis or tarsus directly behind the edge of the lifted eyelid skin. The suture can be then passed through the superior incision orbicularis muscle (Fig. 19.29). Sutures can be placed as buried interrupted sutures (upper tarsus/levator-inferior subcutaneous tissue-superior subcutaneous tissue) or passed through the skin surface as simple interrupted sutures (skin-tarsus-skin or skin-levator-skin) if utilizing nonabsorbable sutures. Some surgeons prefer suturing to the distal levator aponeurosis rather than tarsus, as they feel it may result in a more dynamic crease that more accurately simulates the normal anatomic distal levator attachments to the crease.
- Additional interrupted sutures should be placed along the entire incision to securely tuck the eyelid crease to the underlying tarsus or aponeurosis. If appropriate, slight superior placement of the tarsal pass into tarsus can also

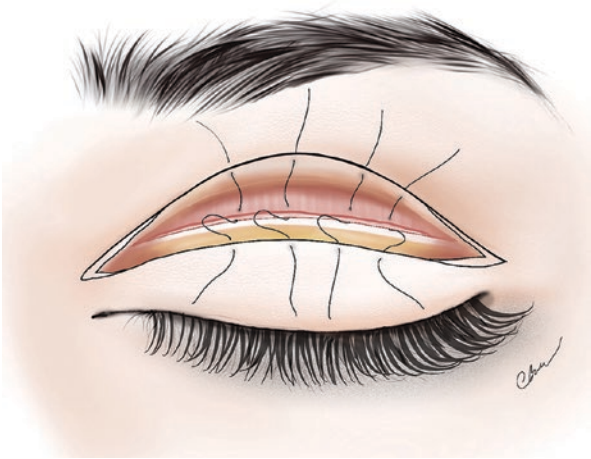

Fig. 19.29 Posterior fixation, or tacking, sutures are critical to creating a defined crease. A nonabsorbable monofilament is passed through the inferior incision edge and then through corresponding levator aponeurosis or tarsus directly behind the edge of the lifted eyelid skin. The suture is then passed through the superior incision orbicularis muscle and skin

help subtly evert the lashes to minimize the eyelash ptosis often seen in Asian eyelids.
- Nonabsorbable crease fixation sutures should be removed in 7–14 days.

VII. Lagophthalmos

Mild lagophthalmos is common in the early postoperative period and usually resolves with time.

- Minimizing lagophthalmos:
  - Overly aggressive skin removal can cause not only cosmetic problems but also threaten vision from exposure keratitis. In general, careful measurement of the skin crescent to preserve 15–17 mm of skin (rather than the average 18–20 mm in Caucasian eyelids) from the margin to eyebrow can minimize lagophthalmos. Pinching the superior and inferior markings together should confirm that there is no skin tightness or eyelid margin eversion that would suggest aggressive excision. In some older Asian patients, the remaining subbrow skin after skin markings can be less than 15 mm with no significant ocular consequences, although this should be performed cautiously.
  - In older patients with severe dermatochalasis, removal of skin including the orbicularis oculi might result in removal of all the preseptal orbicularis oculi muscle and potentially weaken eyelid closure. Therefore, it is generally preferable to be conservative with orbicularis muscle excision and to remove skin-only flaps, particularly in older patients with decreased blink mechanism.
  - In Asian individuals with preexisting superior sulcus hollowing, retaining the preseptal orbicularis muscle also contributes more volume to restore the youthful, fuller appearance to the Asian eyelid. Excising only a thin horizontal strip of pretarsal orbicularis and subcutaneous/submuscular fat from the inferior incision to create a more defined crease should be sufficient without risking lagophthalmos.
- Surgical correction of lagophthalmos:
  - In the initial postoperative period, patients should use topical lubrication several times daily and ointment at night until the eyelids close more naturally after the first postoperative weeks.
  - If significant keratopathy is noted, taping the upper eyelid shut at night or a temporary bandage contact lens may be considered. Downward massages to the upper eyelids for several weeks can, in some cases, relax the fibrosis sufficiently to facilitate closure. Punctal cautery or plugs can also help decrease exposure keratopathy and dry eye symptoms.
  - If corneal integrity is at risk, release of the upper eyelid incision and placement of a full-thickness skin graft or skin flap may be indicated, although will be suboptimal from an aesthetic standpoint. In extreme cases, a lateral or temporary tarsorrhaphy may be necessary.

VIII. Unrecognized Blepharoptosis or Eyebrow Ptosis

Although blepharoptosis and eyebrow ptosis are ideally recognized prior to blepharoplasty, in many patients the redundant upper eyelid skinfold masks the true eyelid margin height. Preexisting unilateral or bilateral asymmetrical ptosis may then become more noticeable after blepharoplasty (Fig. 19.30a, b). While a difference in margin reflex distance (MRD_{1}) is then present, patients will often seek surgery for presumed asymmetric creases, when in fact the higher eyelid crease is secondary to eyelid ptosis.

- Minimizing unrecognized blepharoptosis or eyebrow ptosis
  - If the skinfold hangs over the eyelid margin, gentle elevation of the skin may allow for more accurate measurements of the $MRD_{1,}$ to evaluate for underlying ptosis.
  - While the average MRD_1 is commonly described as 4–5 mm, on average, it can be lower in Asians at 3–4 mm. Performing blepharoplasty alone without simultaneous correction of involutional/aponeurotic ptosis would result in high creases, excessive tarsal platform visibility, and a sleepy appearance.
  - When a patient requests double eyelid surgery for asymmetric eyelid creases, the "lower crease" eye may be normal, with the contralateral higher crease side suggesting unilateral blepharoptosis. With normal aging, the levator complex becomes attenuated or dehisced from its normal attachments to tarsus, resulting in elevation of the eyelid crease due to pulling of the distal aponeurosis insertions on the subcutaneous tissues. Performing unilateral eyelid crease fixation on the "lower crease" would therefore not correct an asymmetrical MRD_1 secondary to blepharoptosis.

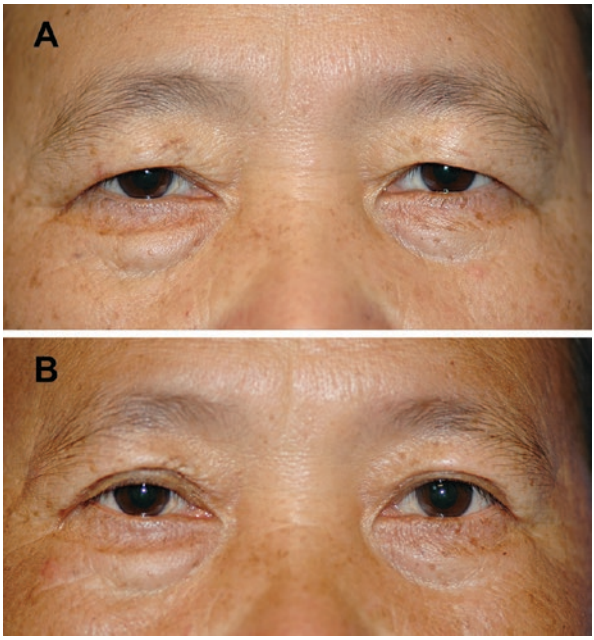

Fig. 19.30 Preexisting unilateral right blepharoptosis may be unmasked after blepharoplasty, as seen by the lower MRD_1 on the right and asymmetric eyelid creases. (**a**) Preoperative skin hooding; (**b**) postoperative right blepharoptosis)

  - As patients with ptosis may also have compensatory eyebrow elevation, it is important to evaluate eyelid height while adequately suppressing the frontalis elevation. In general, the eyebrows often rest flatter and lower in the Asian population.
  - Care should be taken when placing eyelid crease fixation sutures in Asian blepharoplasty, with minimal manipulation of the levator complex to avoid iatrogenic blepharoptosis. In particular, aggressive blepharoplasty with high eyelid crease fixation may injure the levator and result in thick fibrosis of the distal levator aponeurosis. When possible, the fixation sutures should be tacked to superior tarsus rather than the levator aponeurosis.
- Surgical correction of unrecognized blepharoptosis or eyebrow ptosis
  - Blepharoptosis can be managed by any appropriate ptosis surgery technique depending on the levator function and severity of ptosis. Note that an internal ptosis repair (conjunctival Müller's muscle resection) in the Asian eyelid can actually worsen the overlying skinfold such that the skin hangs further over the eyelid margin and eyelashes (Fig. 19.31). This is a particularly higher risk in patients with a lower, or absent, eyelid crease. Therefore, a conservative blepharoplasty should be considered when performing a posterior approach ptosis repair on the Asian eyelid.
  - Eyebrow ptosis should be corrected with forehead or brow-lifting techniques if significantly contributing to mechanical eyelid ptosis or pseudodermatochalasis.
  - Correction of iatrogenic ptosis often entails debulking any scar at the level of the eyelid crease between the skin and the levator complex, in conjunction with an external levator advancement.

IX. Eyelash Eversion and Margin Ectropion

Although eyelash eversion and margin ectropion, in which there is visibility of the white Meibomian gland line, can occur in any blepharoplasty surgery, it is certainly a complication that can be avoided in Asian blepharoplasty

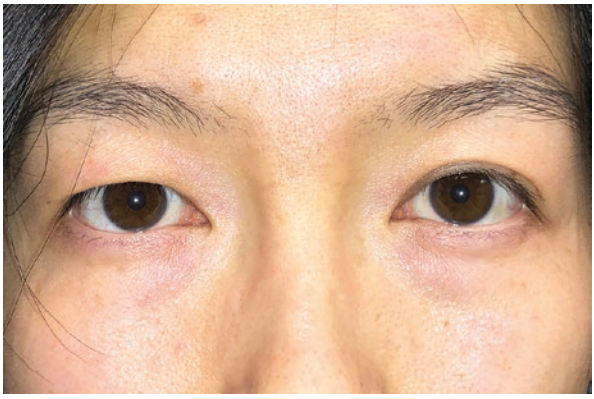

Fig. 19.31 An internal ptosis repair (conjunctival Müller's muscle resection) on the right upper eyelid with low creases resulted in skin hanging farther over the eyelid margin and eyelashes after surgery. Therefore, a small blepharoplasty may be needed in Asian patients undergoing internal ptosis repair

- Minimizing eyelash eversion and margin ectropion
  - As mentioned previously, eyelid crease fixation sutures should be placed exactly at the level of the inferior skin edge. The inferior skin edge should first be gently elevated until the pretarsal skin is smooth; the fixation suture is then placed in the tarsus (or inferior aponeurosis if necessary) precisely where the upper edge of the skin reaches. Ideally, the eyelid crease height in Asians would be 4–7 mm, on average, for the most natural appearance.
  - If the crease fixation sutures are placed too high, the eyelid margin and eyelashes can evert, particularly if preexisting horizontal lid laxity is present.
  - Aggressive skin excision can also result in eversion, as well as lagophthalmos. Make sure to measure carefully to leave an adequate amount of the remaining skin, as well as pinch the superior and inferior markings together to confirm that no skin vertical striae or margin eversion is induced.
  - Conversely, fixating the sutures too low on the tarsus will result in bulging of the pretarsal region due to collapse or "pretarsal sag" of the skin. Although potentially more common in older patients in whom the pretarsal skin demonstrates more laxity, this pretarsal sag may occur in younger patients as well and manifest as multiple skin wrinkles over the pretarsal area (Fig. 19.32). Not only does this cause a thick or swollen appearance to the eyelid, but the collapsed skin can also droop over the eyelashes and further exacerbate eyelash ptosis. Women will often present with complaints that they are unable to place eyeliner or mascara accurately due to the sagging skin. This finding may be subtle and more visible in side profile, where the pretarsal skin can be seen to hang over the eyelash root line (Fig. 19.33).
  - If a concurrent levator advancement surgery is performed, do not excise the inferior redundant levator aponeurosis, as subsequent crease fixation to the inferior edge of aponeurosis will cause eyelash eversion.
- Surgical correction of eyelash eversion and margin ectropion
  - Ideally, avoidance of this complication is best, as correction is more difficult and unpredictable once fibrosis has occurred. In some cases, complete resolution is not achievable.

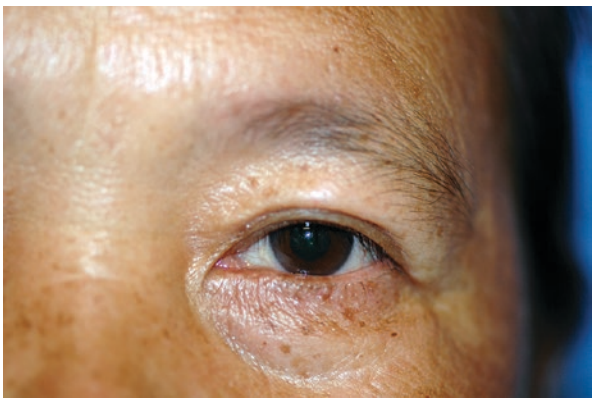

Fig. 19.32 Fixating the sutures too low on the tarsus may result in bulging of the pretarsal region due to collapse or "pretarsal sag" of the skin. This manifests as multiple skin wrinkles over the pretarsal area or a thick or persistent swollen appearance to the eyelid

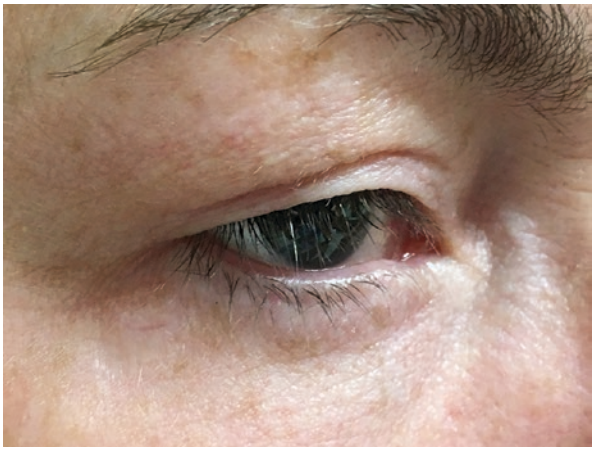

Fig. 19.33 The pretarsal sagging may be subtle and more visible in side profile, which shows skin sagging over the eyelash root line. Women will often present with complaints that they are unable to place eyeliner accurately despite adequate skin removal

- If eyelash eversion is noted during placement of the eyelid crease fixation sutures, the sutures should be removed and fixated more inferiorly and ideally not involving levator.
- Early recognition and early surgical revision may be considered, in order to minimize significant fibrosis of the pretarsal skin and subcutaneous tissues to the tarsal plate.
- If horizontal laxity is contributing to margin ectropion, an upper eyelid lateral tarsal strip or lateral canthopexy can be performed prior to placement of the fixation sutures.
- Upon revision, the eyelid crease is incised and Westcott scissors used to dissect in a pretarsal plane to release all pretarsal scarring down to just above the eyelid margin. If thick fibrosis is noted at the eyelid crease, this can be conservatively excised. Once the anterior lamella is completely released from the tarsal surface, the skin is draped upward and secured to the upper tarsus without eyelash eversion.
- However, patients should be aware that even with complete scar lysis and separation of the anterior lamella from the tarsus, the eyelash eversion may be incompletely resolved.
- In contrast, multiple nonabsorbable 6-0 or 7-0 sutures securing the pretarsal orbicularis to the upper tarsus can be used to gently evert the eyelash ptosis commonly seen in Asian individuals, although patients should be aware that long-lasting results are not typical.

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Part IV

Special Topics

Facial Liposculpture Complications

20

Samuel M. Lam

Introduction

There has been a plethora of literature written about fat transfer over the past two decades. Early adopters in the 1990s were oftentimes shunned for their work with critics who believed that fat grafting did not survive long term or led to serious contour problems [1]. With refined techniques and knowledge, autologous fat grafting entered the modern age in the 2000s with improved outcomes using finer cannulas and a microdroplet technique [2]. Great enthusiasm for fat grafting over the past 15 years has unfortunately led to many overfilled faces that has in turn dissuaded some surgeons from performing fat grafting [3]. With a proper understanding of the benefits, limitations, and risks along with how to manage complications should they arise, the practitioner of the art of fat grafting can achieve more consistent outcomes through technical and artistic excellence along with fastidious patient counseling and judicious patient selection [4].

Avoidance of Complications

Preoperative Considerations to Avoid Complications

Avoidance of complications, or at least minimizing their risk, begins in the preoperative setting, which is focused on proper patient selection. The single most important point of history that must be established is the patient's prior course of weight fluctuation, especially over the recent past, that is, the past several years. Since transplanted fat is not a bioinert substance but instead a live graft, it is susceptible to hypertrophy with weight gain and atrophy with weight loss. If a patient has a

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significant history of weight changes, then the surgeon should be cautious in proceeding with fat grafting. It is far better for a patient to be heavier and in the process of losing weight than an individual who has lost a significant amount of weight and could be struggling to keep it off. If someone loses weight after a fat transfer, then fillers can be used to touch up the result so that if there is subsequent weight gain, the fillers could be dissolved. Safety always trumps everything else. It is better to assume that someone will be unable to maintain a much lower weight profile than that the lower weight would be indefinitely maintained.

If the person is in the process of losing weight, typically a third into the targeted total weight loss may be a preferred window to perform the procedure to allow a margin in both directions. A natural question is how much weight gain is considered too much? This is hard to answer, but in general, 15–20 pounds or more could lead to an overfilled appearance, but it could be even a lower number if the person is very petite in size. Perhaps, a percentage of total body weight would be a more reliable indicator of a margin of safety. The specific percentage is hard to accurately assess. In general, it is wiser to select a patient at least over 35 or 40 years of age, because a younger patient may subsequently gain weight as he or she ages and also may not need fat transfer when younger.

A patient may not suffer a complication but may perceive an untoward outcome if he or she is not appropriately and thoroughly counseled. The old maxim should be recalled that the difference between an education and excuse is that an education is given to a patient beforehand while an excuse, afterward. Education is far better than excuses. One of the most important limitations of fat grafting is that there will be some degree of partial absorption, and it is hard to accurately predict precisely how much loss of fat there will be. Patients must know that they may benefit from a small injectable filler touch-up in the office to achieve more flawless outcomes. Performing repeated fat grafting sessions, on the contrary, may lead to overfilled results so in the author's opinion should not be undertaken. In addition, it is important to counsel patients that they will not achieve perfect symmetry (which is always elusive) and that fat grafting is too soft, deeply placed, and imprecise to correct particular surface flaws like acne scarring, etc. In addition, because it is a live graft, it may be unwise to use it for reconstructive purposes, for example, filling a mandibular defect, especially if there is a history of weight fluctuations [5]. By placing a large amount of bioactive fat into one side of the face, there is a risk that even a mild degree of weight change may lead to a contour problem [6, 7]. Further, 4% of Human Immunodeficiency Virus (HIV) patients may exhibit "hamster syndrome" postoperatively, a potentially disfiguring postoperative fat hypertrophy [8]. For this reason, caution should be exercised when considering fat grafting in HIV patients with lipodystrophy.

Operative Considerations to Avoid Complications

There are so many technical details in terms of performing excellent fat grafting that would require a textbook to cover [9]. Instead, this shorter and more focused chapter will highlight only the most significant problems that surgeons encounter

when performing fat grafting [10]. The most common contour problem occurs in the lower-eyelid area, and the most common overfilled appearance is caused by anterior cheek filling.

The lower eyelid technically must be approached in a prescribed manner to avoid these complications. Unlike injectable fillers using microdisposable cannulas that are injected parallel to the orbital rim [11], fat grafting must be injected perpendicular to the orbital rim to avoid contour problems (Fig. 20.1). More specifically, the nondominant index finger should be placed along the inferior orbital rim to protect the globe but also to provide tactile feedback to the surgeon that he or she is in the right plane. The surgeon should feel a slight release of the arcus marginalis as he or she penetrates this structure while simultaneously the nondominant index finger feels that the tip of the cannula dances back and forth across the inferior orbital rim. Very small aliquots of fat of no more than 1/50th to 1/20th of a milliliter should be injected with every pass. The fat can be injected back and forth across the orbital rim, dancing about 1–2 mm on either side as the injection proceeds. If there is a clog, the surgeon should remove the cannula and clear the obstruction outside of the body before continuing so as not to inject too large a single bolus. The inferior orbital rim can be divided into the medial half of the orbital rim, the lateral half of the orbital rim, and the lateral canthus. Each of the aforementioned sections is approached with a separate entry and on average, approximately 1.5 ml is injected into each half of the orbital rim with an additional 0.5 ml into the lateral canthus. Sometimes more can be injected and definitely less can be injected depending on the amount of perceived need for volumization. However, a more conservative amount is always recommended, especially for the beginning surgeon trying to determine a safe volume for injection. For the first-time surgeon, using hyaluronic acid but injecting it just like a fat transfer with the same technique and instruments, while, for example, a patient may be undergoing a rhytidectomy, is a good way to practice with a reversible product.

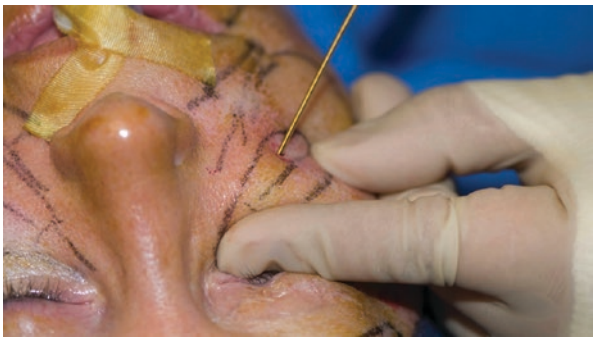

Fig. 20.1 To avoid contour problems in the lower eyelid, fat grafting must be injected perpendicular to the orbital rim. More specifically, the nondominant index finger should be placed along the inferior orbital rim to protect the globe but also to provide tactile feedback to the surgeon that he or she is in the right plane. The surgeon should feel a slight release of the arcus marginalis as he or she penetrates this structure while simultaneously the nondominant index finger feels that the tip of the cannula dances back and forth across the inferior orbital rim. Very small aliquots of fat of no more than 1/50th to 1/20th of a milliliter should be injected with every pass. The fat can be injected back and forth across the orbital rim, moving 1–2 mm on either side as the injection proceeds

In the past, the anterior cheek was thought to be an important area to fill to achieve a more rejuvenated and feminine appearance. However, some of the problems encountered were that the filled anterior cheek does not appear natural when smiling, and the retention of fat in this area is far higher than elsewhere on the face (Fig. 20.2). Even 1–2 ml of fat injected into the anterior cheek can lead to an overfilled appearance. Now the author injects no fat into the anterior cheek but only around it, for example, inferior orbital rim, canine fossa, lateral cheek, and subzygomatic space. Even the buccal area must be cautiously approached, because the buccal area can contribute to

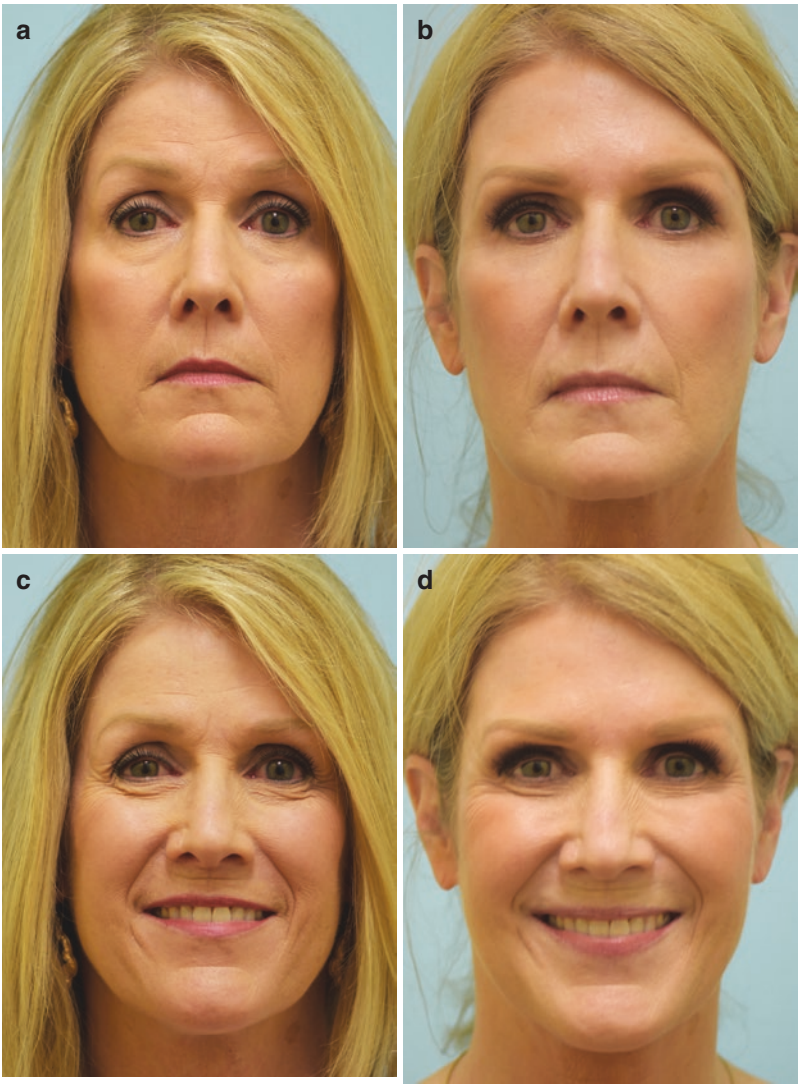

Fig. 20.2 This woman is shown before (**a**) and after fat grafting (**b**) with favorable aesthetic improvement. Of note, even when smiling before (**c**) and after (**d**), her cheeks appear natural, because no fat was placed into the anterior cheek

an overfilled appearance when smiling. If these areas appear underfilled postoperatively, hyaluronic-acid fillers can be injected to compensate, and any appearance of being overfilled can then be corrected with hyaluronidase as needed.

Management of Complications

Underfilled Faces

An underfilled face may almost not be considered a complication, since it can be easily corrected with additional fat transfer and/or injectable fillers. However, if a patient were under the assumption that fat grafting would be near-flawless after a single session, then this could still be considered a complication, since there would be a cost that the surgeon may need to incur for additional fat grafting and/or fillers, or would need to pass along those costs to the patient not to mention attendant recovery needed for any additional cosmetic procedure. This situation can be avoided, first and foremost, by lengthy consultation about the limitations of fat transfer, which have been outlined in the prior section of this chapter on preoperative counseling. In addition, fat grafting performed more globally over many areas may lead to greater patient satisfaction, since any one area of the face that diminishes may be aesthetically counteracted by a global improvement in aesthetic appearance. For individuals who desire only a small area of the face to be corrected, it may be worth performing injectable fillers over fat grafting based on cost, recovery, and perceived benefit.

Overfilled Faces

As mentioned, typically, an overfilled face is most noticeable in the anterior cheek, especially when smiling. If the patient has gained weight and now appears overfilled, the first course of action that could be recommended is to lose weight. In addition, at times, the face appears overfilled, because it has been filled in a way that is aesthetically unbalanced, for example, too much fat in the cheek but not enough laterally in the temple and in the lateral cheek. Using hyaluronic-acid fillers can be a method to blend in the transplanted fat so that the face appears more balanced, and doing so can offset the appearance of a face overfilled typically anteriorly.

If all of these methods fail, are not relevant to the situation, or are rejected by the patient, then the fat can be selectively removed by a couple of methods. Surgically, the area of overfilled fat can be anesthetized even under local anesthesia, then a 1.2 mm fat injection cannula (Tulip Biomed Inc., San Diego, CA) can be outfitted on a 10-cc Luer-Lok syringe and with a Johnnie Lock device (Tulip Biomed) to hold negative suction. An 18-gauge needle is used for entry, and typically, two entry sites are made perpendicularly from one another at the perimeter of the outlined facial area to be reduced. After the cannula is inserted, full 10-cc negative pressure is applied and maintained with the Johnnie Lock, then multiple passes are made repeatedly in different depths and radially along the entire expanse of the area to be reduced (Fig. 20.3). The same technique is undertaken from the other entry site.

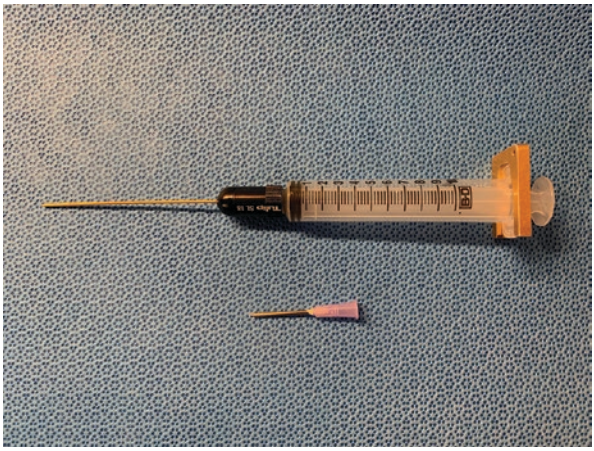

Fig. 20.3 This photograph shows the 1.2 mm Tulip fat infiltration cannula outfitted with a 10-cc syringe and a Johnnie Lock used to perform microliposuction for overfilled fat transplanted facial areas. There is an accompanying 18-gauge needle used for skin entry adjacent to the syringe

Since it is very hard to determine a visual endpoint with the edema, local anesthetic, and the patient in a supine position, the endpoint should be that the area is constantly suctioned until very little to no fat is removed.

A nonsurgical alternative for the patient is the use of deoxycholic acid/phosphatidyl serine (DCA/PPS) injections (Kybella, Allergan Inc., Irvine, CA). One vial of Kybella can be used at a time or more depending on the extent of the overfill. Kybella is dispensed as a 2 ml vial; 1 ml of 2% lidocaine is mixed with it to yield a total of 3 ml drawn in three 1-ml Luer-Lok syringes outfitted with 32-gauge needles. The mixture is then injected in aliquots of about 0.2–0.3 ml equally divided over the expanse of the overfilled facial area. Using lidocaine almost entirely eliminates the discomfort, and repeated sessions can be undertaken until the desired results, preferably spaced a minimum of 6 weeks apart to evaluate the need for additional treatments. DCA/PPS should not be used to reduce orbital fat, as there may be a risk of blindness. Even though it has been reported that a temporary facial nerve palsy can be induced by injecting DCA/PPS, the author has not seen this sequela after many sessions of facial DCA/PPS injections and has heard that the palsy is typically limited to approximately a month or longer despite original reports to the contrary. In addition, the protracted, disfiguring edema that is well known for submental DCA/PPS injections that can last several weeks is oftentimes not observed with facial injections of DCA/PPS. The edema is not as significant and oftentimes is most resolved within a week.

Contour Issues

A discrete contour issue is typically observed in the inferior orbital rim, manifested as an oblong protuberance or multiple discrete convexities along the orbital rim. The area should be palpated to determine if the contour issue is indurated or soft. If the area feels hard, then an injection of 5-fluorouracil and triamcinolone acetonide 10 mg/ml in a ratio of 3:1 can be injected into the firm mass and repeated every 6 weeks until resolution. Depending on the size of the deformity, a range of

0.3–0.6 ml will usually suffice per side. However, if the mass feels soft, this injection will typically be ineffective.

The preferred method of addressing a discrete, soft contour area along the inferior orbital rim is surgical excision. An incision is planned along the inferior orbital rim and the length planned to match a natural tear trough that traverses the medial aspect of the lower eyelid so as to better camouflage the incision (Fig. 20.4). After local anesthesia is administered, the incision is cut down until the fat is identified. To minimize the risk of overresection, the fat is carefully cauterized using bipolar cautery until the area appears flat. The subcutaneous tissue/orbicularis muscle is

Fig. 20.4 This woman is shown before (**a**), 1 week after (**b**), and 6 weeks after (**c**), surgical excision along her right lower eyelid to remove indurated polymethylmethacrylate (PMMA), which failed dissolving with 5-fluorouracil/triamcinolone. Although this photograph does not show a fat grafting complication, it shows how well this incision can heal along the tear trough, since it is the exact same method to remove excessive fat grafting along the orbital rim

closed with two to three interrupted, buried 6-0 polyglactin sutures, and the overlying skin is closed with 6-0 or 7-0 nonabsorbable or absorbable suture in an interrupted fashion. The external sutures are removed or left in place until they fall out 2–3 weeks later.

Overfilled Lips

If lips have been overfilled with fat grafting, then like the inferior orbital rim, the best management is surgical excision (Fig. 20.5). The planned excision is along the wet-dry lip interface with a proportionate degree of dry and wet lip to be removed with the new incision positioned to recreate a new wet-dry lip line. A dental block is administered for adequate anesthesia. With fat-grafted lips, a conservative amount of surface mucosa is planned for excision, since most of the fat can be reduced through cauterization using a bipolar cautery as described for the inferior orbital rim (Fig. 20.6).

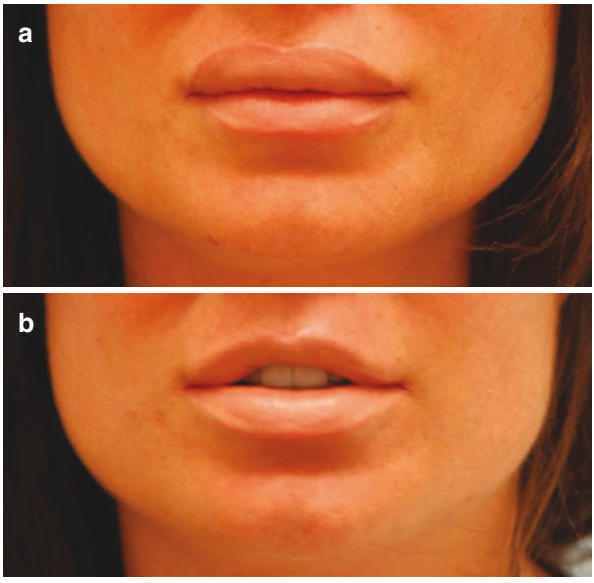

Fig. 20.5 This woman had her lips overinjected with fat grafting (**a**), which was corrected via surgical excision to reduce her lips (**b**)

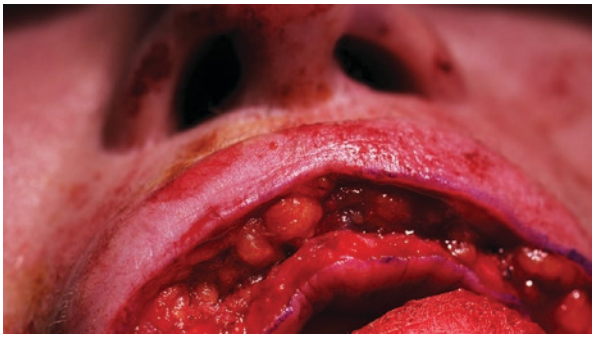

Fig. 20.6 This is a close-up intraoperative photograph of a correction of a lip overfilled with fat. Through the incision, multiple globules of distinct fat can be appreciated and can be reduced through bipolar electrocautery or simple excision

The lip incision is closed with both interrupted and running 5-0 chromic sutures, which are left in place to dissolve over 1–2 weeks.

Summary

Fat grafting can provide durable, safe aesthetic outcomes with the proper counseling, patient selection, technique, and artistic judgment. Avoidance of a complication begins with ensuring that the patient does not have a significant history of weight fluctuation and counseling the patient that the fat will be partially absorbed and can be touched up with office-based fillers as needed. Overfilled faces can be addressed surgically with microliposuction, or nonsurgically with DCA/PPS injections. Indurated contour issues along the inferior orbital rim should be managed with 5-flourouracil/triamcinolone injections. Soft contour issues along the inferior orbital rim and in the lips should be surgically excised using bipolar electrocautery to physically and incrementally shrink the transplanted fat. Fat grafting has become a cornerstone for facial rejuvenation and can be the ideal choice in the right patient in the right hands.

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Brow Lifting Complications

21

Morris E. Hartstein, Sathyadeepak Ramesh,
and Cat Nguyen Burkat

Introduction

Brow lifting is integral to management of the aging face. Brow descent, particularly laterally, is responsible for lateral hooding of the eyelids, that often make the patient look tired or unhappy. Achieving a consistent tarsal platform show throughout the length of the upper eyelid during upper blepharoplasty often requires reshaping of the brow simultaneously. Numerous techniques have been reported [1] for adjustment of brow shape and position. While the endoscopic brow lift has largely surpassed other brow lifting techniques in surgical forehead rejuvenation in recent years, we will discuss common complications associated with the most common brow lifting techniques in this chapter.

Types of Brow Lifting

While a full discussion of all brow lifting methods and the advantages of each are beyond the scope of this chapter, we will briefly discuss the types of brow lift techniques herein.

The coronal brow lift has largely passed out of vogue due to its prolonged postoperative healing phase, large incision, and imprecise nature. In this procedure, a bicoronal incision is created from temple to temple. After a limited subgaleal

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dissection is performed, the desired amount of excess skin is resected and the wound closed. This results in a higher brow position across the full length of the forehead, although at the expense of a higher hairline.

In pretrichial [2] or temporal brow lifting [3] the dissection begins at the temple itself with a beveled incision at the hairline. This allows resection of non-hair-bearing scalp to lift the brows, and results in a shortened, or lower, hairline. Midforehead [4] and direct brow lifting techniques involve placing the incision further inferior still, either in a midforehead rhytid or at the supraciliary line directly above the brow hairs. Here, the desired skin crescent resection allows for precise contouring of the shape and height of the brow with minimal dissection. Transeyelid approaches [5] have limited ability to elevate the brow with significant durability, but can be helpful in fixating it to prevent further descent after blepharoplasty or with time. Small-incision external browpexy approaches, or lateral transposition of the frontalis muscle to the tail of the brow, have also been described for mild-to-moderate brow ptosis.

Endoscopic brow lifting [6], or endoscopic brow lifting, remains popular for forehead rejuvenation due to its longevity and ability to precisely tailor brow shape and height. In this procedure, the forehead is elevated as a composite flap after releasing all tethering structures (the temporal fusion line, inferior and superior temporal septa, arcus marginalis, and brow depressors) and fixated with suture, screws, or devices. While the procedure does elevate the hairline, this risk is often outweighed by the ability to tailor a lateral lift without extensive incisions.

Patient Selection

There are many keys to a successful endoscopic brow lift. The first thing to understand is that the endoscopic brow lift achieves its lift, not from an excision of tissues as in traditional forms of brow lifting, but rather, from a repositioning of tissues. Learning to perform endoscopic brow lifting requires surgeon commitment as it requires new instrumentation and a steep learning curve to perform well.

The first critical consideration is choosing the appropriate patient. The endoscopic brow lift works best for patients generally between the ages of 40 and 60. It is important to explain to the patient that it provides a mild-to-moderate brow elevation, with generally a rapid recovery and reproducible results. It is important to discuss, however, that it is not effective for rhytids (as compared to a subcutaneous pretrichial lift) and will not produce significant change. Patients who are less likely to benefit from the procedure include those with a high hairline (such as 6 cm from the eyebrow), or patients with significant tissue glide (greater than 2 cm) or thick sebaceous skin.

As mentioned, endoscopic brow lifting requires instrumentation, which not every surgeon is readily familiar. The camera and monitor are standard in most operating rooms. In addition, a sleeve is required in order to elevate the tissues, and well as specific elevators.

Complications and Management

The most common complications with brow lifting include the following:

1. Facial nerve apraxia
2. Alopecia
3. Poor scarring
4. Infection
5. Brow malposition
6. Numbness
7. Forehead hematoma
8. Granulomas, lumps
9. Cerebrospinal fluid leak

Facial Nerve Apraxia

Perhaps, the most feared complication of brow lifting procedures is damage to the temporal branch of the facial nerve (Fig. 21.1). This risk can be reduced by understanding the path of the nerve and always knowing your plane of dissection. The course of the temporal branch of the frontal nerve may be approximated by Pitanguy's line [7], which courses from the inferior border of the tragus to 1 cm, on average, superior to the tail of the brow, within the superficial temporalis fascia just anterior to the deep temporalis fascia. This natural landmark may be complicated by prior surgeries (facelift, skin cancer resection) that obliterate surgical planes, as well as aesthetic interventions to the brow (tweezing, threading) that alter ciliary position and mask the true brow position.

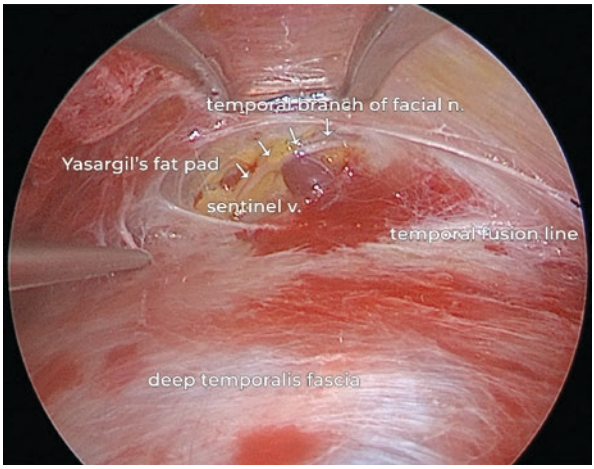

Fig. 21.1 Endoscopic view of the temporal branch of the facial nerve adjacent to the sentinel vein

To avoid injuring the temporal facial nerve branch, dissection should be performed either in the subcutaneous plane (e.g., in coronal, direct, pretrichial, or midforehead techniques) or along the deep temporalis fascia (e.g., in endoscopic brow lift). The course of the nerve can be marked on the skin, if needed, to avoid incorporating the critical area when marking the lateral crescent for excision in a supraciliary brow lift.

Similarly, when dividing the conjoint fascia, it is best to work from temporal to medial to ensure the elevator or dissecting instrument is in the correct plane. The dissection along the deep temporalis fascia should be performed with care to avoid iatrogenic nerve injury, utilizing the endoscope if visualization is preferred. When approaching the temporal portion of the brow, it is important not to lift up the distal end of the elevator as this retraction can stretch and damage the nerve. The sentinel vein, a deep perforating vein, which pierces the temporalis muscle, is an excellent indicator and the nerve typically lies within 2 mm of this structure [8]. Multiple sentinel veins can be encountered, suggesting the presence of multiple branches of the temporal nerve. Cautery in this area must be very judicious given the proximity to the nerve; suction-cautery can limit the amount of energy needed to obtain hemostasis.

Fortunately, permanent motor damage is rare. Temporary apraxia (Fig. 21.2), while distressing to the surgeon and the patient, typically resolves within 3–6 months [9]. Simple reassurance may be all that is necessary to manage this patient, with

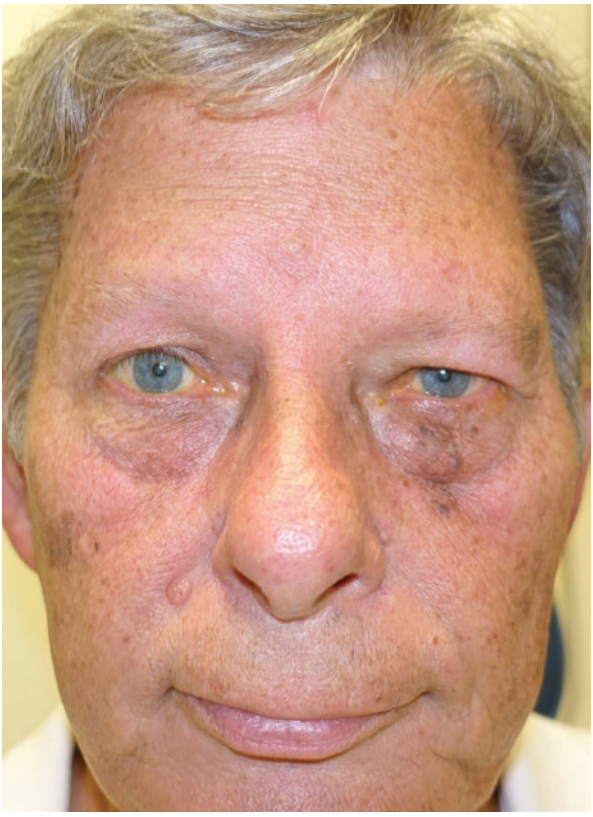

Fig. 21.2 Postoperative week 4 clinical photograph of a 62-year-old male with temporary apraxia of the left temporal branch of the facial nerve

early twitches in the brow and/or corrugator muscles suggesting that the nerve was not severed, but rather injured via stretch or heat.

In the unfortunate event that the paresis is permanent, an alternative method of brow lifting may be considered to provide brow elevation (e.g., direct or pretrichial) with the understanding that the paretic brow will not be functional, but remain static in position. Botulinum toxin injection to the contralateral functional forehead may also be considered to increase symmetry between the two sides.

Alopecia

Any incision in hair-bearing scalp risks postoperative alopecia (Fig. 21.3). Specific causes of alopecia include wound closure with excessive tension, excessive cautery to the wound, postoperative infection, or improper wound closure. Specific steps can be taken to reduce the risk of alopecia. Firstly, skin resection in hair-bearing areas (as in coronal, temporal, or endoscopic brow lifting) must be limited to ensure that the wound can be closed primarily without significant tension. The scalp

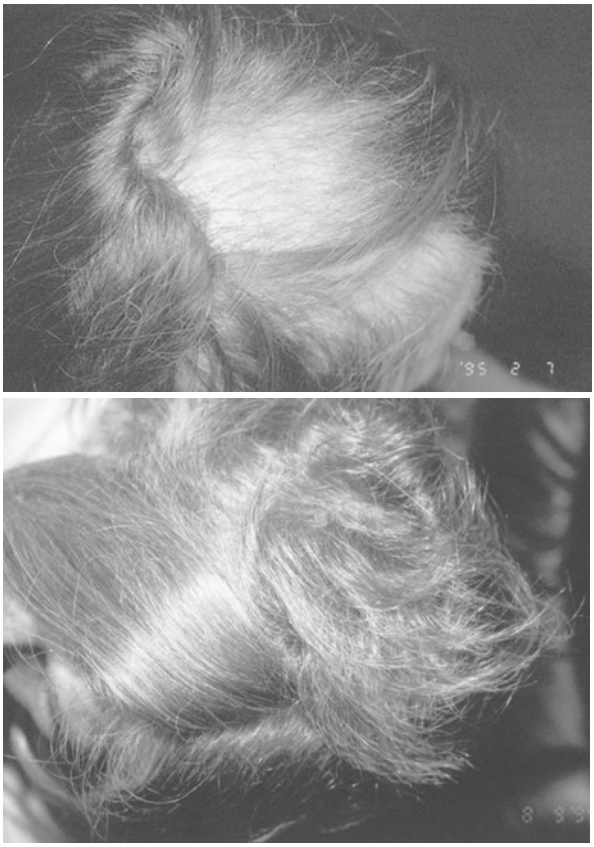

Fig. 21.3 (Above) Severe alopecia seen in one patient in group 1 following posterior undermining. (Below) The alopecia resolved spontaneously after 6 months. (Reproduced with permission from Jones et al. [9])

typically does not share the redundancy of eyelid or lower facial skin, and care must be taken when choosing how much tissue to resect. The scalp skin is extremely vascular, with numerous small arterioles in the subdermal plane that nourish the hair follicles. The superficial temporalis fascia also contains large vascular branches that stem from the external carotid circulation, including the superficial temporal artery. Inadvertent injury to these vessels can lead to significant hemorrhage with poor visibility; aggressive cautery can damage the pilosebaceous unit and lead to skin atrophy and alopecia postoperatively. Judicious use of anesthetic with epinephrine, pressure, or Raney clips can be used to control hemorrhage with reduced risk of alopecia.

Postoperative infection can lead to wound dehiscence and the closure of wounds by secondary intention. The resultant glabrous skin is not hair-bearing, and can be cosmetically bothersome. Finally, inaccurate wound closure of like tissue layers can lead to step-off ridges at the scar, in-grown hairs, or alopecia. Beveled incisions, where hair follicles must grow through a skin flap, are particularly at risk for this complication. This risk can be reduced with meticulous wound closure.

Alopecia can be treated by either resecting the hairless skin with primary closure, or by performing limited hair transplantation. Resection with closure is difficult to perform in the initial healing period as the tight skin usually makes it difficult to close the resected area without significant tension. The procedure may need to be staged after several months, and should be performed using a surgical blade and minimal cautery, to avoid more injury to the hair follicles. Hair transplantation can also be helpful, although survival of the grafts, time to full healing, and high cost of the procedure make this a less desirable option.

Poor Scarring

Undesirable scarring in non-hair-bearing areas can result from improper wound closure, wound dehiscence with secondary intention healing, excessive wound tension, or placement outside of natural rhytids. A full discussion on scarring is presented in a separate chapter. Similar conditions that can cause alopecia can also cause scarring in non-hair-bearing scalp. Incisions should be placed horizontally within the transverse forehead rhytids, or in the supraciliary line. Wound edges should be everted with appropriate mattress sutures to prevent depression of the scar. Incisions placed in hair-bearing skin may become visible with the onset of androgenic or pathogenic alopecia. Management of scars is further detailed in Chap. 23, but can consist of surgical wound revision, skin resurfacing with chemical peels, fillers, or laser resurfacing.

Infection

Hair must be cleansed thoroughly to minimize the infectious risk of surgery. Prescribing an antibacterial or chlorhexidine shampoo for the night prior to surgery

can reduce bacterial colonization. This is then followed by a thorough antimicrobial preparation of the full face and scalp at surgery, including a shampoo wash from the base to the tips of the hairs. Care must be taken to ensure that strands of hair are not trapped either in the dissected tissue or the wound.

Postoperatively, patients must be counseled to cover incisions with a barrier antibiotic ointment and avoid makeup until the incision has closed. Skin infections are typically caused by Gram-positive organisms, and a high suspicion must be maintained for methicillin-resistant Staphylococcal infection. Oral antibiotics specific to the appropriate organism are often adequate for treatment, and patients can be reassured that an excellent cosmetic outcome is still typical despite infection.

Brow Malposition

The key step to achieve lift in endoscopic brow surgery is the periosteal release. The periosteum must be completely released from canthus to canthus, or at least in the dissected area if confined temporally. The release alone will allow the brow to elevate 2–4 mm, on average.

Brow malposition or asymmetry can be troubling for the patient who initially desired cosmetic correction of brow position. Immediate asymmetry is most often due to preoperative bony asymmetry that leads to asymmetric draping of the soft tissues over the underlying anatomy. Often, surgeons need to perform asymmetric surgery to achieve symmetric results, whether that means greater periosteal release (in endoscopic brow lift) or larger skin resection on the more ptotic side. Skin-based surgeries (coronal, pretrichial, midforehead, or direct brow lifting), which depend on resection of scalp tissue to provide elevation and contouring of the brow, tend to have earlier recurrence than other techniques, as natural elasticity and actinic damage can lead to late drooping [1]. Endoscopic brow lifting, in particular, alters brow homeostasis on a fundamental level; over-aggressive periosteal release at the medial brow or excessive resection of brow depressor musculature can lead to splaying and "surprised" facies (Fig. 21.4) [10–12].

During the central dissection, the corrugator and procerus muscles can be manipulated, cut, excised, or stretched. However, extensive literature has reported that these techniques can lead to glabellar depression, irregular lumps, splaying of the medial brows, excessive bruising, or abnormal/asymmetric movements. Therefore, the glabellar and medial brow can be handled instead more predictably with neurotoxin injections, both before and after surgery.

Management of overly elevated brows can be conservative – quarterly botulinum toxin injection to address the asymmetry – or surgical, wherein the surgeon releases the attachments from the frontalis muscle to the brow via a transeyelid incision. Titrated botulinum toxin injection is typically more predictable and acceptable to the patient for minor asymmetries.

Management of recurrent or residual brow ptosis can be accomplished conservatively – small asymmetries may be managed with botulinum toxin to either drop the higher brow, or slightly lift the lower brow by reducing action of the medial

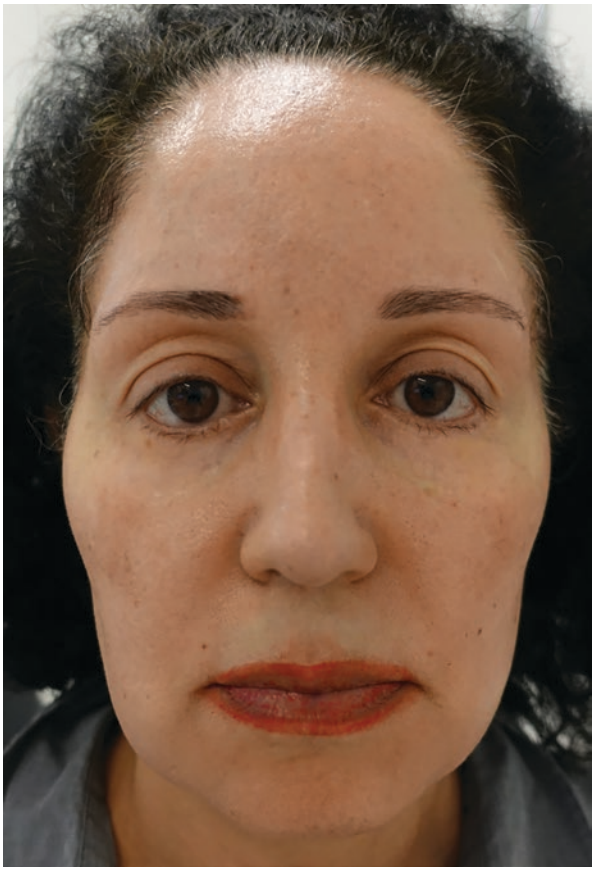

Fig. 21.4 Postoperative clinical photograph of a 54-year-old female who underwent endoscopic brow lift elsewhere. The medial brows are higher than the lateral and splayed, leading to a "surprised" expression. This may have been due to aggressive medial periosteal release and/or medial eyebrow depressor resection

brow depressors and lateral orbital orbicularis oculi muscle. Significant recurrent brow ptosis is most commonly due to poor selection of the initial procedure or thick, heavy skin and brow-fat pads [2], and may ultimately require a second procedure.

Transeyelid (transblepharoplasty) approaches to lifting the brow are low risk, particularly in regards to facial nerve injury, but may be more limited in results. This is typically performed in the preperiosteal plane, and requires complete release of the periosteal ligamentous attachment to the tail of the brow for optimal elevation. With a wide dissection cavity, the brow fat can be secured to the frontal periosteum at least 10–20 mm above the orbital rim. In general, transblepharoplasty brow suspension can be thought of as a fixation technique to minimize or delay further brow ptosis, rather than a tool to primarily elevate the brow; as such, inadequate patient counseling may lead to inappropriately heightened expectations of brow elevation after this procedure.

Resection of forehead skin is the most predictable method of achieving symmetry in the patient who is already unhappy to be undergoing a second procedure. In

men, a midforehead or direct lift can be utilized, and in women, a pretrichial approach can be taken. Scalp resection at the forehead often corresponds 1:1 with the postoperative brow elevation, and results can be seen immediately.

Intraoperatively, it can be helpful to place drains at the end of surgery, using a 10 French size catheter attached to a suction bulb or vacutainer. This reduces bruising and swelling, and also helps the released periosteum adhere to the bone without an excessive fluid barrier. The drains can be flushed postoperatively with either local anesthetic for pain control, or steroids for itching or edema. In general, pressure dressings appear to cause more pain and nausea, and may "squeeze" the bruising down to the lids.

Numbness

Numbness is common in the immediate postoperative period around incisions, and can often extend to the vertex of the scalp following the distribution of the sensory nerves of the forehead. Care must be taken to identify and preserve the neurovascular bundles intraoperatively, particularly the supraorbital nerve. While there are no immediate treatments for postoperative numbness, sensory nerves are well collateralized and sensation is regained in usually 3–6 months after surgery.

Forehead Hematoma

A forehead hematoma can occur if a large potential space is opened, either in the subcutaneous or subgaleal plane. Avoidance of medications that cause bleeding including aspirin and other nonsteroidal anti-inflammatory medicines, herbs, supplements, and vitamins is critical (discussed in more detail in Chap. 2). Control of postoperative nausea and vomiting as well as activity restrictions can reduce the risk as well. Intraoperative drain placement attached to a suction bulb or vacutainer can allow faster adherence of tissues and reduce the risk of hematoma/seroma formation. Hematomas may be drained in the clinic after surgery should they develop.

Granulomas, Lumps

There are many bioresorbable or nonresorbable devices that are utilized for brow fixation, including screws, miniplates, and bone anchors. These can be utilized during endoscopic, temporal, or transeyelid lifting approaches. Resorbable implants can lead to late inflammation, granulomas, and skin breakdown at the site of implantation. Resorbable and nonresorbable implants may be felt in thin-skinned patients or as the patient ages. Steroid injection and/or removal of the implant may be necessary in such cases.

Cerebrospinal Fluid Leak

Finally, cortical bone tunnel fixation has attendant risks due to the drilling of the frontal bone [3]. Inadvertent penetration of the posterior table of the bone can lead to dural or parenchymal injury with cerebrospinal fluid leak (CSF) leak. Bone wax can be used to control bleeding vessels emanating from bone and neurosurgical consultation should be considered should CSF be noted. A guarded drill bit or bone tunnel guide can be used to minimize the risk of intracranial injury.

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Midface Lifting Complications

22

Allan E. Wulc

Introduction

The past two decades have awakened our awareness to the importance of the midface to the appearance of youth. Procedures have been devised to elevate and volumize this area to re-create the appearance of youth. With every procedure that has been described, unfortunate complications arise, whether in the hands of the neophyte or a master. These complications are often unique to the individual procedure, but some have the final common pathway—eyelid retraction and dry eye. This chapter discusses the rationale for midface lifting from an aesthetic perspective and describes the basic techniques and the complications common to each of them.

Anatomy and Involutional Changes

The midface comprises all the anatomy of the middle third of the face and therefore includes the eyes, the eyelids, the nose, and the cheeks and the submalar zone. The topographic aesthetic ideal for the midface has been described as a smooth ogee that proceeds from the eyelids to the cheek to the submalar area without interruption, with a short lower eyelid that arcs to a convexity in the cheek. The maximum point of this convexity has been called the interzygomatic point [1] or, alternatively, the WIZDOM (the width of the interzygomatic distance of the midface) [2]. This area can be measured with a high degree of interobserver correlation. This distance, in the ideal aesthetic female, is approximately the distance between the most lateral brow hairs. The distance between the WIZDOM and the lateral or medial canthus in the ideal youthful eyelid is less than 12 mm^2. Swift and Remington [3] have

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emphasized the importance of the location of midfacial highlights in the perception of beauty, calling this area the "Triangle of Youth." Ideal proportions in this area—and the apex of the midface ogee— can be described as the intersection of a line drawn from the alar groove to the upper tragal cartilage and the vertical descended from the midpoint of the lateral orbital rim.

Aging of the midface is due to gravity, volume loss, and textural change of all anatomic layers, and these have been well described elsewhere [4]. Bone remodeling is responsible for an increase in the posterior cant of the maxilla and loss of projection of the pyriform, resulting in collapse of midfacial surface projection [5]. Our understanding of fat changes has been greatly advanced through the work of Pessa and Rohrich who have demonstrated individual fat compartments, superficial, surrounded by a connective tissue septal system, and suspended by midfacial ligaments [6, 7]. The orbital fat compartment may increase in volume over time [8]. The deep and superficial fat compartments have been shown using CT imaging to lose volume and descend in aging faces [9]. Others have emphasized the importance of these compartments in the treatment of facial aging and suggest that volumization of the deep compartments leads to volumetric expansion and the appearance of facial rejuvenation [10, 11]. Changes in muscle have also been observed with atrophy and simultaneously, the skin loses its luster and rhytids and dyschromias develop [12]. Gravity plays a large role in midfacial aging [4]. The ligaments of the midface lengthen and their attachments to the facial fat compartments attenuate. In the lower eyelid, volume changes predominate and gravity does not have as large an effect—the appearance of fat excess in the lower eyelids, due to volume increase in this location, and baring of the inferior orbital rim as the orbital retaining ligament, placed on stretch, allows the midface to descend, deepening the tear trough and creating the appearance of a longer lower eyelid [13]. Lambros [14] demonstrated that nevi in the skin of the preseptal eyelid do not descend over time. This finding suggests that gravity is not as much of a force in the vicinity of fixed ligaments (the orbital retaining ligament in particular) that do not allow the skin to drift where they are anchored. However, nevi in the midface lack the same solid ligamentous attachments and descend over time, and are therefore more subject to the effects of gravity [14]. The midface has been demonstrated to reassume a more youthful appearance in the supine position, suggesting that gravity plays a role in the morphologic changes suggestive of facial aging, with revolumization of the fat compartments occurring as the face assumes a position where gravitational vectors are more posterior.

Techniques and Their Complications

For these reasons, various techniques have emerged to treat all the features that occur as a result of aging.

Implants are commonly employed to address the bony changes and to ameliorate soft tissue drift. Most implants are made of silicone or porous polyethylene and are

inserted subperiosteally and can be tailored to address zygomatic arch, orbital rim, or submalar insufficiencies. Custom carved Gore-tex implants have also been described [15].

The fat compartments can be volumized with *fat or fillers* to increase midfacial projection. Contrary to generalized thinking, injections in these compartments may improve overall facial aesthetics but do not improve the nasolabial fold [16]. Preliminary studies done in our practice demonstrate that they also do not elevate the midface.

The midface can be elevated via a variety of approaches that are well described elsewhere [1, 7, 17–19]. The *trans-eyelid transcutaneous* approach can be performed and can simultaneously address aging (lower eyelid changes), canthal tightening, and skin excess. The *trans-conjunctival* approach allows all these issues to be addressed with the exception of skin. The *trans-temporal endoscopic* approach involves an incision in the temple and permits the surgeon to address brow changes simultaneously, but also may require lower blepharoplasty to address lower eyelid aging issues. The above lifts, trans-eyelid or trans-temporal, may be performed in the *subperiosteal* plane of the malar body and the maxillary face, or *supraperiosteally*, in the prezygomatic space.

Thread lifts have been described to address midfacial issues. A series of barbed or coned sutures are placed and fixed to allow elevation of the skin. Finally, the *deep-plane face lift*, done through a lateral approach, has been described as a means of elevating the midface. Essential to this procedure is the division and complete release of the zygomatic ligaments to allow suspension and re-elevation of the face. The particulars of these procedures are beyond the scope of this chapter.

All surgery has attendant risks, and midfacial surgery shares these risks, which include: persistent swelling, infection, hemorrhage, scars in the location of incision placement, suture reactions, allergy, and the risks of anesthesia. Numbness at the incision sites is seen in almost all patients and, fortunately, diminishes over time and requires nothing more than reassurance on the part of the surgeon.

The individual procedures listed above that address the midface each have their own set of complications and will be detailed individually. Complications can be divided into complications where a new problem is created such as dry eye or scarring, or an aesthetic problem—the patient just does not look right. Usually, the aesthetic problem involves an overcorrection—a widened midface with an unrealistic and unearthly appearing interzygomatic distance. In cases of lower eyelid retraction or frank ectropion, the problem is both aesthetically unappealing and often devastating symptomatically. The patient looks sad because of downward displacement of the lower eyelid and/or the canthus, and often is sad, because of the attendant dry eye symptoms.

Implants

Implants rest on bone and have been documented to cause bone resorption in chin implantation, and our experience with extrusion of cheek implants also suggests

that resorption occurs beneath a fixated or a nonfixated implant [20]. The implant can migrate if not fixated or if the subperiosteal pocket that was originally created is too large. The implant can extrude (Fig. 22.1). The implant can be inserted upside down (Fig. 22.2). They can be mismatched to the patient's face, expanding the midface unequally or unrealistically (Fig. 22.3).

Implants are foreign bodies that can become infected even at a date well distant from original implantation. Dental work, facial manipulation such as massage or the use of dermabrasion, or hydrosonic facial cleansing can give rise to bacteremia and implant infection. Management of infection includes the use of systemic

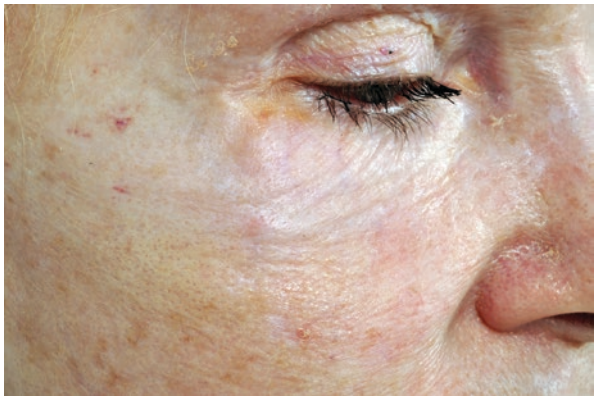

Fig. 22.1 A patient who presented to the author with extrusion of a midface implant placed elsewhere due to infection. This necessitated removal and left the patient with skin abnormalities overlying the region

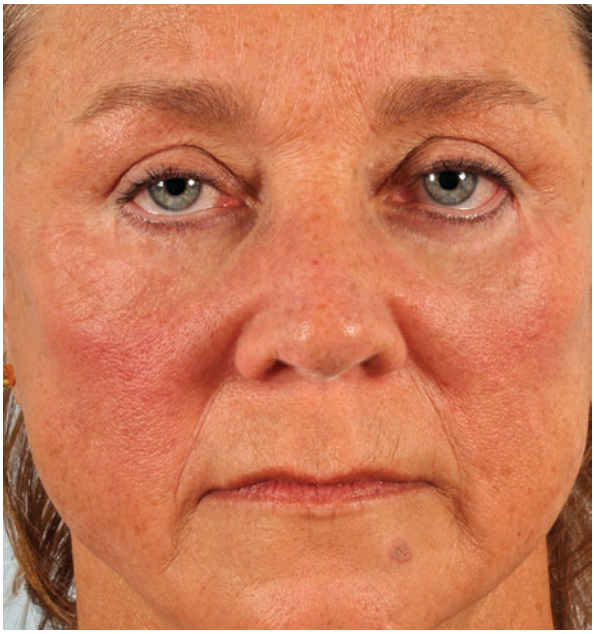

Fig. 22.2 A patient who presented to the author with a midface implant placed elsewhere, which was noted to be upside-down bilaterally and causing lower eyelid retraction

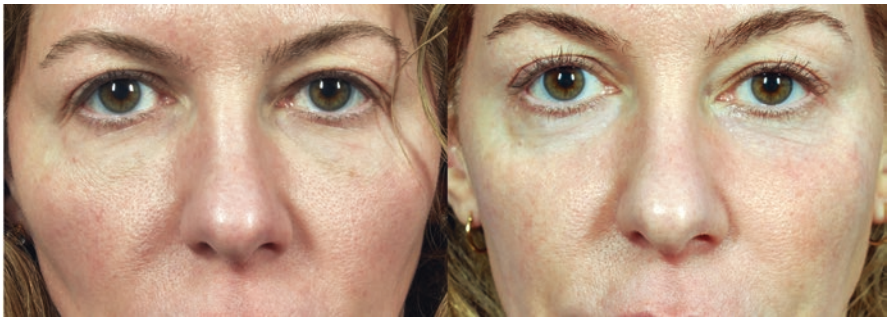

Fig. 22.3 A patient who presented to the author with a midface lifting and fat grafting performed elsewhere, which was overexpanded and led to a leonine facies. Correction included removal of extra volume, midface lift, facial liposculpture, and revisional surgery, shown 1 year postoperatively (right)

antibiotics to salvage the implant, a return to the operating room for antibiotic lavage, or definitive implant removal. Often the pocket created by fibrous reaction around the implant allows the cheek to maintain the expansion that the implant was placed to correct.

Fillers and Fat

Fillers are classified by the FDA as implants. Filler injections, when performed superficially, can cause a Tyndall-like phenomenon [21], which more likely represents internal reflectivity and altered spectral absorption, but creates a bluish hue to the lower eyelid. (Fig. 22.4).

The property of imbibition created by the hydrophilic properties of HA fillers can result in prolonged swelling, whether it is injected in the midface or in the tear trough, and can give rise to festooning. The best treatment is removal with hyaluronidase. In general, doses of 75 unit per side are recommended and may be required based on the cohesivity and crosslinking of the hyaluronic acid (HA) filler that was previously injected. It is erroneous to attempt to correct festooning with filler, particularly when it is due to previous filler [22].

Granulomas have been described to occur from almost all fillers. Nodules can occur from Sculptra injections and therefore Sculptra is no longer recommended for insertion under the eye. Nodules that have occurred due to erroneous injection in these locations can be treated with saline and dilute steroid injections [23].

Particular to fat injections are the occurrence of excesses in the lower lids creating the appearance of exaggerated festoons, when the fat is injected from a lateral approach or if an overcorrection exists. Isolated cystic nodules of fat that behave like lipomas can occur (see Fig. 22.3). Management involves either the injection of dilute steroids, warning the patient of the risks of adjacent atrophy, or direct

Fig. 22.4 Lower eyelid permanent filler placed by another practitioner resulting in edema and a bluish, Tyndall-like hue. Correction involved subcision, direct excision, midface lift, and liposculpture (below)

excision. Our initial experience with subcutaneous radiofrequency energy for the treatment of fat excess is encouraging. Blindness and skin necrosis can occur and are devastating.

The most aesthetic common complication seen in our practices involves overfill—where the injector overfills the wrong compartment or errs by mistakenly believing that a lift will occur with volumization. This creates the leonine facies (Fig. 22.3)—an interzygomatic distance that is unrealistic—and also weighs down the aging face.

The management of overexpansion involves dissolving the filler if it is an HA, or in cases where the filler is permanent (e.g., silicone), semipermanent, or fat, attempting to resect the fat or utilize steroid injections, saline, or radiofrequency (RF) energy to dissolve the components. Sodium thiosulfate has been described in vitro to dissolve calcium hydroxyapatite, but we have no experience with this technique [24].

Trans-eyelid Approaches to the Midface

Trans-eyelid surgery is appealing, because it allows all components of midfacial aging to be addressed simultaneously—fat excess, skin excess, and midface gravitational changes. This procedure was extensively described by McCord, Hester, et al. [25]. The initial rate of ectropion described by their group and reoperation rate was as high as 19%. Hester's subsequent article led to significant modifications, but the procedure still has a high postoperative morbidity and the surgeon performing midface lift with this technique should be cautious and conservative.

All midface surgery that involves an incision around the eyelids can give rise to the lower eyelid complications detailed elsewhere in this text. These complications include chemosis, exacerbation of dry eye, and lower eyelid retraction, round eye, and scleral show, due to midlamellar scar contracture (Fig. 22.5). It is important to emphasize, however, that lysis of the orbital retaining ligament (ORL)—done sometimes as a routine component of lower eyelid blepharoplasty, but always done using the trans-eyelid approaches to the midface—can result in prolonged chemosis and lower eyelid ectropion [26]. This may occur due to denervation of the orbicularis in the early postoperative period. Lysis of the ORL also removes support to the lower

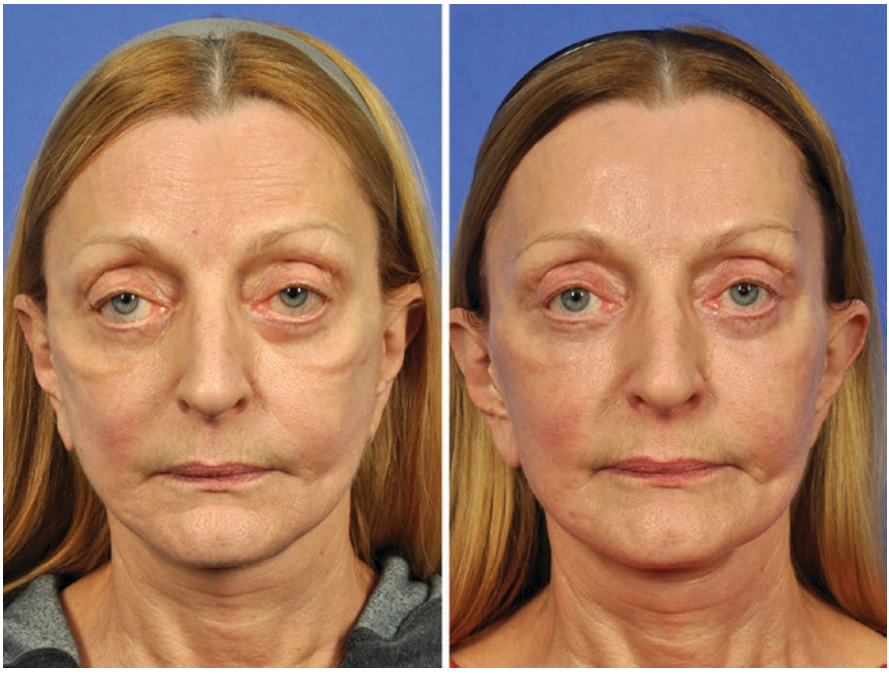

Fig. 22.5 65 year old woman who underwent deep plane facelift, upper blepharoplasty, and transcutaneous lower blepharoplasty 2 years prior with a previous surgeon. Photos before and 1 year following endoscopic midfacelift lift with lysis of midlamellar scar, liposculpture, and lower eyelid and midcheek laser resurfacing

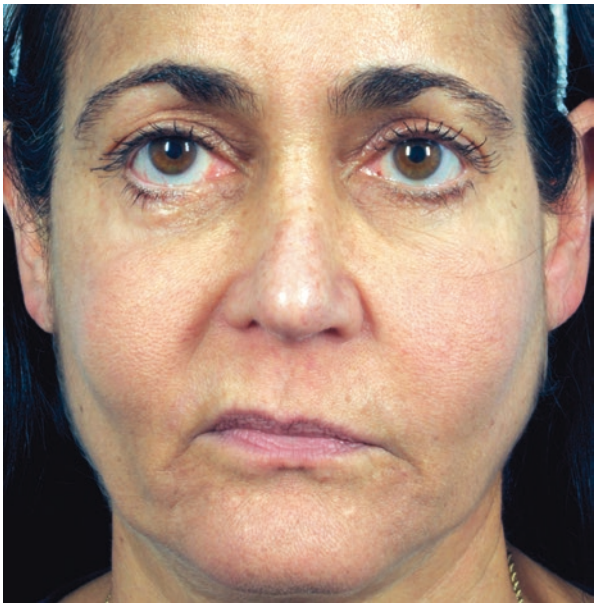

Fig. 22.6 A patient who presented to the author after surgery performed elsewhere. She has asymmetric midface implants, bilateral lower eyelid retraction, left facial paralysis, and migration of injected silicone to the submalar zone

eyelid hammock and the lower eyelid succumbs to the weight of the midface, which has been deprived of its attachments. During healing, the ORL reforms and thickens, creating the middle lamellar scar. Other complications of trans-eyelid surgery include injury to the infraorbital nerve due to excessive traction or transection during subperiosteal release and partial facial paralysis due to injury to the zygomatic or buccal branches during either supraperiosteal or subperiosteal approaches (Fig. 22.6). Because there are multiple ramifying branches of the facial nerve, fortunately, these complications are rare. However, we have seen aberrant regeneration in several postoperative patients from other surgeons that have presented for management of midface complications.

Endoscopic Midface Lifts

All surgery that involves an approach to the midface from an incision in the temple can give rise to a temporal branch facial nerve paralysis. The frontal branch of the facial nerve is vulnerable as it crosses the zygomatic arch where it goes from being deep in the parotid to superficial as it travels in the superficial temporal fascia above the intermediate fascia and the intermediate fat pad. Like the marginal mandibular nerve, the frontal branch does not enjoy heavy collateralization, so injury to a single ramus can be responsible for a brow droop, whether permanent or temporary. The sentinel veins and nerves, which traverse from the superficial to the deeper planes in the temporalis, derive their names, because the frontal branch travels immediately above them and should be clear indicators that the surgeon is in the correct plane

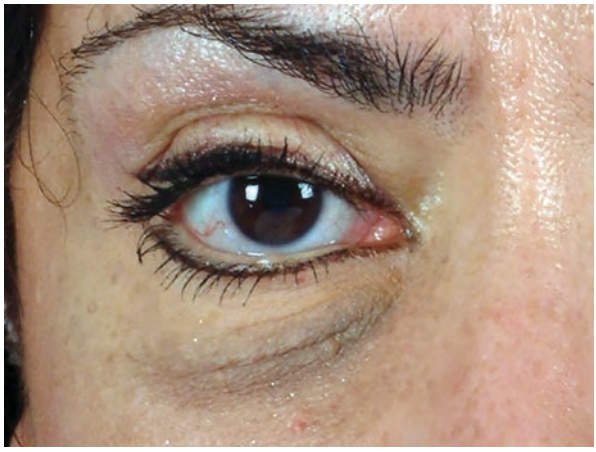

Fig. 22.7 Prolonged swelling and ecchymosis leading to postoperative hyperpigmentation in the thin eyelid skin

during surgery. However, these branches can be injured due to overzealous stretching during dissection or inadvertently transected. Management consists of treating the contralateral side with botulinum toxin, and watchful waiting. The majority of pareses from endoscopic midface lifts return within 4 months, the time for regeneration of the nerve from its pontine origin.

The subperiosteal midface lift has a particular set of complications that differ from its supraperiosteal counterpart. The interzygomatic distance is invariably widened with this procedure and the midfacial muscular origins are supraplaced, resulting in subtle abnormalities of facial animation. Prolonged swelling can be seen with this technique, creating midfacial brawny edema, festooning, and hyperpigmentation (Fig. 22.7).

Thread Lifts

Thread lifts are controversial. It is our opinion that they have no long-lasting effect on the midface and offer much in the way of hope and little in the way of permanence. Threads are made of polydioxanone or polypropylene can give rise to pain, infection, and extrusion. They enjoy wide popularity despite their inefficacy, perhaps because they do not necessitate a trip to the operating room and do not involve lengthy incisions or downtime. Injury to the parotid duct has been reported [27].

Deep Plane Midface Lift

The deep plane lift allows for elevation of the superficial components of the midface above the zygomaticus major and minor muscles [18]. The deep plane is entered by transecting the zygomatic ligaments. Presumably, the zygomatic branches of the facial nerve penetrated the parotid gland and remain deep and extend and ramify in the

face below the zygomaticus major muscle, making the suprazygomatic plane safe for dissection and allowing a robust flap to be created that allows a good blood supply and for the facial compartments and skin to be placed on tension without fear of skin necrosis [18]. The composite lift, as described by Hamra, allows for the elevation of the orbicularis as well [28]. These procedures are not performed by the majority of aesthetic plastic surgeons, but nonetheless enjoy increasing popularity. Complications of this procedure include all complications of facelift in general. These include: hematoma, seroma, fibrosis, slough (necrosis of a portion of the facelift flap—particularly in smokers), which is thought to be less due to the depth and vascularity of the deep plane flap, open tragal deformity, and pixie ear, due to downward traction on the facelift flap. Sialocele—injury to the parotid duct—can also occur as the duct runs beneath the masseteric fascia, which should not be violated during facelift surgery but can if surgical confusion supervenes. Paralysis can occur if the zygomatic nerve is injured. If the nerve recovers, aberrant regeneration is often seen.

Aesthetically, a deep plane midface lift is said not to create lower facial lateral sweep. Instead, we have found that the lift as performed by some surgeons results in an upper facial sweep, as the midface is translocated overly laterally rather than superiorly. With expression, all facelifts, particularly if the wrong vector of lift is chosen, can cause bunching deformities, lateral displacement of the mouth along with an overly hollowed submalar pocket with a joker-like appearance. It is important in performing this surgery to lift the deep plane primarily in a vertical vector. This often does not allow for the correction of skin excess in aging faces and may be one of the limitations of this procedure. A too horizontal vector, if chosen, gives rise to a windswept appearance. In these cases, rather than performing a horizontal vectored deep plane lift, it may be preferable to separate the superficial muscular aponeurotic system (SMAS) to lift it vertically and then to deal with the skin changes in a more posterior superior vector.

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Periocular Scarring

23

Addison M. Demer, Andrew R. Harrison, Ali Mokhtarzadeh, and Ian A. Maher

Introduction

Scar formation is an inevitable outcome of all invasive surgical procedures of the skin. In this chapter, we will discuss the topics of prevention, analysis, management, and revision strategies for periocular scars. To master these concepts, the surgeon must first understand the factors that make a good scar.

The best surgical scars, while subtle and unidentifiable at a conversational distance, are never totally invisible to close inspection by the trained eye. Full-thickness wounds of the skin invariably lead to characteristic dermal fibrosis, disturbance of collagen fiber alignment, and disappearance of both adnexal structures and elastic fibers [1]. These changes can be identified both visually and histologically. Therefore, a cosmetic surgical outcome relies primarily on appropriate scar camouflage.

A well-designed closure will take advantage of natural cosmetic subunit junctions and/or relaxed skin tension lines to obtain proper scar camouflage. Cosmetic subunit junctions are fixed landmarks that separate the cosmetic units of the face, and include the infraorbital creases, and nasolabial folds, among others [2]. Cosmetic subunit junctions are particularly advantageous for scar placement as the human eye is accustomed to perceiving lines at these junctions, and the natural light reflexes and shadows that occur at the junctions improve scar camouflage [3]. It is unsurprising that most periocular cosmetic procedures, such as the blepharoplasty, integrate this foundational concept into their design.

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In addition to cosmetic subunit junctions, the wise surgeon will take advantage of relaxed skin tension lines (RSTLs) when designing a repair. RSTLs are useful for cosmetic repair for several reasons; in photodamaged skin, scars can be successfully camouflaged within the rhytids that form along RSTLs. Perhaps more importantly, orienting closures along RSTLs will usually result in decreased tension on the wound, which minimizes resulting scar formation [4]. The caveat to this is closure of periocular defects for which repair along RSTLs may result in traction on the eyelid margin and ultimately induce cicatricial ectropion, eyelid retraction, and lagophthalmos. For all repairs, meticulous and atraumatic suture technique with resulting eversion of the wound edges will optimize scar formation and make camouflage easier [5].

First and foremost, the key to ensuring success of a revision procedure is taking the necessary steps to avoid it. A properly designed primary operative plan is paramount to long-term success, and is arguably more important than surgical execution. Even the most masterfully performed procedure is destined for failure if tension vectors are not oriented appropriately, suture lines cross essential subunit cosmetic junctions, or tissue support is not reestablished [3, 6]. A wise surgeon must fight tendencies to overly simplify surgical plans, as attempts to shorten scars and minimize operative time often result in the very opposite. It is important to recognize that a favorably placed scar that recreates natural contour, even if longer, will be better camouflaged than a shorter mal-oriented scar, or one that interferes with surface contour.

A well-designed primary surgical plan will not only minimize the probability of requiring a revisionary procedure, but importantly improve the likelihood of success after said revision in the event it is necessitated. Revision procedures that are required after a properly conceptualized repair are often executable, and have a higher likelihood of long-term success [6]. In contrast, revisions necessitated by an inadequate operative design will be challenging, if not impossible to successfully execute without a complete "do over."

Unique to the periocular skin is the risk for cicatricial ectropion and associated morbidity. When performing high-tension repairs of the lower eyelid or central cheek, techniques such as the canthopexy and Frost suture can serve as useful techniques to mitigate risk for resulting cicatricial ectropion [7].

Scar Analysis

A wise surgeon will thoughtfully consider the probability of obtaining a superior result after revision. The first step in this consideration is scar analysis. Proper scar analysis is paramount, as different patients and scars require variable approaches to revision. Prior to considering an additional revisionary procedure, it is essential to obtain a thorough history of patient scarring. This should include: history of keloidal, hypertrophic, spread or atrophic scars, history of hyperpigmentation, use of medications like systemic corticosteroids, and past medical history of genetic conditions such as Ehlers Danlos, which can affect scaring tendencies.

It is essential to corroborate scarring history with a thorough physical examination including both visual and tactile analysis of previous scars. In our experience, patient's characterization of their scarring tendencies is often inconsistent, and is less reliable than the clinician's examination. To form meaningful information from the

exam, one must thoroughly evaluate previous scars, while considering their timing, location, and factors such as tension that may lead to higher rates of spread or hypertrophy. For example, a previous hypertrophic scar on the central chest would be of less concern than one occurring on the central cheek. Scarring history and previous scar appearance should be thoughtfully considered when determining the level of aggressiveness in revision, and whether or not revision should be attempted at all.

In order to create a well-designed plan for revision, a patient's scar must be initially categorized appropriately. The recommended treatment modality varies significantly by scar type, which can broadly be grouped into (1) hypertrophic/keloidal, (2) hypotrophic, (3) inverted, (4) red, and (5) contracted (Table 23.1). Hypertrophic scars are raised, fibrotic plaques that remain limited to the site of the original wound, and have potential to involute spontaneously. In contrast, keloids are similar fibrotic plaques that extend beyond the margin of the original injury. They rarely involute and more commonly present with symptoms of pruritus and pain. Fortunately, keloids are exquisitely rare on eyelid skin.

Hypotrophic scars most commonly present as hypopigmented depressed and atrophic plaques, which may widen to the extent of the original defect. In contrast, inverted scars are narrow depressed scars and do not develop spreading. They are most commonly observed on thick sebaceous skin or seen in cases with imprecise epidermal approximation. Erythematous or red scars are common during the early postoperative period, but may persist, particularly in patients with tendency toward erythematotelangiectatic rosacea. In our experience, red scars are the most common subtype to coexist with other scar morphologies. Finally, contracted scars are often the most challenging to treat, and may result in either free-margin contraction or webbing. Webbing can result from insufficient repair length and/or scar contraction, and occurs most commonly at a site of natural concavity like the medial canthus (Fig. 23.1).

Table 23.1 Categorization of scars and treatment modality options

Hypertrophic/keloidal	1. Intralesional injection (corticosteroid, 5-fluorouracil) 2. Pulse dye laser 3. Ablative resurfacing 4. Excision
Hypotrophic/spread	1. Nonablative fractionated resurfacing 2. Ablative fractionated resurfacing 3. Excision +/− scar disruption technique (running W-plasty, or geometric broken line)
Inverted scar	1. Dermabrasion (if on firm skin, e.g., nose or forehead) 2. Nonablative fractionated resurfacing 3. Ablative fractionated resurfacing 4. Traditional ablative resurfacing 5. Pulse dye laser 6. Excision +/− scar disruption technique (running W-plasty, or geometric broken line)
Erythematous scars	1. Pulse dye laser 2. Watchful waiting and sun protection
Contracted scar/ webbing	1. Z-plasty 2. Ablative fractionated resurfacing
Mal-oriented scar	1. Z-plasty 2. Excision with scar disruption technique

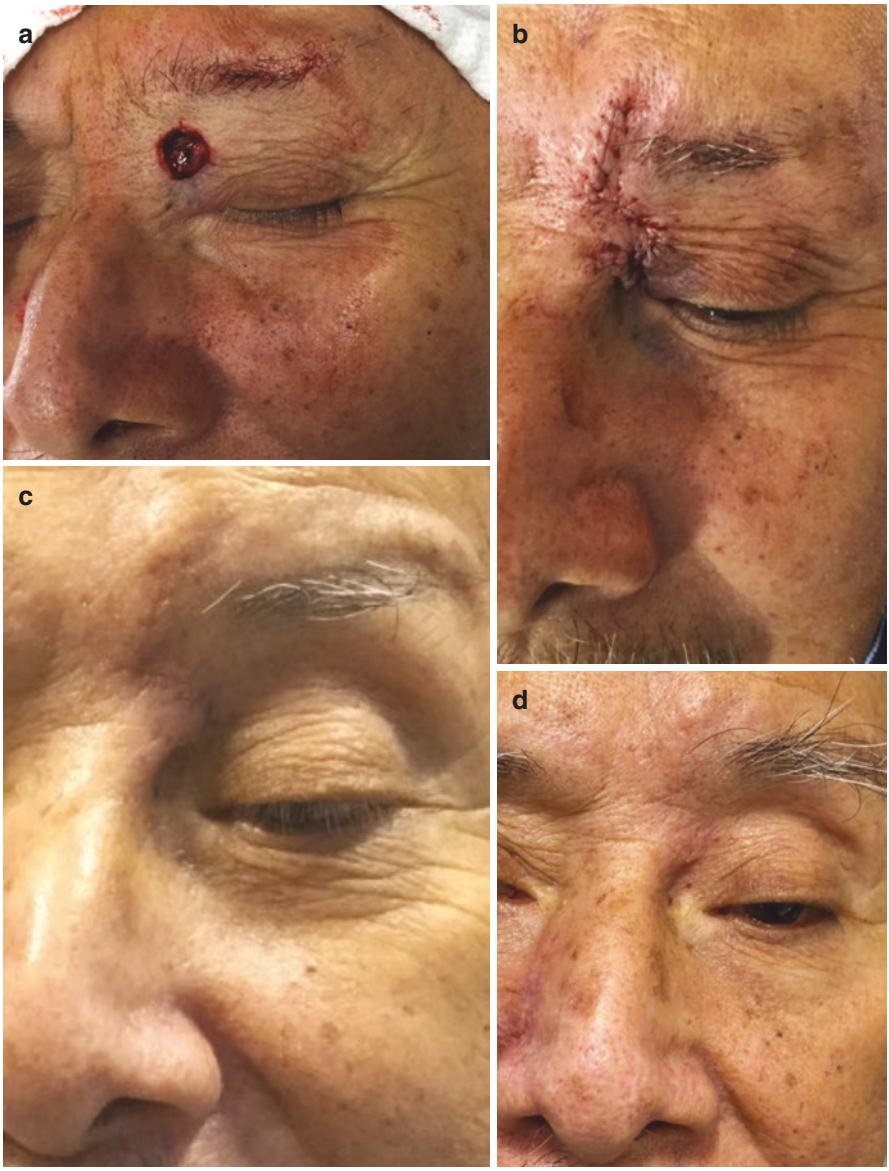

Fig. 23.1 (**a**) 1.0 cm surgical defect following one-stage Mohs procedure for a pigmented BCC of the upper eyelid/medial canthus. (**b**) The defect was repaired with a superomedially based rhombic flap, taking advantage of glabellar laxity and excellent color-texture match of immediately adjacent skin. (**c**) At 2-week follow-up, the flap is well healing and fully viable. There is notable edema with mild pincushioning and webbing. Webbing may have been prevented by slightly extending flap length at the time of reconstruction. Given the mild and asymptomatic nature of the scar irregularity, conservative scar massage and silicone gel ointment application was recommended. (**d**) At 3-month postoperative follow-up visit, pincushioning had resolved. However, while it improved, the mild webbing persisted. Continued scar massage was recommended. In our experience, this degree of webbing resolves with conservative measures over subsequent months and does not require surgical revision. Given Fitzpatrick type IV skin, light-based modalities are best avoided in this patient to avoid dyspigmentation. Long-term follow-up is pending

It is common for a surgical scar to fit more than one of the above categories, though each component may be considered separately when planning for revision. The remaining text will review the various treatment modalities for scar revision, while indicating the scar subtypes that are most likely to benefit from each treatment option (Table 23.1).

Nonsurgical Scar Revision Techniques

Watchful Waiting and Noninvasive Interventions

A tincture of time is often all that is required for correction of mild scar irregularities. Cosmetic improvement can be expected for most scars over the course of the first 18–24 months as scar tissues remodel after surgery [8, 9]. While there is little high-quality data supporting the practice, many experts recommend scar massage as a low-risk measure that can be utilized to improve scar appearance in the first weeks-to-months following a procedure [10]. At best, scar massage may expedite and facilitate scar remodeling; at worst, the low-risk measure encourages patience with natural scar maturation. The authors encourage patients to firmly massage the scar line with a petrolatum-lubricated finger using small circular motions. They are encouraged to do so for 4–5 minutes, two to three times daily. For periocular scars, patients should be counseled to avoid applying direct pressure on the globe, instead redirecting force onto the surrounding bony orbit.

Another low-risk measure that can be recommended for mild scar abnormalities is silicone gel sheeting. Like scar massage, data supporting the use of silicone gel sheeting is largely of poor quality; however, there is some evidence that use may reduce incidence of hypertrophic scarring and improve scar thickness and color [11]. Due to limitations with gel sheet applications on periocular skin, when silicone products are recommended, the authors typically encourage topical silicone gel for practicality and ease of use.

Watchful waiting (including scar massage and silicone topical use) is best reserved for subtle imperfections—including mildly depressed wounds, those with mild webbing or pincushioning, and very early scars with subtle raised/hypertrophic quality (Fig. 23.1). Patients should be counseled early and often on the normal scar maturation process when these measures are utilized.

Intralesional Injections

Intralesional corticosteroid injections are a useful and minimally invasive treatment modality for hypertrophic wounds, including keloidal scars and those with mild pincushioning [12–14]. When injected into the substance of a scar, steroid injections decrease both collagen production and fibroblast activity—effectively flattening a hypertrophic and raised scar. While relatively safe and well tolerated, intralesional steroid injection into eyelid and central facial skin has been associated with the rare and disastrous complication of retinal artery occlusion [15]. When utilized for periocular scars, the authors prefer to use slow micro-aliquot injections

of higher concentrated triamcinolone acetonide 40 mg/cc. Low volumes injected slowly are felt to decrease risk for local and intravascular sequelae, while the effective high concentration minimizes requirement for repeat injections over time. Others have advocated for use of 5-Fluorouracil 50 mg/ml or combined Kenalog/5-fluorouracil (1:10 dilution) as alternative options for hypertrophic periocular scars. The Kenalog may also be diluted to 10 mg/ml and injected more often if there is concern for hypopigmentation. Also, celestone can be injected safely as it is not particulate like Kenalog. The most common side effect of corticosteroid injection is hypotrophy and hypopigmentation if injected into normal surrounding tissue. Injections can be safely repeated at 3–6 week intervals as needed to achieve desired scar improvement.

Light-Based Technologies

There are a variety of laser technologies that can be used in the scar revision process. The various technologies and their indications will be briefly reviewed below. All of the reviewed modalities carry potential risk for ocular damage and blindness. It is essential that the eyes are appropriately shielded during treatment. Metal laser corneal shields should be utilized during treatment of eyelid scars within the bony orbit.

Pulse Dye Laser

The pulse dye laser (PDL) has a wavelength of 585 nm or 595 nm and targets hemoglobin as its chromophore. It selectively targets the newly formed blood vessels in an erythematous scar, and is the treatment of choice for scar redness (Fig. 23.2) [16]. In addition, it causes heating of dermal collagen that promotes scar maturation and inducing improvement in parameters other than redness [17–19]. In fact, PDL has shown efficacy in treating hypertrophic scars [20, 21].

The PDL can induce burns and permanent hypopigmentation when used in darker skin types due to absorption of light by epidermal melanin. Fluences of 6–8 J/cm^2 with a 7 mm spot size and 1.5 ms pulse width are frequently used, though functionally equivalent treatment parameters may be achieved when using larger spot sizes [17, 22]. Small spot sizes are encouraged when treating scars on the eyelid and periorbital area. Patients should be counseled to expect purpura in the treated area. These purpura fade within a week, with redness improving for a month thereafter. Dermal remodeling proceeds for several months post-PDL treatment.

Fractional Resurfacing

The advent of fractional resurfacing technology has allowed for an additional minimally invasive scar revision technology. Fractionated resurfacing is useful for the treatment of atrophic, and depressed scars, as well as for improving textural

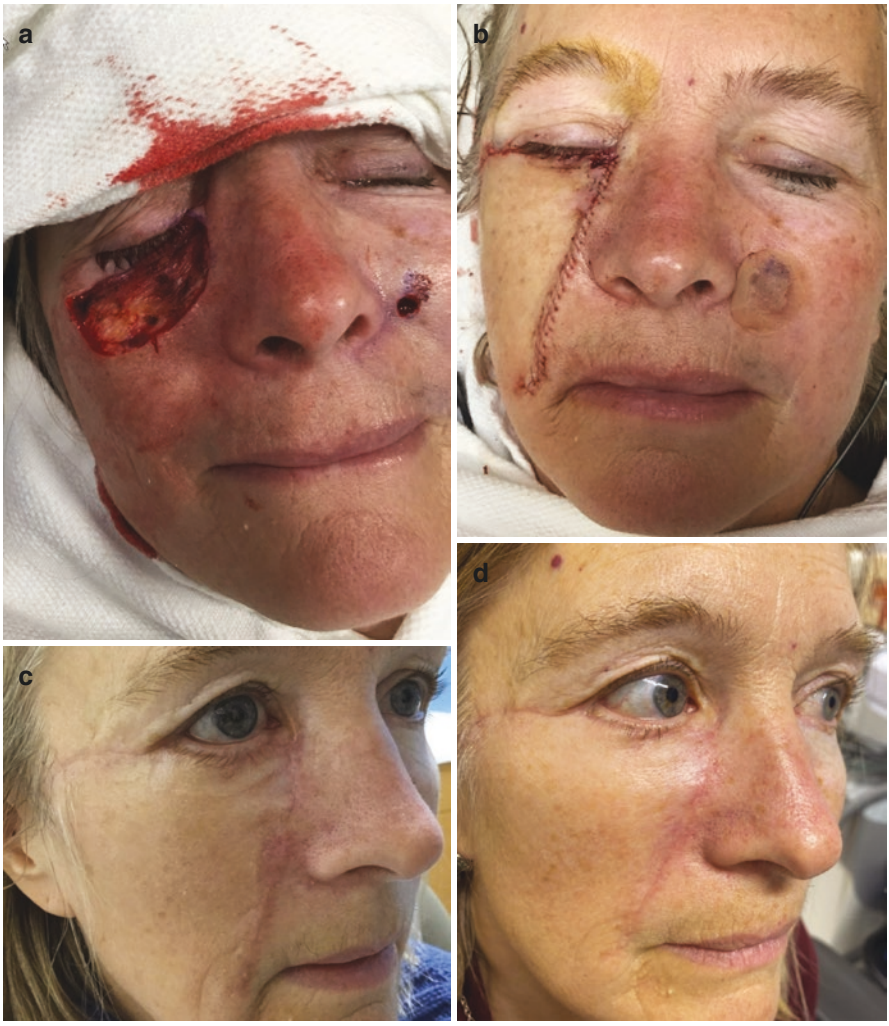

Fig. 23.2 (**a**) 4 cm defect of the right lower eyelid following Mohs surgery for a large melanoma in situ. Mohs was performed with aid of Mart-1 immunostain. Note the small partial-thickness defect on the contralateral cheek representing a control biopsy site. (**b**) The defect was repaired with a large Mustarde cheek rotation flap. Note the defect was extended to cosmetic subunit junction lines to assist in long-term scar camouflage. The lateral aspect of the flap extended well above the lateral canthus, and care was taken to ensure that there was no downward tension on the eyelid free margin. (**c**) At 2-month follow-up, there is moderate persistent erythema along the medial suture line. Pulse dye laser (PDL) treatment was offered. Due to flap edema, the lateral aspect of the right lower eyelid was not fully apposed to the globe. This mild ectropion was expected to resolve with a tincture of time and gentle scar massage. (**d**) One month later, the eyelid was found to be in appropriate position. Flap edema had improved as had texture of the suture line with scar massage and silicone gel ointment. This photo was taken immediately after PDL treatment. Nonpurpuric settings were utilized; note mild posttreatment erythema. Settings: 595 nm, 6 J, 10 mm spot size, 10 ms pulse duration. Given mild atrophic nature of the temporal aspect of the scar line and cosmetic focus of the patient, fractionated ablative resurfacing with a CO_2 laser is planned

irregularities (Fig. 23.3). Fractional resurfacing utilizes water as its chromophore and creates microscopic columns of injury, microthermal zones (MTZs), in a regular pattern. The density of these MTZs can be modulated, controlling the percentage of the cutaneous surface area treated in each session. These MTZs heal rapidly, provoking a regenerative dermal response. Nonablative fractional resurfacing lasers utilize wavelengths in the near-infrared portion of the spectrum. The lower absorption coefficient of water in this range allows the stratum corneum to remain intact. The maintenance of an intact stratum corneum is associated with a lower adverse effect profile. Ablative fractional lasers emit wavelengths in the far infrared. In this portion of the spectrum, the absorption coefficient of water is higher and the stratum corneum is ablated due to the heating of corneal water.

Multiple treatments with a nonablative fractionated 1550 nm erbium:glass has been shown to be effective in the treatment of atrophic surgical scars [23, 24]. When compared with PDL, fractionated nonablative resurfacing was found to be superior for improving all scar parameters except for redness [16]. Fractionated nonablative resurfacing has an excellent safety profile, with most patients experiencing only redness and mild swelling limited to 48–72 hours post-op. This technology is generally considered to be safe to use on scars in nonfacial areas [23].

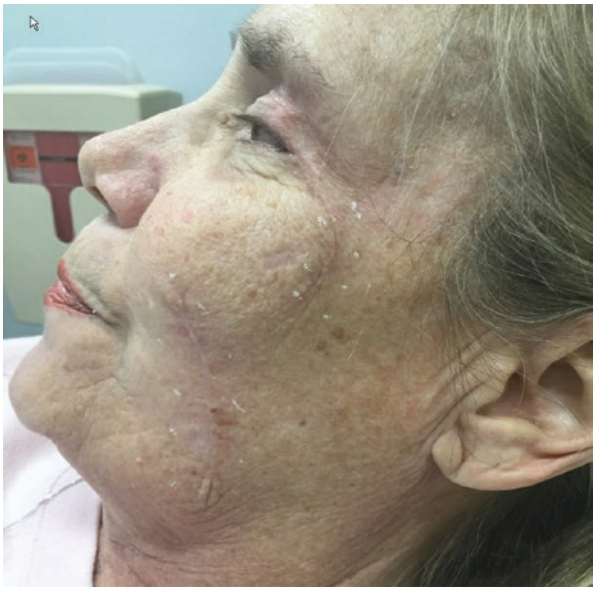

Fig. 23.3 This solid organ transplant patient presented with a combination of hypotrophic, depressed, and hypopigmented facial scars after numerous nonmelanoma skin cancer Mohs surgeries. Two-months prior to this photo, she was treated with an O-H advancement flap for a 2 cm poorly differentiated squamous cell carcinoma (SCC) of the left superior eyelid. Prior to that, a 6 cm defect of the left cheek was closed primarily after a large SCC was extirpated with Mohs. She also had several additional facial scars that are not visible in this photo. All scar lines were treated with an ablative fractionated CO2 laser. White surgical markings outline treatment areas. Additional laser treatment will be considered at 3-month post-laser follow-up

Fractionated ablative lasers, including carbon dioxide (10,600 nm) and erbium:YAG (2940 nm), have been shown to be useful in the treatment of surgical scars [17, 19, 25]. In contrast to nonablative fractionated resurfacing, often only a single treatment is necessary. Ablative technologies have a higher rate of scarring than nonablative counterparts and should be used conservatively in nonfacial areas. The fractionated CO_2 laser was found to have a superior safety profile when compared with dermabrasion [26]. These lasers have shown efficacy in the treatment of contracted scars [27, 28].

Traditional Ablative Resurfacing

Traditional ablative laser resurfacing ablates the epidermis and superficial dermis. This induces dermal collagenesis twice the scale of fractionated ablative resurfacing [29]. Both the CO_2 and Er:YAG lasers have been shown to be effective in the treatment of surgical scars [18, 30]. These devices should be used with care in nonfacial areas as slower wound healing increases the risk of hypertrophic scarring [31].

Dermabrasion

While less commonly utilized for oculoplastic scar revision, dermabrasion remains a cost-effective and useful tool for smoothing uneven scars [32]. Dermabrasion results in both scar flattening and blending of textural mismatches, and does so via mechanical removal of the epidermis and superficial dermis overlying the area of treatment. While the technique cannot add volume to a depressed or hypotrophic scar, appropriately performed dermabrasion can attenuate scar edges, thus improving light reflex and visibility of hyper- and hypotrophic scars alike [33].

Dermabrasion is best utilized on firm and stable locations, such as the nasal tip. While some groups have utilized cryogen spray to harden soft tissue to make it more amenable to dermabrasion [34], in recent times, these products can be challenging to obtain. The authors instead prefer fractionated ablative laser treatment for most nonsurgical revisions at such locations. With rare exception, dermabrasion is best avoided on the eyelid due to risk of injury and cicatricial ectropion from scar contracture [35]. In situations where mechanical dermabrasion is pursued near a free margin, it is essential to ensure that the fraise is never rotating away from the free margin. Dermabrasion should be used cautiously in patients with history of keloid formation. Additional contraindications include active inflammatory disease, infection, and isotretinoin within the previous 6 months [36]. While historical wisdom dictates that dermabrasion should be performed within 8 weeks of the primary procedure, this practice is supported only by in vitro evidence [37, 38]. In the authors' experience, delayed treatment outside of this window can result in impressive improvement in scar appearance.

Equipment

Dermabrasion can effectively be performed with either manual or mechanical techniques [39, 40]. Manual dermabrasion is commonly performed with sterilized sandpaper, or more recently with a cautery tip scratch pad [41]. In contrast, mechanical dermabrasion is performed with a mechanical hand engine, including those manufactured by Osada or Bell [35, 42]. Due to perceived efficiency and control, the authors prefer mechanical dermabrasion with a Bell hand engine. In addition to the primary dermabrasion tool, required equipment includes a surgical marker, moist gauze, local anesthetic, surgical prep, eye protection for patient and staff, and occlusive gowns, facemasks, and headcovers.

Technique

Using a gentian violet marker, the area of treatment should first be demarcated. The surgeon should be thoughtful to mark both areas of elevation and depression, as well as anatomic subunit junctions. The primary strategy with dermabrasion is to bring "high" down to "low," while making areas of topographic transition more gradual. In addition to treatment of transition zones and areas of elevation, one can benefit from gently dermabrading areas of the depressed scar itself, though care should be taken to do so lightly as to promote scar remodeling and avoid deepening an already atrophic site. Results are often most aesthetic when at least superficial dermabrasion is utilized for the entire anatomic subunit, as this approach leads to overall uniformity of color and texture.

Once marked, the area of treatment should be infiltrated with a local anesthetic—typically lidocaine with epinephrine. In addition to providing anesthesia, local infiltration improves turgor of dermabraded skin, thus making the treatment easier to deliver [35]. Next, the area is prepped using a surgical antiseptic and sterilely draped. While the authors prefer chlorhexidine for most sites due to its favorable chemical properties, it should be avoided on periocular skin due to the risk of keratitis [43, 44]. For periocular revision, the authors prefer 5% povidone-iodine.

When utilizing a mechanical engine, the handle and fraise should be securely held and thoughtfully oriented above the treatment area prior to actuation. The spinning fraise should then be placed into light contact with the skin, taking care to maintain constant circular motion to avoid deep burrowing into the skin. The technique can be likened to the use of a Dremel tool. It is essential that hair is properly secured prior to treatment and materials like gauze, drapes remain far from the rotating fraise to avoid entanglement and subsequent injury. The primary endpoint for dermabrasion (mechanical and manual) is brisk diffuse punctate bleeding—corresponding to dermal level of injury. Wound care recommendations are similar to those following scalpel-based surgery.

Surgical Interventions for Scar Revision

A wide variety of surgical interventions for scar revision exist; proper technique selection, timing, and execution are paramount for success. This section will review the most common surgical approaches for cosmetic and function limiting scars of the periocular skin.

In contrast to the less invasive techniques reviewed previously in this chapter, the decision to pursue surgical scar revision should not be taken lightly. Surgical revision techniques often carry similar risk of morbidity to the patient as the original procedure. Subsequently, cosmetic surgical scar revision should be delayed for at least 6–12 months from the initial injury to allow for appropriate scar maturation. It is not uncommon for initially unsightly scars to gracefully remodel with a tincture of time or with a combination of the above nonsurgical revision modalities—ultimately without the requirement for additional surgical procedures. Even in cases where surgical revision is inevitable for a nonaesthetic scar, this treatment delay is important in allowing wound contraction to progress to completion—ensuring appropriate operative design. Significant function-limiting scars, including severe cicatricial ectropion, serve as an exception to this principle of delayed revision. In instances of significant functional impairment, surgical revision may be best performed in the initial weeks following the primary procedure.

Pincushioning Debulking

Pincushioning, or trapdoor phenomenon, is a common complication of cutaneous flaps at all anatomic sites; the periocular skin is no exception. Transposition and sliding flaps from glabellar skin to the eyelid appear to be particularly high risk for this complication, likely due to the intrinsic differences in skin thickness, challenges with appropriate flap sizing secondary to complex surface topography, limited capacity for primary undermining on the eyelid, and tendency for retention of edema [45, 46]. For cases of cosmetically significant pincushioning, the authors generally maximize injectable therapy prior to considering surgical revision. As noted previously in the chapter, low-volume intralesional 40 mg/cc triamcinolone is most commonly utilized in our practice. Only after an extended course of minimally invasive intralesional treatments should the decision for surgical revision be made.

When surgical revision is deemed necessary for the correction of a pincushioned scar, sharp incision and debulking is indicated. After routine surgical marking, anesthetic infiltration, and sterile prep, the original suture lines are sharply re-incised using a 15 blade. With the aid of skin hooks, the pincushioned flap is carefully lifted; excess scar and fibrofatty tissue is sharply debulked until the contour deformity is resolved. Hemostasis is meticulously obtained to avoid hematoma formation, and after wide undermining, well-placed buried sutures are utilized to reapproximate the skin edges while ensuring contact of the flap to the wound bed.

Direct Scar Excision

Many hypertrophic, hypotrophic, and inverted scars can be easily revised with direct scar excision [47]. With this simple technique, a problematic scar is excised in a fusiform or elliptical manner and closed linearly with meticulous, hyper-everted sutures. As discussed in the scar analysis section of this chapter, one should carefully analyze intrinsic and site-specific factors that led to the suboptimal result; surgical revision should only be pursued if and only if the probability of obtaining a favorable result outweighs the risks of the procedure.

When direct scar excision is performed, some advocate for incomplete resection of the scar tissue to ensure there is appropriate bulk in the defect and to prevent subsequent re-inversion [48]. Regardless of the extent of tissue resection, wide tissue undermining should be performed and hyper-everting buried vertical mattress sutures should be carefully placed to minimize tension and precisely approximate wound edges.

Broken Line Closure

Broken line techniques, or scar disruption, can serve as useful adjuncts to direct scar excision alone. The most commonly utilized broken line techniques include the W-plasty and the geometric broken line closure. While different in their design and execution, both techniques take advantage of the same concept, and seek to "irregularize" a scar by breaking it up into short, and subsequently less perceptible segments [49]. With the W-plasty, a scar is sharply excised in a zig-zag fashion, with mirrored wound edges along the long axis of the wound. If designed appropriately, the edges should reapproximate in a tongue in groove fashion. The geometric broken line closure is similar to the W-plasty in that it results in a tongue in groove closure, though in contrast, the excisional pattern of the geometric broken line closure consists of random, mirrored, geometric shapes instead of repetitious zig-zagging triangles [49]. As with all surgical revision techniques, broken line closure revision requires thoughtful patient selection and scrupulous operative technique.

Scar Lengthening Procedures

Due to the complex topography and presence of delicate free margins, periorbital scars tend to develop functional impairment at higher rates than other anatomical sites. Scar lengthening and lid tightening procedures are commonly necessitated for periorbital scars complicated by lid retraction or cicatricial ectropion. This section will review common scar lengthening procedures that are typically combined with the lateral tarsal strip (+/− medial spindle) procedure to restore normal eyelid position.

Z-plasty

The Z-plasty is a workhorse technique for surgical scar revision. It makes use of two, opposing, identically sized triangular skin flaps, which, when transposed, reorient the scar 90° while functionally lengthening the scar along the central limb of the Z-plasty [49]. The scar lengthening component of the Z-plasty is useful for lid repositioning and resolution of medial canthal webbing, while the reorientation associated with the procedure is helpful for placing the resultant irregularized scar into RSTLs and/or anatomic subunit junctions.

The Z-plasty can be challenging to conceptualize for even the veteran surgeon. There are a few central concepts that make the Z-plasty easier to design and successfully execute. The central limb of the flap should be oriented along the scar that needs revision. The angle of the peripheral limbs relative to the central limb determines the amount of functional scar lengthening, with larger angles resulting in increased lengthening. An imaginary line drawn between the termini of the mirrored peripheral limbs of the Z-plasty approximates the final scar orientation after flap transposition. Large Z-plasties can be cosmetically obvious and impossible to design at sites with tight anatomic constraints (i.e., periocular skin). In these situations, a scar may be revised with multiple, smaller Z-plasties. It should be noted that these attenuated flaps are designed identically, but result in less scar lengthening.

Once designed appropriately, the area should be anesthetized and prepped as usual, and the flap incised sharply with the scalpel blade. Some have found that dotting one of the triangular flaps with ink prior to incision can assist in ensuring correct final orientation [47]. The area surrounding the wound must be broadly undermined for contracture release and subsequent tension-free transposition. The flaps should then be transposed and meticulously sutured into place. While one or two buried vertical mattress sutures can be helpful to hold the transposed flaps into position under minimal tension, epidermal sutures should primarily be utilized for closure.

V-Y and Y-V Advancement

The V-Y and Y-V flaps are opposing variants of an islanded advancement flap. The V-Y flap is helpful in "pushing" contracted free margins, while the Y-V can be utilized for "pulling" surrounding tissue [47, 50].

To execute the V-Y advancement flap, one should make a V-shaped incision through epidermis and dermis immediately below the distorted free margin or contracture of interest. During the undermining phase of the procedure, careful attention should be paid to ensure that tissue underlying the V-shaped flap is not undermined, though the tissue surrounding the flap should be fully released to ensure proper flap movement and subsequent wound healing. After thoughtful and selective undermining, the trailing aspect of the V-shaped incision should be closed primarily with buried vertical mattress sutures, subsequently pushing the flap toward

the desired free margin and into appropriate position. Because the lengthening component of the V-Y advancement flap results from a pushing vector from surrounding skin, variable lengthening effects will be observed depending on the firmness and stability of adjacent tissue. We have found the lengthening effect to be modest for periorbital skin, but more robust for more sebaceous areas of the face like the perinasal skin.

The Y-V flap is best utilized for pulling a free margin into appropriate place after distortion by a pushing vector—commonly a previous poorly designed reconstruction that has resulted in "bulldozing" of said free margin. The flap can be best conceptualized as the reverse order of the Y-V. A Y-shaped incision is made adjacent to the distorted free margin with the scalpel blade. Undermining is performed in similar fashion to the V-Y flap—namely, the V-shaped component of the flap should be selectively avoided. The V-shaped tissue is then advanced away from the free margin until appropriate position is achieved and then carefully sewn into place. Utilization of a fully buried or half-buried horizontal mattress sutures (i.e., tip stich) can be useful.

Other Approaches to Ectropion Repair (Incision and Back-grafting and Transposition Flaps)

While the V-Y advancement flap and Z-plasty are useful lengthening procedures for periocular revision, there are several other techniques that can be utilized for free-margin repositioning and ectropion repair [7]. Eyelid retraction commonly results from a combination of lid laxity and tissue deficiency—which can be due to either poor reconstructive design or unanticipated scar retraction. Cases of cicatricial ectropion commonly require a combination of primary lid tightening procedures (i.e., lateral tarsal strip with or without medial spindle) with the release of scar contraction and addition of tissue. When dealing with lower eyelid cicatricial ectropion, or retraction, placement of the lower eyelid on a Frost suture at the end of the case is helpful; the suture is left in place for 4–7 days.

One simple approach to a contracted periorbital scar is incision and back-grafting (Fig. 23.4). With this technique, the contracted scar is incised sharply, debulked as necessary, and widely undermined. Using gentle traction, the defect is expanded to its full-extent and a full-thickness skin graft (FTSG) template is made. One should consider oversizing the graft by 20–30% to account for anticipated scar contraction. This template is then transposed to an optimal donor site (e.g., opposite lid, postauricular scalp/neck, preauricular cheek, supraclavicular neck), harvested and inset with epidermal sutures. In cases where basting sutures are not feasibly placed, we rely on a sewed-on bolster consisting of petrolatum-impregnated gauze to ensure appropriate contact with the wound bed for the first week until appropriate neovascularization occurs.

Similar to incision and back-grafting, local random-pattern transposition flaps can be utilized to provide additional tissue after contracted scar release. As outlined

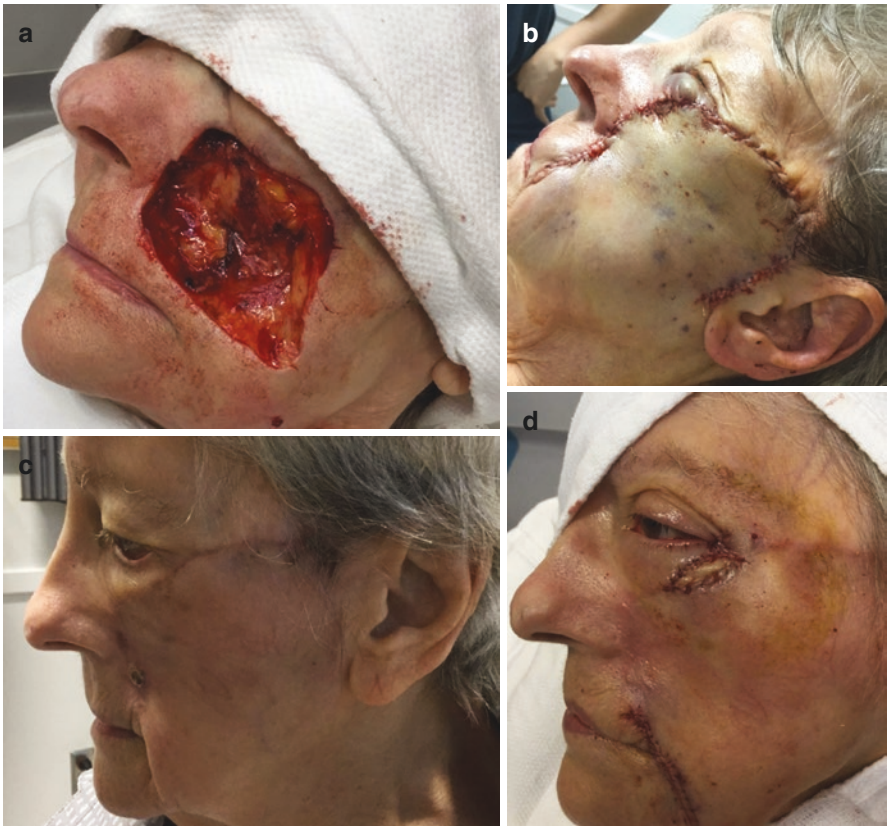

Fig. 23.4 (**a**) 5.8 × 4.5 cm surgical defect following two-stage Mohs procedure for a neglected basal cell carcinoma of the cheek. (**b**) The defect was repaired with a large Mustarde cheek rotation flap. (**c**) At 2-month follow-up, the flap was found to be fully viable; however, the patient had developed notable cicatricial ectropion. The patient complained of associated mild epiphora. Note the persistent skin and soft tissue redundancy over the lower cheek at site of standing cutaneous deformity (SCD). The SCD was intentionally left in place at the time of flap repair in an effort to preserve an adequate vascular pedicle. Surgical revision was anticipated at the time of initial reconstruction. Given mildly symptomatic nature of the ectropion, revision was delayed until the 6-month postoperative follow-up visit. (**d**) Surgical revision was pursued at the 6-month follow-up visit. First, a lateral tarsal strip procedure was performed. Next, the contracted scar was incised sharply with a 15-blade and appropriately undermined. The defect was then expanded to its full extent and a full-thickness skin graft (FTSG) template was made. The persistent SCD on the left lower cheek served as the donor site for the FTSG. The resulting fusiform defect on the lower cheek was closed primarily in standard dual-layer fashion. 5-0 fast absorbing gut cutaneous sutures were utilized to inset the FTSG. (**e**) A petrolatum-impregnated gauze bolster was sewn into place using interrupted 5-0 polypropylene sutures. The bolster was removed at 1-week follow-up visit. (**f**) 6-months after surgical revision, the eyelid position and lower cheek contour are found to be significantly improved. The patient no longer complained of epiphora. Ablative fractionated resurfacing was offered to further camouflage suture lines; this was declined by the patient, who was pleased with the revised result

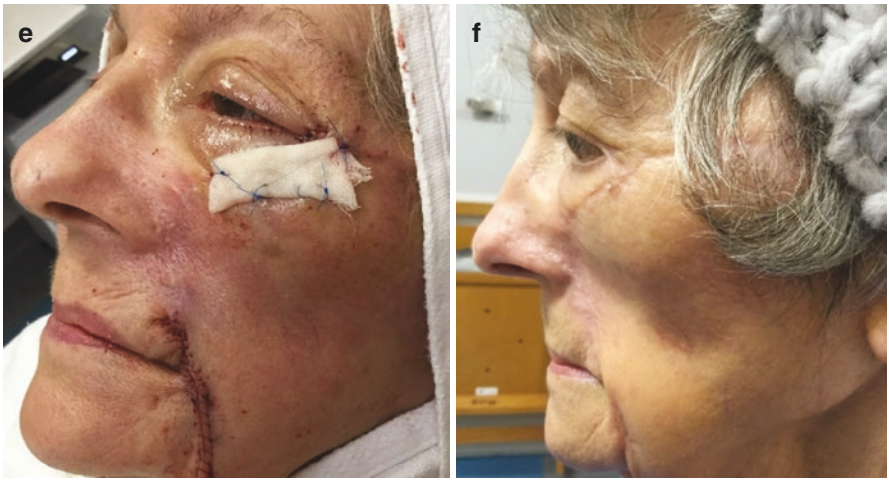

Fig. 23.4 (continued)

above, the contracture should be incised sharply, widely undermined, retracted to full-extent, and templated. This template can then be integrated into a superiorly based Tripier-type transposition flap, or alternatively an inferiorly based rhombic transposition flap [7]. The Tripier flap was originally described as a myocutaneous bipedicle flap from redundant upper eyelid skin (attached to vascular supply both medially and laterally) that is transposed into a lower eyelid defect. Variations of this flap are the monopedicled flap based at the lateral canthal angle to transpose a flap into a lateral lower eyelid defect. Both flaps should be combined with a lateral canthopexy to ensure appropriate position of the lateral canthus.

The Re-repair or "Do Over"

If the original reconstruction was grossly inadequate, it is likely that a complete re-repair or "do over" will be necessitated [6]. Like other forms of surgical revision, the decision to initiate rerepair should not be taken lightly. With the exception of significant functional limitation, such as corneal decompensation, timing should be delayed by 6–12 months. When approaching the "do over" revision, the complete extent of scarring should first be delineated with gentian violet. A thoughtful surgeon will also take care to delineate surrounding anatomic subunit junctions. The previous scar should be excised in toto; in many instances, it is advisable to extend the defect to subunit junction lines to ensure long-term scar camouflage. The defect may then be resurfaced with one of the many oculoplastic techniques reviewed in this book. In our experience, periocular re-repair often necessitates more involved reconstructive approaches like the Hughes flap, Cutler-Beard flap, Tenzel Flap, free tarsoconjunctival grafting, and/or combination techniques. A thorough review of the "do over" revision techniques is outside of the scope of this chapter.

Summary

The expert surgeon respects free margins, re-establishes natural topography, has a thorough knowledge of periocular scar camouflage, and has mastered techniques for scar minimization. One should recognize the importance of thoughtful preoperative planning and understand that the key to ensuring the success of a revision procedure is taking careful steps during the primary procedure to avoid its necessity. However, suboptimal results will arise from the hands of even the most veteran clinician; a wise surgeon will ensure that they are well versed with the full-repertoire of both invasive and noninvasive revisionary techniques. Scars resulting in significant functional limitation should be revised expeditiously, whereas most scars are best treated with minimally invasive techniques prior to consideration of surgical revision at 6–12 months. Mild cosmetically limiting scars are commonly treated with a combination of noninvasive techniques, including watchful waiting, scar massage, and silicone gel sheeting. Scars can be reliably categorized; minimally invasive and surgical scar revision techniques should be thoughtfully tailored to the individual and scar subtype. In most instances, one should maximize results of minimally invasive procedures (intralesional injection, light-based interventions, and dermabrasion) prior to moving on to surgical revision. Surgical approaches to periocular scar revision include pincushioning debulking, direct scar incision, broken line closure, scar lengthening procedures (Z-plasty, V-Y/Y-V advancement), ectropion repair techniques, and the dreaded complete "do over." Mastery of this content is essential for consistent operative success.

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Miscellaneous Complications

24

Elaine M. Downie and Cat Nguyen Burkat

Hemorrhage

The most feared complication of periocular surgery is permanent loss of vision. When it occurs, it is most frequently due to orbital compartment syndrome related to retrobulbar hemorrhage. In one large study looking at more than 250,000 cases, the incidence of orbital hemorrhage was found to be 0.05%, with permanent visual occurring in 0.0045% or 1/22,000 cases [1].

Manipulation of orbital fat or incisions extending into the orbital septum increase the risk of hemorrhage that may lead to possible blindness. Hemorrhage may be due to traction on or resection of orbital fat, leading to unidentified intraoperative hemorrhage, or may be due to delayed bleeding in patients who are anticoagulated or who have systemic hypertension [2]. Orbital hemorrhage usually occurs within the first 24 hours after surgery, especially in the first few hours postoperatively, but can be seen even several days following surgery. Use of patches or bandages postoperatively should be discouraged to allow bleeding to be discovered quickly.

Acute orbital hemorrhage is a medical emergency. Signs of hemorrhage include decreased visual acuity, tense periorbital hematoma, brisk incisional bleeding, proptosis, severe pain, and presence of a relative afferent pupillary defect. If there is significant increase in intraocular pressure, topical intraocular-pressure-lowering medications, such as carbonic anhydrase inhibitors and β-blockers, can be used. In the event of a retrobulbar hemorrhage, especially if there is evidence of vision loss or afferent pupillary defect, immediate release of the compartment should be attempted. Decompression can be performed in the emergency, clinic, or operating

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room; but urgency is of paramount importance. The first step is to open the surgical wounds. If this does not allow sufficient decompression of the hematoma, then a lateral canthotomy with lysis of the inferior and/or superior crus of the lateral canthal tendon should be performed [2, 3] (Fig. 24.1). In the event that adequate decompression of the orbital hemorrhage is still not achieved, the patient should be urgently returned to the operating room for surgical exploration. Rapid restoration of blood flow to the optic nerve and retina is critical to reduce permanent vision loss.

In addition to vision-threatening orbital hemorrhages, patients can develop significant periorbital hematomas. They are usually related to bleeding from the orbicularis oculi muscle or may be from vessels injured during debulking of orbital fat pads [4]. These need to be distinguished from retrobulbar hematomas, and assessed for continued expansion versus a stable hematoma. Small hematomas will typically resolve spontaneously and can be managed conservatively with pressure, ice/cold compresses, and elevation of the head. On occasion, they may need to be drained by needle aspiration (taking care to avoid globe injury) or by creating a small opening within the incision. If an expanding hematoma is noted, patient should undergo immediate surgical exploration to evacuate the hematoma and achieve hemostasis. In severe cases, eyelid hematomas can lead to fibrosis and scarring in the adjacent tissues [5].

In general, the risk of hemorrhage can be mitigated by proper discontinuation of anticoagulants, aspirin, nonsteroidal anti-inflammatory agents, and other natural vitamins or supplements that may increase bleeding such as

1. Chinese wolfberry
2. Dong quai
3. Echinacea
4. Feverfew
5. Fish oil

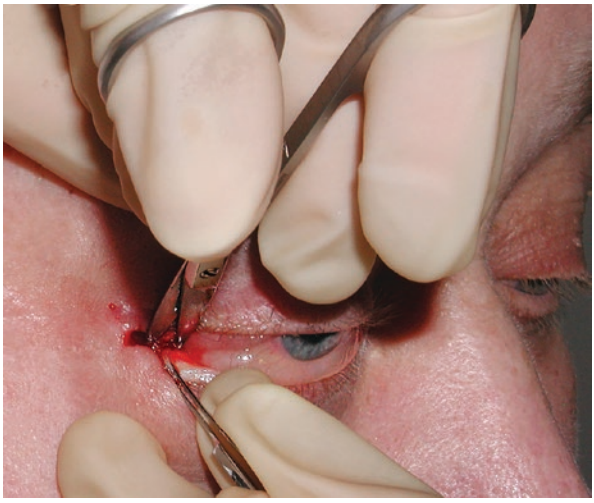

Fig. 24.1 Lateral canthotomy and inferior cantholysis performed to release a retrobulbar hemorrhage, with care to direct the scissor tips away from the globe

6. Garlic
7. Ginger
8. *Ginkgo biloba*
9. Ginseng
10. Green tea
11. Niacin
12. Quilinggao
13. St. John's wort
14. Vitamin E

These are further discussed in a separate chapter.

Infection

Fortunately, for both patients and surgeons, development of postoperative infections is quite rare in the well-vascularized eyelid. In one study, the rate of infection in patients having blepharoplasty alone (without ptosis repair) was estimated to be 0.2% [6]. However, when they do occur, they can be serious, especially if there is orbital extension that can lead to vision loss or thrombosis of the cavernous sinus [7, 8]. Minor preseptal cellulitis near the incision can be treated with an oral fluoroquinolone or a third-generation cephalosporin [4]. However, patients must be carefully evaluated to ensure there is no evidence of orbital cellulitis.

Signs and symptoms of orbital cellulitis may include

1. Increasing pain
2. Progressive periorbital swelling
3. Erythema
4. Warmth (calor)
5. Worsening conjunctivitis and chemosis
6. Decreased visual acuity
7. Restricted extraocular motility or pain with extraocular movements
8. Relative afferent pupillary defect
9. Fevers or chills

Computed tomography (CT) scan with contrast or magnetic resonance imaging (MRI) can be used to evaluate for orbital abscess and extension of disease into the cavernous sinus. There are a wide variety of pathogens that have been known to cause orbital cellulitis. The most common species are *Streptococcus pyogenes*, *Hemophilus influenzae*, and *Staphylococcus aureus*. Cases following blepharoplasty have largely been due to group A β-hemolytic *Streptococcus* or *Streptococcus pyogenes* [7]. Patients typically present with infection between 4 and 7 days following surgery [6]; however, *Streptococcus* infections can be more aggressive, with symptoms occurring within as little as 6–48 hours after surgery [7].

Rare cases of necrotizing fasciitis after blepharoplasty have been reported, which are characterized by serosanguinous filled violaceous bullae, necrosis of overlying tissue, and a sharp delineation between the infected area and uninvolved tissue. Treatment of necrotizing disease may require extensive debridement and in some aggressive cases, even this may not be adequate for treatment of the infection [9]. Early administration of intravenous antibiotics, such as piperacillin-tazobactam, is critical. Use of hyperbaric oxygen therapy may help preserve tissue, but efficacy has not been clearly established [1].

All cases of periorbital infection occurring in the early postoperative period should be treated based on the clinical presentation. Empiric therapy with broad-spectrum antibiotics is the first step in therapy. Antibiotic selection can later be narrowed based on culture results; however, adequate cultures may be difficult to obtain and may often merely demonstrate the normal skin flora. If there is evidence of abscess formation, surgical drainage should be considered.

Consideration should be given to the possibility of infection due to methicillin-resistant *S. aureus* (MRSA), particularly if the infection is severe or continues to progress despite oral antibiotics (Fig. 24.2). Although reports of MRSA infection involving the ocular adnexa have been rare, the incidence is increasing [2]. For suspected MRSA infection, all strains should be susceptible to vancomycin and linezolid. Additionally, community-acquired MRSA may also be sensitive to clindamycin, doxycycline, trimethoprim-sulfamethoxazole, and rifampin. Careful review of local clindamycin resistance rates is recommended especially if susceptibility testing is not available.

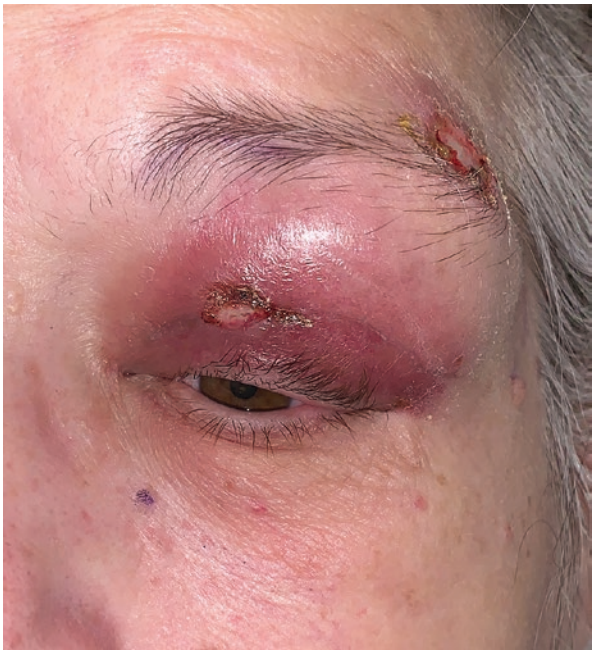

Fig. 24.2 Severe MRSA infection of the eyelids and eyebrows starting 5 days after combined blepharoplasty and browpexy

Atypical Infections

It is atypical for patients to present with erythema or other evidence of infection 6 or more weeks postoperatively. However, if this does occur, the infection is most likely caused by an atypical mycobacteria (*Mycobacterium abscessus*, *M. fortuitum*, or *M. chelonae*) [4]. These infections are likely due to normal skin flora, although there have been cases associated with contaminated saline, gentian violet skin markers, and perioperative international travel [4]. These may present as a nodular swelling, sometimes with draining abscesses and fistula tracks through the surrounding tissue. Any drainage should be sent for gram stain, and cultures obtained for evaluation of acid-fast bacilli and fungus. However, mycobacteria are challenging to culture and confirmation of cultures may take weeks. Therefore, if clinical suspicion includes atypical mycobacteria, initial treatment should include a broad-spectrum antibiotic that covers mycobacteria. Once cultures are confirmatory, then a prolonged course of oral clarithromycin 500 mg/day over 6 weeks to several months is often effective [2, 4]. If the infection is extensive, long-term intravenous treatment may be required. Treatment with steroids of any kind may worsen the infection and should be avoided.

Allergic Reaction

There is a wide range of allergic and inflammatory reactions that can be seen following oculofacial surgery. One of the more common etiologies is a contact hypersensitivity reaction that can present in the early postoperative period, typically 24–72 hours after initiation of the drug. These usually present with pruritus, significant eyelid erythema, and/or conjunctivitis greater than would be expected at that time in the postoperative course (Fig. 24.3). The affected tissues may drain clear fluid, crack, and eventually crust. With continued drug use, worsening itching and crusting may leave the affected areas raw, scaly, waxy, and indurated.

This type of reaction is most commonly caused by a topical ointment containing neomycin. Common "triple antibiotics" used after eyelid surgery, such as maxitrol,

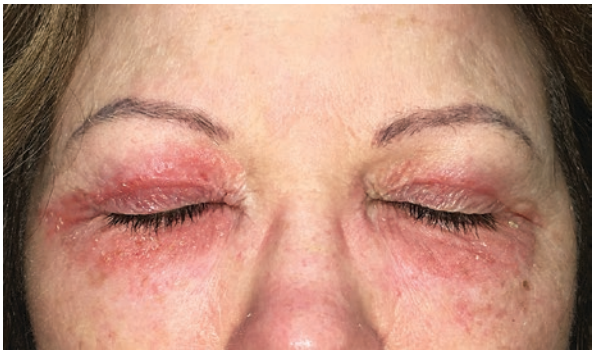

Fig. 24.3 Allergic hypersensitivity reaction due to topical neomycin antibiotic ointment, presenting with significant pruritus, eyelid erythema, and crusting

contain neomycin, bacitracin, and polymyxin B sulfate. The reported prevalence of an allergic reaction to neomycin is approximately 1% of the population [11], but contact hypersensitivity/allergic reaction can be seen with almost any type of drug. Patients may also develop a hypersensitivity reaction to artificial tears that contain a benzalkonium chloride preservative; therefore, preservative-free artificial tears are recommended if frequent use is required. Immediate discontinuation of the causative topical ointment or drop is the treatment for these types of allergic reactions. Additionally, antihistamines, topical corticosteroids, and cold compresses can be used to speed resolution. Severe urticaria/hives or angioedema is rare from topical antibiotic use.

Inflammatory Reactions

Inflammatory reactions to sutures may occur. Early after surgery, patients may present with erythema along the incision line that can be due to suture sensitivity. Sutures left in place for more than 7 days can also increase the risk of inflammation [4].

Localized inflammation can also be due to foreign body granuloma formation around sutures, also called suture granulomas. This typically presents as a tender, erythematous nodule along the incision approximately 4–8 weeks after surgery. A foreign body/suture granuloma forms when the immune system attempts to separate the foreign substance from surrounding body tissues, by aggregating clusters of immune cells around the "foreign body" material. Suture granulomas occur more commonly with implanted permanent materials, but also with polyglactin, buried catgut, and other slowly absorbable sutures [2]. Data on incidence of suture granuloma following blepharoplasty is limited; however, incidence following frontalis suspension is estimated to be 2–17% [12].

In some instances, the body will attempt to extrude the foreign body granuloma through the skin, which presents as an erythematous or draining "pimple" along the incision line. Warm compresses and topical or intralesional corticosteroids can be used for initial treatment. If unresponsive or painful, excision may be required for complete resolution.

Pyogenic granulomas can develop along transconjunctival incision sites, although the prevalence in blepharoplasty surgery is unknown. These present as a tender, erythematous, pedunculated mass in the conjunctiva, such as after transconjunctival lower blepharoplasty or upper conjunctivomullerectomy. Lubrication and topical steroid eye drops or ointment can be useful for resolution. Topical timolol may also be useful, though efficacy has not been well established [13]. Pyogenic granulomas may regress with conservative management, but can be excised if necessary. Application of cautery or cryotherapy at the base of the lesion after excision reduces recurrence.

Another reported complication following transconjunctival blepharoplasty is ointment granuloma. This may occur when ophthalmic ointment containing white petrolatum, paraffin, or mineral oil is exposed to subconjunctival blood vessels.

This stimulates formation of a foreign body granulomatous reaction around the ointment. The appearance of nodules near the area of the incision in the early to mid-postoperative period can be suggestive of ointment granuloma [14]. Treatment is similar to that for suture granulomas and includes topical and intralesional steroids and surgical excision.

Ptosis

Postoperative ptosis can occur for a variety of reasons. Significant dermatochalasis may often mask subtle levator attenuation that is undiagnosed preoperatively. Mechanical ptosis can occur secondary to local anesthetic effect, postoperative edema, or ecchymosis. This type of mechanical ptosis should resolve with conservative management, including cold compresses. For persistent edema, treatment with oral diuretics and/or oral steroids may be considered, although often unnecessary. Patients who receive diuretics should be monitored for electrolyte disturbances and may benefit from having potassium replacement prescribed along with the diuretic [15, 16].

If ptosis persists after the edema and ecchymosis have resolved, then it is possible that the prolonged edema or slowly resolving hematoma may have led to attenuation of the levator muscle or aponeurotic changes that does not improve. Occasionally, ptosis may be due to undiagnosed coexisting aponeurotic/involutional levator ptosis. In rare cases, iatrogenic ptosis may occur from inadvertent injury to the levator or Müller's muscle during surgery, and can be avoided with careful surgical technique. Cases of persistent postoperative ptosis should be observed for at least 3–6 months, as spontaneous improvement can occur even months after surgery [15, 16]. If clinically significant ptosis still remains after an appropriate period of observation, then levator muscle surgery may be considered.

Dry Eyes

Dry eye symptoms, such as eye irritation, redness, dryness, sandy/gritty sensation, itching, pain or discomfort, or blurry or decreased vision, following blepharoplasty are common after surgery and may take weeks to months to improve. In some patients, some degree of dry eyes may persist long-term and require additional treatment. This is discussed in more detail in a separate chapter.

Diplopia

Diplopia is a rare complication following blepharoplasty. Patients may report monocular diplopia, typically due to tear film abnormality, or binocular diplopia. Binocular diplopia can occur secondary to a variety of causes. Most commonly, it is transient due to effects of local anesthesia, hematoma, or edema.

However, iatrogenic injury to the extraocular muscles can also occur. This may be due to direct damage to the muscle or secondary to aggressive cautery. The most commonly injured muscle is the inferior oblique muscle during lower eyelid blepharoplasty [5]. This complication is best avoided through careful surgical technique when manipulating or excising the medial and central fat pads between which the inferior oblique muscle traverses. Initial treatment of diplopia should always be conservative, even when due to known iatrogenic trauma, as improvement may still occur as edema and hemorrhage improves. Fresnel prisms can be used for relief of diplopia during this period. If complete resolution does not occur over 2–3 months, then referral to a strabismus surgeon for further management is recommended.

Wound Dehiscence

Wound dehiscence can occur due to accidental trauma, high tension on the closure, poor wound healing, hematoma, severe edema, early suture removal, or infection. It often occurs while sleeping, when people are more likely to inadvertently rub the incision, or when their eyelids are numb in the early postoperative period. Following upper or lower blepharoplasty, wound dehiscence usually occurs in the lateral incision, where there may be more tension, particularly if concurrent eyebrow elevation was performed [2]. Patients may also sleep on the side of the face, which can add traction to the lateral eyelids. Those who utilize a CPAP machine at night for sleep apnea may need to be careful with the mask to avoid excessive traction on the eyelid incisions.

Closure of the incision should gently reapproximate the skin edges, but without pulling the suture taut such that the incision line appears tight or more “ropy” appearing. This allows for normal edema to occur without increasing tension on the sutures.

Type of suture can also play a role, with dehiscence more likely to occur when a rapidly absorbing suture is used. However, wound dehiscence can occur with early removal of nonabsorbable suture as well. Patients with diabetes, smoking history, or poor healing may need the sutures removed closer to 7–10 days after surgery. Patients should also be instructed to avoid rubbing the eyelids and face for approximately 2 weeks after surgery, and to pat the face dry after bathing.

Small areas of dehiscence, particularly in low-tension areas, may be allowed to granulate closed with good aesthetic outcomes. The patient should avoid repeatedly lifting the eyebrow to look at the incision, as this may further spread open the dehiscence. For larger dehiscences, or areas under tension, repair may be indicated. Prior to reclosure, granulation tissue should be gently removed and the wound edges freshened (without removing too much additional eyelid tissue). A layered closure technique using buried absorbable sutures to reapproximate the orbicularis muscle can minimize tension on the skin closure. Interrupted sutures to close the skin edges may also minimize recurrence, compared to a running suture that can continue to unravel after any break.

Refractive Error Change

Blurry vision after upper eyelid surgery is a relatively common postoperative complaint, and is most often related to topical ointment and dry eyes. However, alterations of the corneal curvature following surgeries that reposition the upper eyelid have been demonstrated in some studies using corneal topography and are often underrecognized [17–19]. In one retrospective study, 5.7% had subjective visual acuity changes (either worse or improved vision) at 1 year after upper blepharoplasty or combined blepharoplasty/ptosis repair [17].

Although prior studies have demonstrated increased corneal astigmatism in the initial months following upper eyelid blepharoplasty in 60% of eyes compared to preoperative measurements, clinically significant visual acuity changes persisted in less than 5% of eyes by 1 year [17–19]. Astigmatic axis changes were not significant. Mean changes in total corneal astigmatism may also be correlated with the severity of upper eyelid abnormality, with Zinkernagel et al. reporting a change of 0.25 diopter (D) after ptosis surgery, 0.21 D after blepharoplasty with large fat debulking, and much smaller changes (0.09 D) following skin-only blepharoplasty [17]. Similarly, other studies have demonstrated that repositioning the eyelid in levator resection surgery showed greater changes in corneal curvature, central corneal power, and corneal astigmatism, than after blepharoplasty. Elevating the eyelid height with levator aponeurosis advancement may theoretically decrease the pressure of the eyelid against the cornea, and thus result in changes in corneal curvature. Kim et al. found that corneal astigmatism decreased in 50% of eyes following levator resection, and increased in 19% [18].

It is therefore important for surgeons to appropriately counsel patients undergoing upper blepharoplasty, particularly if combined with ptosis repair to elevate the eyelid, that long-term changes in refractive error and vision may occur. In rare instances, patients may require a new prescription for contact lenses or eyeglasses if not improved after several months following surgery.

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Botulinum Toxin Complications

25

José Raúl Montes

Introduction

As an ophthalmology resident in the early 1990s, my initial experience with neurotoxins was via successfully treating blepharospasm patients. The typical injection pattern included not only the depressor muscles outside the orbit but the eyelid itself, despite the potential complication of eyelid drooping (Fig. 25.1). However, patients with blepharospasm almost never present with the same degree of spasticity over time, so injection patterns may need to be adjusted accordingly (Fig. 25.2).

Extensive first-hand experience in treating blepharospasm has allowed me to master neurotoxin injections to avoid eyelid ptosis complications, while taking into consideration, facial asymmetries and muscle strength variations. This chapter will concentrate on potential complications of neuromodulators, and the most common impediment to an artful outcome, which is always following a standard injection

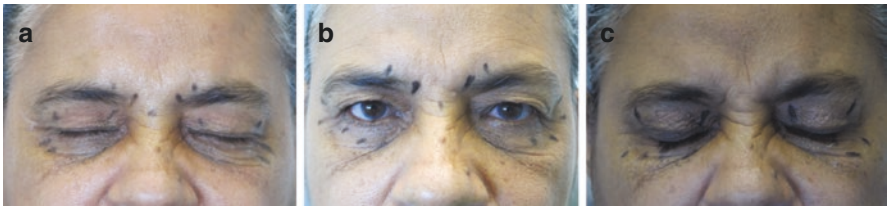

Fig. 25.1 Patient with blepharospasm. (**a**) First neurotoxin treatment, July 2011, (**b**) second neurotoxin treatment, November 2011, (**c**) fourth neurotoxin treatment, June 2012

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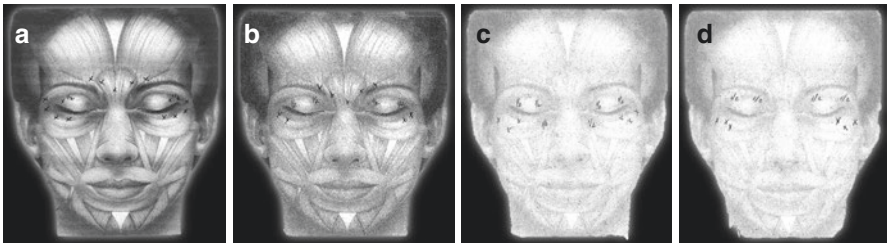

Fig. 25.2 Injection pattern for patient with blepharospasm. (**a**) First neurotoxin treatment, July 2011, (**b**) second neurotoxin treatment, November 2011, (**c**) third neurotoxin treatment, March 2012, (**d**) fourth neurotoxin treatment, June 2012

pattern for every patient. In general, complications of neurotoxins are often the result of injector inexperience, including [1]

1. Eyelid ptosis
2. Eyebrow ptosis
3. Bruising
4. Failure to address asymmetry
5. Dry eye worsening
6. Malar edema/festoons
7. Immune complex development
8. Diplopia
9. Eyelid edema
10. Allergic reaction
11. Flu-like symptoms
12. Headache
13. Toxin spread

Eyelid Ptosis

Administration of neurotoxin to the glabella has been associated with ptosis of the upper eyelid. This complication occurs most often due to inaccurate injection technique by placing the toxin deep with diffusion along the periosteum, or injecting too close below the medial eyebrow. It may take 48 hours to 2 weeks for ptosis to develop, and may persist 2–4 weeks or longer (Table 25.1) [2].

Prevention

To prevent the toxin from denervating muscles that elevate the eyelid, causing ptosis, the injection needle should aim upward above the bony orbit. However, care should be taken not to inject the lower frontalis muscle or orbicularis oculi muscles of the eye at sites that are lateral to the mid-pupillary line [7]. The recommendation per package insert information is injecting 0.1 mL (reconstituted 40 U/mL) in five

Table 25.1 Rate of eyelid ptosis among FDA-approved neuromodulators for cosmetic use

Neuromodulator	Ptosis rate
Onabotulinum toxin A	2–3% [3]
Abobotulinum toxin A	2–3% [4]
Incobotulinum toxin A	<1% [5]
Prabotulinum toxin A	2% [6]

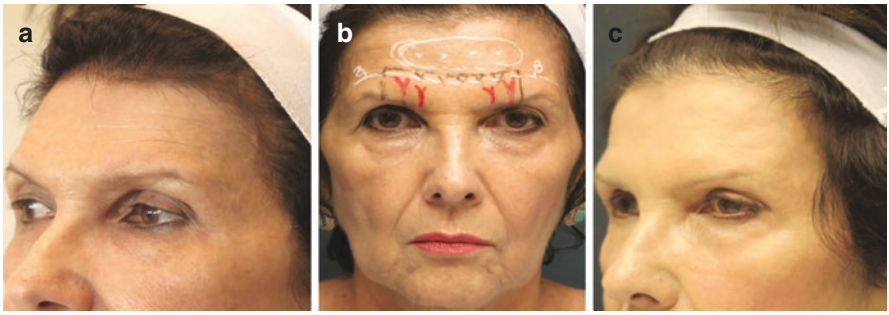

Fig. 25.3 Patient with low-set eyebrows and frontal bossing. (**a**) Prior to forehead injection, (**b**) marking of injections higher than 1 cm above supraorbital rim, (**c**) medial brow descent is noted after treatment

sites: two in each corrugator muscle and one in the procerus muscle, for a total dose of 20 U [8]. To minimize the risk of blepharoptosis, neurotoxin injections should not be placed near the levator palpebrae superioris of the eyelid.

Although some have advocated that medial corrugator injections should be placed ≥1 cm above the supraorbital ridge to avoid potential toxin diffusion and subsequent ptosis, injecting high above the supraorbital rim will often affect frontalis muscle elevation with consequential medial eyebrows descent (Fig. 25.3). The posttreatment result of this commonly recommended injection technique renders patients looking "surprised," which is an undesirable and unnatural look.

Treatment of Ptosis

Eyelid droopiness or ptosis after neurotoxin treatment may be temporarily treated by alpha-2 agonist eyedrops such as apraclonidine (Iopidine) or other alpha-adrenergic eyedrops. These substances will stimulate the smooth Müller's muscle responsible for eyelid elevation of about 2 mm. Over-the-counter eyedrops with vasoconstriction capability, typically used for red eye relief, may also temporarily improve a small eyelid ptosis.

Eyebrow Ptosis

Brow descent is one of the most common complications of treating the periocular zone with neurotoxins, with a reported incidence of 3–5% [9, 10]. This can be significantly reduced by proper patient assessment in resting and dynamic positions.

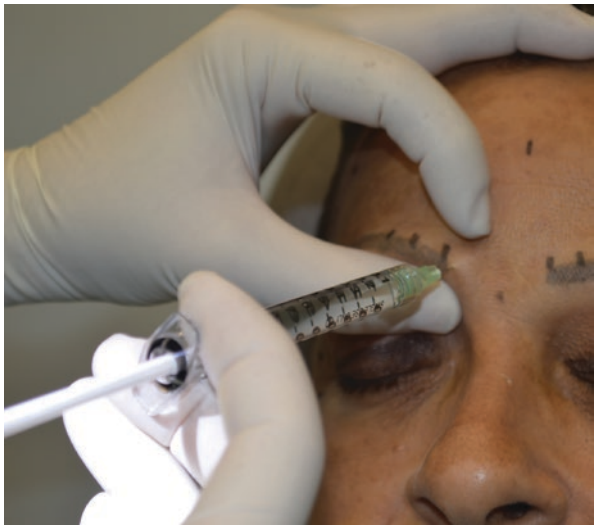

Fig. 25.4 Nondominant hand is used to prevent inferior migration of toxin

There is a common misconception that placing injections 1–2 cm above the superior orbital rim is necessary to prevent eyelid ptosis.

As discussed previously, such a high injection of the neuromodulator above the orbit can be actually responsible for eyebrow ptosis in many patients. It has been demonstrated that frontalis muscle proximal fibers are the ones responsible for keeping eyebrows in a "good resting position" [11].

Instead of injecting 1 cm above, practitioners should inject directly above the periorbital rim using their nondominant hand to exert pressure below the bony orbital rim, therefore preventing inferior diffusion into the eyelid (Fig. 25.4).

The use of higher concentrations of botulinum toxin within lower volumes also reduces the possibility of toxin diffusing to unwanted areas [12].

To prevent patient dissatisfaction, the injector should also carefully assess for an underlying eyebrow ptosis that is not initially evident. Frontalis muscle contraction naturally compensates for a droopy eyebrow; therefore, patients with frontalis compensation have pronounced static and dynamic rhytids along the forehead. If manual pressure is applied to the frontal aspect above the eyebrows, preventing the frontalis action, an underlying eyebrow ptosis can be revealed (Fig. 25.5).

Pearl

For patients who demonstrate significant frontalis flexion to compensate for eyebrow ptosis, avoid frontalis muscle injections completely, or be very conservative with the number of injected units (daxibotulinum, onabotulinum, or incobotulinum toxin A – 7.5–12 units total; abobotulinum toxin A – 20–30 units).

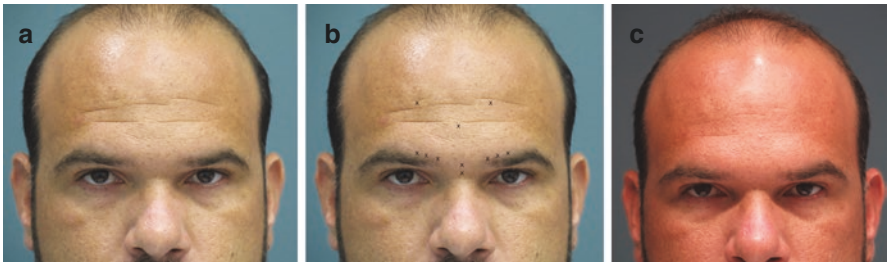

Fig. 25.5 In a male with low-set eyebrows, place glabellar injections close to the orbital rim. (**a**) Before treatment, (**b**) treatment injection markings, (**c**) after treatment

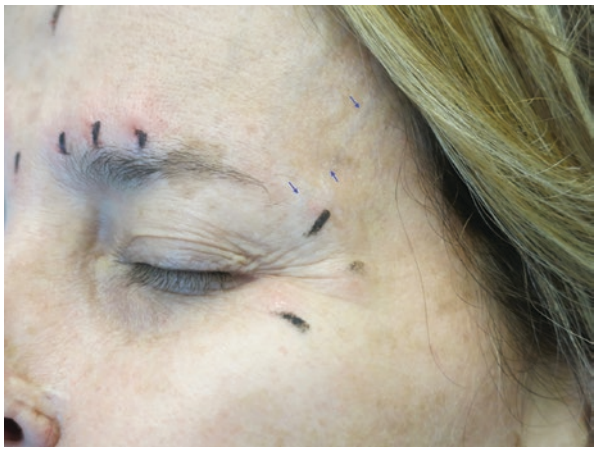

Fig. 25.6 To minimize ecchymosis, inject superficially in the periocular region, creating a bleb

Bruising

One of the most common adverse effects with botulinum toxin injection is bruising [10]. The incidence is variable and dependent on many factors; such as patient position [13] (ideally should sit in a chair reclined 30°), medication [14], and needle size (use of smaller 30 or 32 gauge needle) [13]. Looking for small vessels at the injection site is one of the most important factors to prevent ecchymosis, particularly at the lateral canthus where the skin is extremely thin and the veins more superficial [15] (Fig. 25.6).

Failure to Address Asymmetry

A common "complication" with neurotoxin treatments includes failure to correct asymmetry. Patients often present with expectations of softening or erasing expression lines, but hardly request that the injector correct – for example – a difference in

eyebrow position. By correctly evaluating patients, the practitioner can selectively individualize treatment, such that a more symmetrical and balanced face is achieved. The following examples depict patients who recruit a single brow, or other asymmetric patients, and how an irregular uneven pattern of injections will result in a better outcome (Figs. 25.7, 25.8, and 25.9). Often these injection sites include areas not noticed by the patient themselves, and demonstrate the artistic evaluation of an experienced injector.

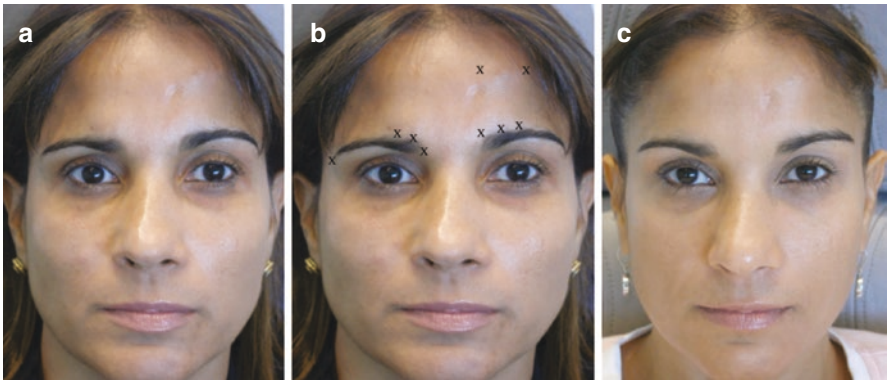

Fig. 25.7 Correction of asymmetry. (**a**) Before treatment, (**b**) treatment injection markings, (**c**) after treatment

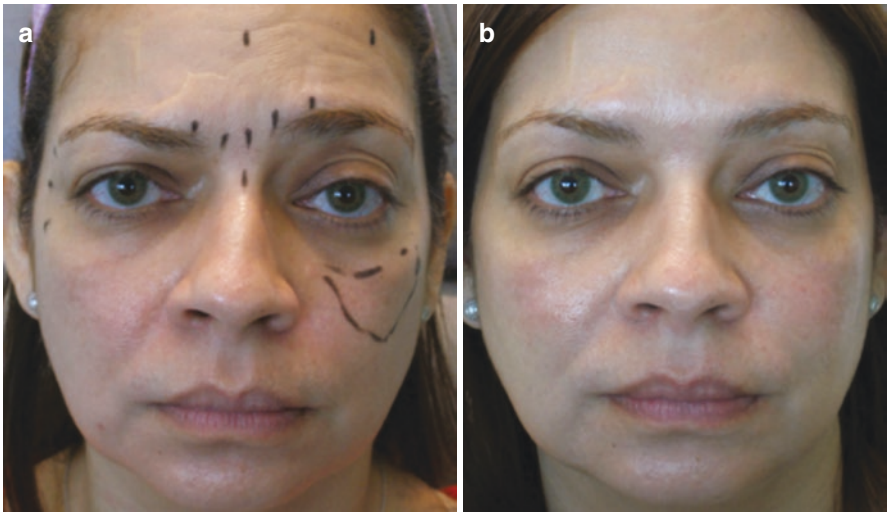

Fig. 25.8 Correction of asymmetry after trauma. (**a**) Before treatment, (**b**) after treatment

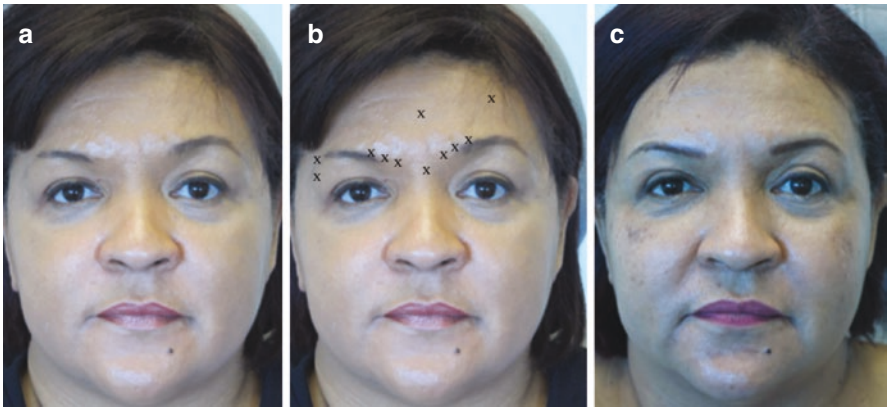

Fig. 25.9 Correction of asymmetry. (**a**) Before treatment, (**b**) treatment injection markings, (**c**) after treatment

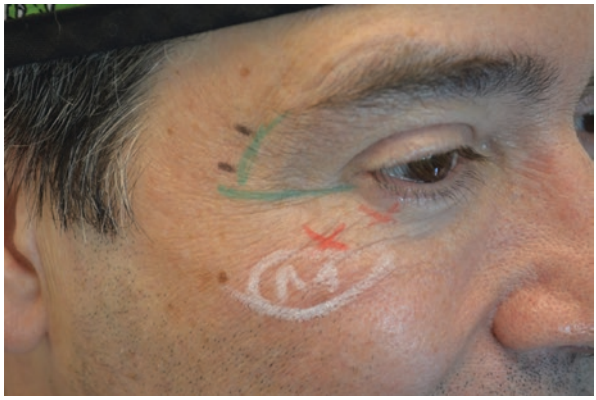

Fig. 25.10 To prevent worsening of dry eye symptoms, avoid pretarsal or preseptal orbicularis muscle injections below the lateral canthus

Dry Eye Worsening

A common side effect of botulinum toxin injections in the periorbital region is the exacerbation of dry eyes. To avoid worsening symptoms in a patient already suffering from dry eyes, ask if they are using any treatment or if they wake up in the morning with ocular foreign body sensation. Mild dry eyes should be treated with over-the-counter eyedrops and lubricants. If the injection is placed in the orbicularis oculi muscle, it can disrupt the eyelid blinking by weakening the muscle. Symptoms may escalate and turn into dry eye syndrome, if the neurotoxin treatments are not adjusted or discontinued [16]. Appropriate precautions include injecting the lateral orbicularis in no more than two to three sites, and avoiding injections in the pretarsal or preseptal orbicularis muscle in patients at risk (Fig. 25.10).

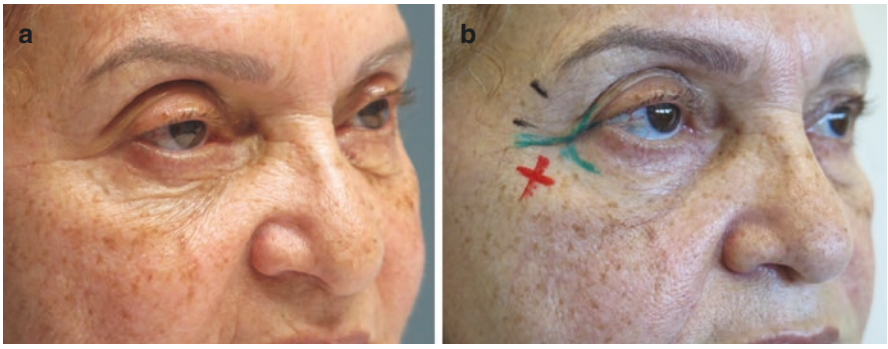

Fig. 25.11 Patient with malar edema. (**a**) Patient with malar edema or festoons, (**b**) avoid injections below the lateral canthus on patients with malar edema or festoons

Malar Edema/Festoons

Patients prone to chronic periocular allergies, upper respiratory tract conditions, sinus disease, apnea, cardiovascular disease, arterial hypertension, or high sodium content diets may experience lower eyelid/check edema or festoons. Patients should be asked prior to treatment if swelling often occurs at the check/malar area, and documentation with photographs is helpful. In these patients, minimize injections to the lateral orbicularis below the lateral canthus (Fig. 25.11).

Immune Complex Development

One of the rarest complications of botulinum toxins is the development of neutralizing antibodies that leads to secondary treatment failure [17]. The first reported case of antibody-induced failure of botulinum toxin type-A (BTX-A) in the aesthetic field was the case of a 20-year-old Korean woman with masseteric hypertrophy reported in 2007. After the fourth series of injections, the patient developed neutralizing antibodies and became unresponsive to BTX-A [18]. In 2014, there were five other reported cases of patients developing neutralizing antibodies to aesthetic BTX-A, with secondary treatment failure [19]. Although this issue is still rare in cosmetic botulinum toxin applications, due to low dosages and long injection intervals, it is relevant to educate patients of this possibility.

One of the most currently debated factors of immunogenicity is the presence, or absence, of complexing proteins that have no therapeutic purpose in botulinum neurotoxin agents. Currently used BTX-A products (Botox® Dysport®, and Jeuveau®) contain complexing proteins in order to better diffuse the neurotoxin and stabilize it against acidic conditions of the body [19]. In contrast, these complexing proteins are not present in Xeomin®, whose manufacturers claim that it is a critical factor in preventing immunogenic response risk [20]. Since these complexing proteins do not influence the clinical outcome, present studies argue that they "increase the

bacterial protein load and potentially increase the immunogenic risk of neutralizing antibody formation" [21, 22]. Further studies are necessary to better clarify the effect of complexing proteins in BTX-A formulations, since available studies have not included long-term results.

Diplopia

A transient and rare complication is diplopia caused by the spread of botulinum toxin injection to adjacent muscles. A possible cause of this complication is a greater volume of dilution when injecting for facial rejuvenation, creating a greater area of effect and potential toxin diffusion to the extraocular muscles [23]. Likewise, poor injection placement or a defective orbital septum may allow toxin to reach the extraocular muscles and trigger diplopia [24].

Eyelid Edema

There is very little literature regarding the development of periocular eyelid edema after botulinum toxin injection. One retrospective study reported that 0.04% (two patients) of 5310 injected patients developed eyelid edema [25]. The median duration of the eyelid edema was 15 days with a median onset of 5 days [26]. To minimize this, it is important to evaluate the function and tone of the orbicularis oculi and levator palpebrae superioris muscles before treatment, perform the eyelid winking/squeezing test, and adjust dosages and injection sites as needed [26].

Allergic Reaction

The first case of allergic reaction after onabotulinium toxin A treatment was reported by Rosenfield, Kardassakis, Tsia, and Stayner in 2014 [27]. It has been reported that patients with serious systemic reactions had received therapeutic doses of onabotulinium toxin A, ranging from 100 to 700 U, rather than the approved cosmetic dose of 20–44 U depending on the injection area [28]. If an allergic reaction occurs, systemic corticosteroids and antihistamines can be of benefit.

Flu-Like Symptoms

The most common flu-like symptoms after botulinum toxin injection are fever, cough, sore throat, diffuse myalgias, chills, malaise, anorexia, and headache [29]. Most reported cases occurred after therapeutic treatments, with an overall frequency between 2% and 16% [30, 31]. If this occurs, another toxin preparation such as abobotulinum toxin A or incobotulinum toxin A can be considered. Analgesics and/or antipyretic agents can also be used [30].

Headache

Headaches are among the most reported side effects after BTX-A treatment for glabellar lines (15.3%) [32]. The onset of headache is likely related to the injection procedure. Wu et al. [33] found that the proportion of subjects with headache was higher during the injector training period and that with more experience, the injection technique improved and the incidence of headaches decreased. The incidence of headaches also varied between studies, depending on the use of different BTX-A preparations [34].

Toxin Spread

Adverse reactions such as respiratory failure and death have been linked with a wide range of BTX-A doses, although none were attributed to cosmetic use [35]. The effects of BTX-A may extend beyond the limits of the desired muscle when a bolus is injected into the center of the muscle; however, when the total dose is distributed in smaller aliquots along the muscle, the biological activity may be contained within the target muscle [36]. Precise injection technique and proper dosages are important to prevent toxin spread, as muscular effects are dose-dependent [37].

Conclusion

Neuromodulators continue to be the most commonly performed nonsurgical cosmetic procedure in the world. The demand seems to grow every year among women and men, because it is precise, predictable, and complications are infrequent. However, the misconception is that everyone is capable of performing the procedure equally. In my opinion, specialists with core cosmetic experience are the ones with ideal training and expertise to deviate from the "standard pattern of injections" to obtain the best treatment outcomes.

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Filler Complications

26

Morris E. Hartstein

Introduction

The use of dermal hyaluronic acid (HA) fillers in the face, and in the periocular region in particular, continues to grow tremendously. In recent years, there has a been a rapid growth in the number of people performing filler injections, coupled with rapid growth of the filler market. There are currently no less than 160 filler products on the market, including some products with less than optimal quality control. With this increase in the number of injectors, across all specialties as well as non-physician injectors, comes an increasing number of complications. Thus, it is imperative for any filler injector to be well-versed in preventing and managing filler-related complications.

While many filler complications are universal all over the face, this chapter will focus on those complications that are more relevant to the periocular region. Many excellent reviews are available for general prevention and treatment of filler complications [1, 2].

As with any set of complications, the best treatment is prevention, and this applies especially to the periocular region. For those who would like to start incorporating filler injections into their practice, the first tip is to obtain good training. There are a multitude of company-sponsored seminars and evening courses. While the company-sponsored courses can be very informative, many injectors may feel emboldened to start injecting after a brief 3-hour evening course, complete with an "official" certificate and a discounted starter kit of fillers. Ideally, a beginning injector should spend a good deal of time at courses, observe an expert injector, and then transition to supervised injections by an experienced colleague. Finally, for the novice injector, the periocular region may be the least forgiving area to inject; therefore, it is better to start injecting in the nasolabial folds and cheeks where lumps are less likely to be noticeable.

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The next tip is to know the anatomy in detail, as well as relevant variations of anatomy. The periocular region may be the least forgiving area of the face to inject because of its anatomy. It is imperative to understand the anatomy of the tear trough which has very little, if any, subcutaneous tissue compared to other facial areas. Tear trough injections should therefore be in the pre-periosteal plane, as there is no subcutaneous tissue into which to inject. This will in turn influence both the choice of filler (usually lower G') and the quantity of material injected. Less is more. Often, seemingly miniscule amounts will suffice in the tear trough, where they would not otherwise have any effect elsewhere on the face. In addition, injecting larger volumes in this region will often result in more edema and Tyndall effect later. It is more prudent to inject small amounts, often to less than complete filling of the fold, and have the patient return in a month or more at which point more filler can be placed if desired.

The next tip is to know your choice of filler. There are over 160 different filler products on the market now. All have their own unique properties in terms of elasticity, viscosity, and firmness. Understanding these properties will enable proper filler selection based on the region of the face and the patient's anatomy. Filler properties will also be critical in determining at what tissue depth to inject. Fillers that are made to be injected deep on the periosteum or in the cheek region would likely not be appropriate for use in the eyelids.

Although all intricate details of filler science may not be easily understood, it is crucial for injectors to know the basic concepts of filler composition. In addition, it is also important to maintain a small, but healthy dose of skepticism. Beware of the newest and greatest fillers with grand promises. Furthermore, most filler companies introduce or create new terms to describe their cross-linking process. These terms are invented by the companies and are descriptive—but they are not hard-core, evidenced-based, universal scientific principles.

Patient Considerations

Finally, very careful patient selection is critical. In general, patients should be screened for skin diseases, inflammatory conditions, remote site infections, autoimmune diseases, allergies, and expectations. If the patient has had previous eyelid surgery, this may impact how the filler flows, as there may be fibrosis that may result in irregular lumps or necessitate higher injection pressures for placement.

In addition, people these days have often undergone multiple injections to their face with different materials. In general, the less biodegradable material is, the more likely it is to incite a reaction. Reactions may not manifest initially, but present only after injection with a second agent, such as HA. An enormous advantage of the HA class of fillers is their reversibility. In addition, if HA filler is layered over an existing non- or less-biodegradable filler, this also increases the likelihood of developing an adverse reaction or event.

Unfortunately, as many patients have been injected for years with various products, they often will not recall which materials are in their face. Patients undergoing dental procedures appear to be particularly at risk and should avoid undergoing filler injections at the same time as dental treatments.

As with any procedure, patient expectations must be considered. Besides the usual pre-injection consultation, two important aspects must be considered— what features the patient seeks to improve and what features the physician observes. The patient should be engaged in the treatment plan and asked to describe their face and periocular region to help the physician understand what bothers the patient the most. But there may be additional areas that the patient is unaware of that could benefit from volume augmentation, and these should be pointed out for optimal results. For example, many patients do not realize the impact of periorbital hollows on the general facial appearance. Many patients first notice a deepening nasolabial fold, but fail to recognize other areas, such as the cheeks, that could benefit even more from filler. Of course, realistic expectations of what can be accomplished with a certain volume of material must be made clear before any treatment, as multiple syringes may be needed.

Many filler companies are publishing inject-by-number maps of the face to guide treatment. While these can be useful initially, one should avoid becoming a "cookbook" injector and just automatically following the same numbers for each patient. One should have an artistic sense, looking closely at the face for hills and valleys that create varying shadows.

Finally, it is crucial to remember that not all lower eyelid hollows or tear troughs are the same. An ideal patient presenting for lower eyelid filling will have thick, tight skin and a short and shallow tear trough (Fig. 26.1). These are patients where it is easy to achieve an excellent outcome with a small quantity of material. It becomes more challenging when the overlying skin is thinner or the tear trough is longer and less shallow (Fig. 26.2). Good results can still be achieved in these patients, but more care must be taken. This may manifest itself in choosing a lower G' filler and spreading the injections over two to three sessions. Some patients will have deep tear troughs, across the entire length of the inferior orbital rim, along with midfacial deflation (Fig. 26.3). Injecting filler in these patients should focus on placing more material in the midface than the actual tear trough.

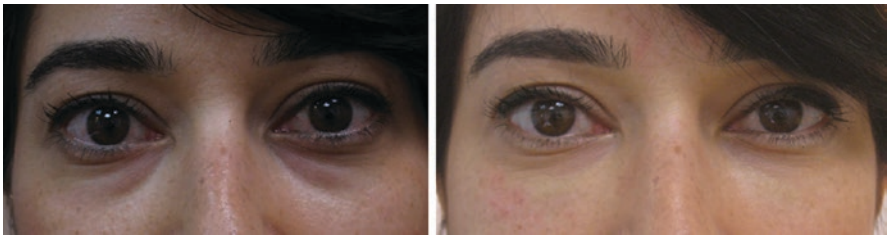

Fig. 26.1 Short, shallow tear trough with thick skin—ideal for filler correction

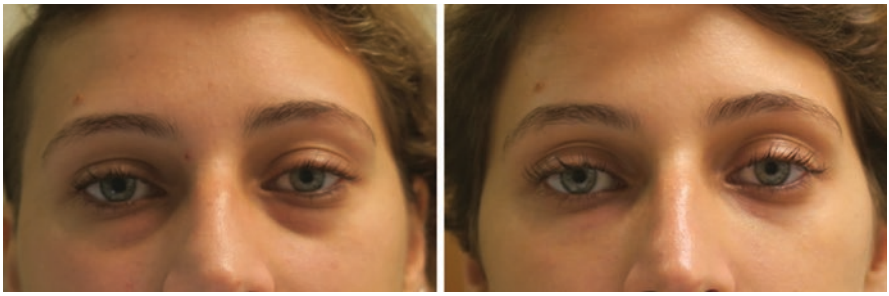

Fig. 26.2 Longer tear trough, thinner skin—more challenging for filler correction

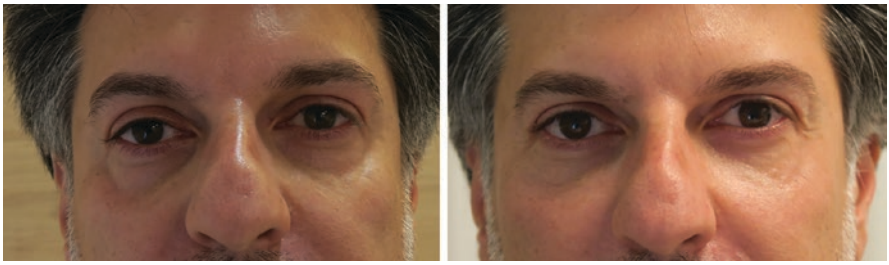

Fig. 26.3 Deep and extensive hollowing across the entire rim with midfacial volume loss. Filling should focus on the midface

Safe Injection Techniques

Much has been written about tips for safe injection. There are recommendations about aspiration before injection to watch for a blood flashback in the needle hub, constant movement of the needle or cannula to avoid placing large volumes in one spot, and small-bore needles to allow for more precise filler placement. There is also debate on whether it is possible to penetrate a vessel with a cannula. When using cannulas, I recommend using a size 25 gauge or a larger 22 gauge. While there is not uniform consensus on these issues, safe injection technique includes injecting slowly under low pressure and placing small aliquots of product per injection site [3–6].

Complications

Most commonly, *minor bruising and swelling* may occur following filler placement. *Allergic reaction* or *delayed hypersensitivity* to the product may occur.

Nodules or granulomas can appear in the periocular region just as in other areas of the face (Figs. 26.4 and 26.5). When a nodule appears after filler injection, it most likely has an infectious component, possibly related to biofilms. Early treatment

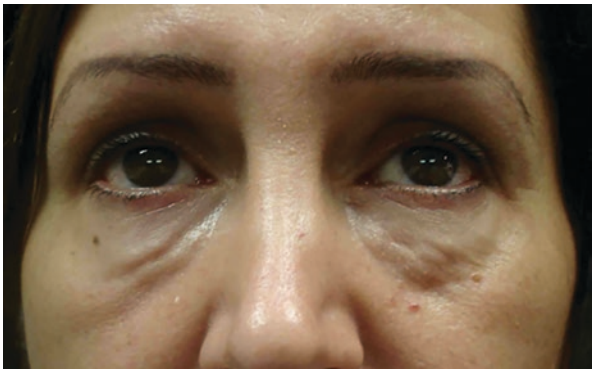

Fig. 26.4 Nodules seen 3 years after injection

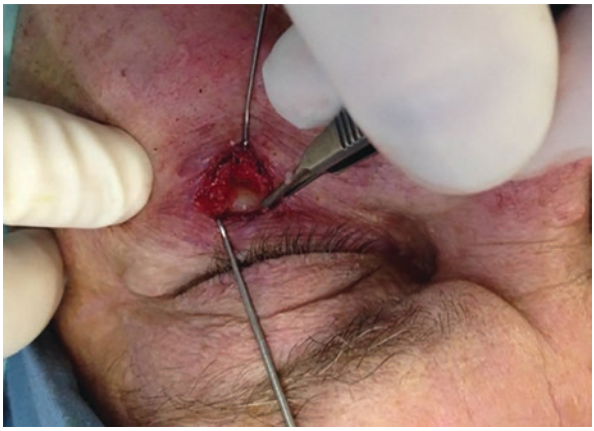

Fig. 26.5 Excision of a hyaluronic acid-induced nodule

should include antibiotics such as ciprofloxacin, levaquin, or clarithromycin. Intralesional steroids may be considered later in the course. Some nodules may be recalcitrant to medical treatment and ultimately require excision. Although some filler types may be thought to be more prone to nodule formation, any fillers can lead to nodules.

One of the most feared complications of any filler injection is *vascular compromise*. The treatment of a vascular event begins with a low threshold of suspicion. Vascular events may present as pain and skin color changes (*blanching* or lacelike bluish purple mottling *livedo reticularis*), often remote from the injection site. Any suspicion of an occlusive event mandates immediate treatment. It is critical for the physician, staff, and patient to understand that these signs may present commonly in the first 24–48 hours after injection, and therefore if a patient calls the office with such concerns, they should be seen urgently. Immediate maneuvers should include warm compresses, massage, and aspirin. The hallmark of treatment for vascular compromise/necrosis of the facial tissues is repeated, high-dose hyaluronidase injections. However, some reports suggest that more severe tissue destruction may occur if the smaller embolus fragments travel distally and occlude additional vessels.

The most serious complication of vascular compromise from filler injection is *blindness* from *central retinal artery occlusion* (CRAO). Fortunately, blindness from periocular filler injections appears to be a rare occurrence. Recently, there has been much discussion in the literature regarding the treatment of blindness from filler injections [7–10]. In the case of immediate visual loss, the first step is to stop the filler injection. Other interventions that may help include ocular massage, rebreathing (paper bag), oral aspirin, and referral to an ophthalmologist for possible anterior chamber paracentesis. At a hospital, IV acetazolamide may be given, and retrobulbar hyaluronidase injection can be considered. However, despite much discussion of retrobulbar hyaluronidase injection in the literature and at conferences, there are currently no evidence-based studies that support this as helpful. Animal and cadaveric studies have not demonstrated reliable resolution of a filler-induced retinal artery occlusion with use of hyaluronidase. However, in the face of a catastrophic complication, it can be considered in the hands of an experienced physician, although globe perforation and other risks should be carefully discussed.

Finally, there are some filler complications that may be unique to the periocular region. We have reported on the appearance of *xanthelasma* in the lower eyelid region after filler injection [11]. This can occur with different types of filler and is distinct from the yellow hue that can be seen after fillers such as Radiesse® which usually resolves in time. Xanthelasma formation after filler injection is thought to occur secondary to macrophages reacting to the filler as a foreign body. Once present, filler-induced xanthelasmas are very difficult to treat. They respond only partially to laser treatment. Direct excision can be complicated by significant fibrosis caused by the material. Since the publication of our report, more cases have been noted; therefore, it is likely that xanthelasma secondary to fillers is more prevalent and currently underreported (Fig. 26.6). However, it is still unclear whether this finding is technique or product dependent.

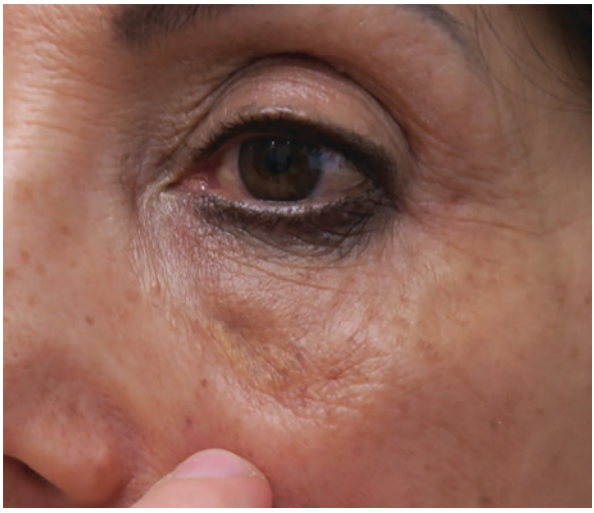

Fig. 26.6 Xanthelasma noted after hyaluronidase injection

Fig. 26.7 Lower eyelid edema appeared 1 year after tear trough filler injection

Another complication unique to the periocular region is *late-onset edema* that can occur in the upper and lower eyelids [12]. This is to be distinguished from the acute-onset edema seen shortly after injection, particularly in the tear trough. It is also different than the Tyndall effect bluish edema, often related to poor injection technique, superficial filler placement, thin eyelid skin, poor filler choice, or a combination. Late-onset edema in the periocular region can occur months to even many years later (Fig. 26.7). This condition is often misdiagnosed and the patient subjected to extensive workups, including imaging. Often the patient does not associate the edema/fullness with a remote filler injection years prior and will believe it is aging fat that requires a cosmetic blepharoplasty or more injection. Filler injections are now so commonplace that any patient presenting with periocular edema should be suspected of having had filler treatment even if the patient does not recall or if the injections occurred even 5–10 years before. We reported cases of similar patients who presented with delayed-onset lower eyelid edema that demonstrated hyaluronic acid material on excisional biopsy.

If a patient does present with late-onset periocular edema (most commonly in the lower eyelid), the treatment of choice is injection with hyaluronidase (hyalase). In our study, over 90% of patients had full resolution of the edema after one hyaluronidase injection. It is important to counsel patients that the eyelids will likely return to their pre-filler state following hyaluronidase injection. Since the initial filler treatment may have taken place years prior, the patient may be surprised at their appearance following hyaluronidase, which can lead to significant patient dissatisfaction and blame for the physician who injected the hyaluronidase. Proper counseling can avoid this unpleasant situation, and the patient can be scheduled for reinjection with soft tissue filler as early as 2 weeks later.

We believe that meticulous injection of the lower eyelid/tear trough region can lead to good, long-lasting results, without the development of subsequent edema. Injections in the tear trough, as outlined above, should use lower G' products, small aliquots, pre-periosteal placement, and less overall product directly into the tear trough. Injecting more inferiorly and laterally in the cheek can minimize the amount of filler needed in the actual tear trough.

Finally, we have observed several cases of apparent *filler migration to the orbit* [13–15]. It is unclear if this was true filler migration or inadvertent/unknown direct injection. However, we have now treated several cases of filler that ended up in the orbit after injection at a more remote site, such as the jawline, cheek, or nasolabial fold (NLF). One case occurred after filler injection to the NLF, causing a massive foreign body reaction in the orbit that did not respond to hyaluronidase or steroid injection. Ultimately, the mass was excised via an orbitotomy and confirmed by histopathology to be filler material. It may be that the orbital septum does not provide a strong enough barrier to prevent migration. This may be yet another aspect of filler injections that should be included in the informed consent.

Conclusion

Periocular filler injections are extremely rewarding and even an isolated injection in this area can produce a "wow" effect for the patient. Because of the unique anatomy in this region, proper patient selection and planning is crucial. It is equally important to know how to recognize complications in the periocular area, as well as to know how to treat them should they occur.

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Complications Related to Lasers and Energy-Based Devices

27

Julie Woodward and Anna Ginter

Abbreviations

AFB	Acid-fast bacilli
BBL	Broad band light
CO2	Carbon dioxide
Er:YAG	Erbium:yittrium aluminum garnet
HQ	Hydroquinone
IPL	Intense pulsed light
MRSA	Methicillin-resistant *Staphylococcus aureus*
OSHA	Occupational Safety and Health Association
PIH	Postinflammatory hyperpigmentation

Introduction

Laser skin resurfacing was pioneered in the early 1980s. The first laser used for cosmetic rejuvenation was carbon dioxide (CO_2) after it was noted that perioral rhytids improved after laser treatment for actinic cheilitis [1]. This laser has been and is still used extensively by surgeons to improve the periocular area. For years, ablative treatments with CO_2 and also the Erbium:Yittrium Aluminum Garnet (Er:YAG) were the mainstay of treatment for skin rejuvenation. Since then, a wide variety of nonablative lasers and other energy-based devices such as intense pulsed light, radiofrequency, plasma resurfacing, and microfocused ultrasound have been developed to help rejuvenate the skin. A variety of complications have been found to occur from these devices.

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Because these devices have the ability to do severe damage to the skin and eyes, the surgeon must be prepared to recognize and manage complications.

The following complications will be discussed in this chapter:

1. Scar
2. Infection
3. Ectropion
4. Pigmentary changes: hypopigmentation or hyperpigmentation
5. Contact dermatitis
6. Acne
7. Milia
8. Ocular injury
9. Others: staff injury, fire, anesthesia toxicity

Scar

The basic anatomy of the three main layers of the skin are the epidermis, the papillary dermis, and the reticular dermis. The rete pegs interdigitate between the papillary dermis and reticular dermis and host the microvascular blood supply to the skin. Damage to the deep papillary and reticular dermis can result in a scar [2]. This can occur with excessive heat due to too vigorous a treatment of a device, an infection, severe contact dermatitis, or areas where skin can fold over on itself such as lower eyelid creases or the intertriginous folds on the neck.

During fully ablative laser resurfacing, the epithelium is 100% removed. The reservoir to replace the epithelium comes from deep in the appendages (hair follicles and pores.) The re-epithelialization process takes about 7 to 10 days for a fully ablative laser [3]. During this time, the surgeon must follow the patient closely to watch for any signs of infection or contact dermatitis that could lead to a scar.

The surgeon should also be aware that the angle of the jaw and neck has much fewer appendages than the central areas of the face, so it is prone to scarring (Fig. 27.1). A lighter laser application should always be applied to the angle of the jaw and the neck.

If there is evidence that the appendages have been damaged and that a scar is forming, steroids, scar gels, and lasers may be used to treat it [4]. Keloids are very rare on the face, but hypertrophic scars can occur. Atrophic depressed scars are more difficult to correct, and may require additional subcision, filler augmentation, and skin resurfacing, although suboptimal results are typical (Fig. 27.2).

Very dilute steroid injections can be injected into scars to slow down the inflammation and fibroblast proliferation. Kenalog or dexamethasone less than 5 mg/ml is recommended. Botulinum toxin injections injected to the surrounding muscles have also been proven to minimize the formation of scars by minimizing tissue movement and skin traction [5].

Scar gels and silicone sheeting have also been shown to minimize scars [6]. The FDA considers a scar gel placed on a wound less than 10 days old to be considered

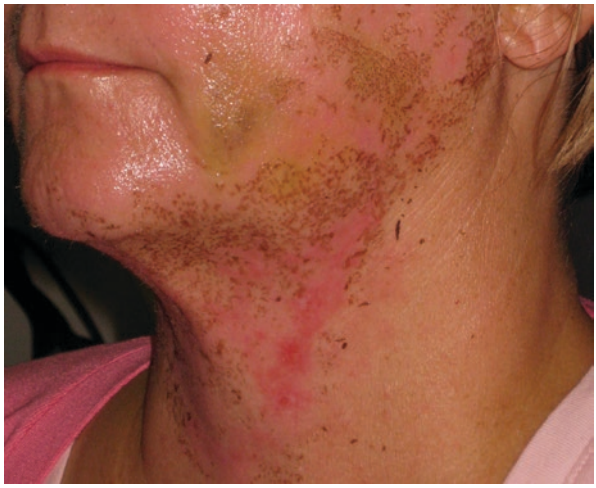

Fig. 27.1 Irritation that created prolonged erythema along the intertriginous fold on the neck during sleep after treatment with a fractional CO_2 laser with a 300 micron spot. Note delayed healing along the jawline where only 1 pass was applied compared to the perioral area where 3 passes were applied. This delayed healing and propensity to scar along the neck and jawline are due to less dermal appendages to facilitate healing

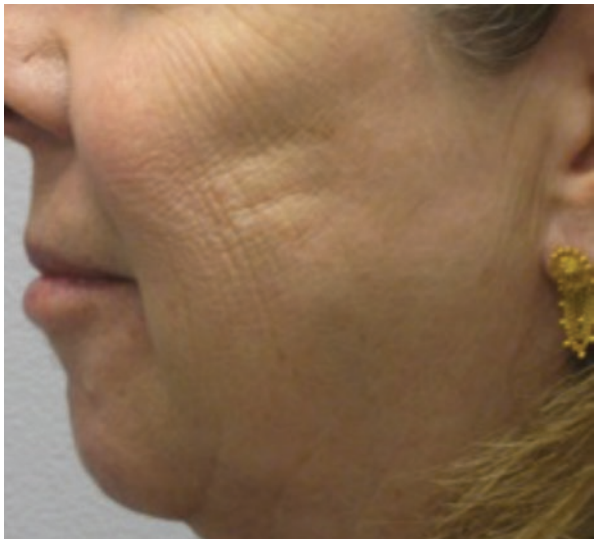

Fig. 27.2 Two linear horizontal depressed scars after too vigorous accumulation of heat with microfocused ultrasound. This can be avoided by not pulse-stacking the energy bursts

a medical device. Very few companies have had their gels approved as medical devices. Patients often ask about vitamin E, but topical application of this has actually been shown in some studies to increase inflammation and worsen scars [7]. Silicone sheets can be cut to the shape of the scar and applied to the area for several hours a day to minimize scar formation.

Once a scar has clearly formed and is epithelialized, it is usually erythematous for several months before it finishes the contraction phase and turns white. During this phase, vascular lasers, such as the 532 nm, of pulsed dye lasers may be used to decrease the vascular supply to the scar and encourage improvement [8].

Infection

Any laser or energy-based device that creates an open wound in the epithelium has the potential for an infection to occur. The surgeon should be aware of the potential for viral, bacterial, or fungal infections. Proper sterile preparation with removal of all makeup before any procedure is standard.

Full-face laser resurfacing patients should be prophylactically treated with antivirals to prevent herpes simples or zoster dermatitis, as this is thought to reduce the infection rate three-fold [9]. Despite prophylactic herpes infections occurring in 2–7% of cases of ablative laser, these can also occur in nonablative treatments [10]. Prophylactic antiviral medications can be started the day before the procedure and taken until the skin is re-epithelialized, usually at day 10. Nonablative treatments will heal faster and may only require 5 days of antiviral treatment. Periocular laser alone does not require prophylactic treatment unless the patient has a strong history of recurrent herpes breakouts. Valtrex ® 1000 mg per day is sufficient for prophylaxis, with the instruction to double to 2000 mg per day if the patient feels a lesion is breaking through.

Bacterial infections are rare but could potentially leave devastating scars. They occur in 0.1% to 4.5% of ablative laser cases [11, 12], presenting with pain, focal erythema, exudate, and crusting. Cultures should be obtained and the patient promptly treated with broad-spectrum antibiotics until the organism is identified.

To attempt to prevent infections after ablative lasers, frequent soaks with 1 cup distilled water to 1 teaspoon of distilled white vinegar can be used every 2 hours until all crusting is gone. This continuously exchanges the protective barrier ointment so that bacteria do not have a chance to colonize. Nonablative treatments do not require soaks, but are still a good idea for procedures that have open wounds such as microneedling.

Preoperative antibiotics are not required, but often prescribed at the discretion of the physician. One report showed that antibiotics actually disturbed the normal flora and increased the chance of infection [13]. The hallmark of a bacterial infection is localized pain. methicillin-resistant *Staphylococcus aureus* (MRSA) classically presents with painful, caramel-colored crusts (Fig. 27.3). Oral BactrimDS® and doxycycline can be used and a consultation with an Infectious Disease specialist should be considered.

In recent years, the most challenging infection has been atypical mycobacterium/acid-fast bacilli (AFB). This bacterium tends to grow in cold dark moist environments such as in water pipes and ice machines [14]. It began rising in Europe several years ago and has been an increasing problem in the US water supply as well. There are over 200 subtypes of AFB. Atypical mycobacterium (AFB) infection is typically delayed in onset, presenting at sometimes 5–6 weeks after surgery. They may appear as small 1 mm pustules with surrounding erythema, and therefore often confused with small granulomas or milia (Fig. 27.4). It can be diagnosed with biopsy, but treatment depends on culture to determine the type of AFB involved. The lab should be made aware that a special culture for AFB is needed, such as Middlebrook agar; otherwise, normal flora may overgrow the culture plate. The

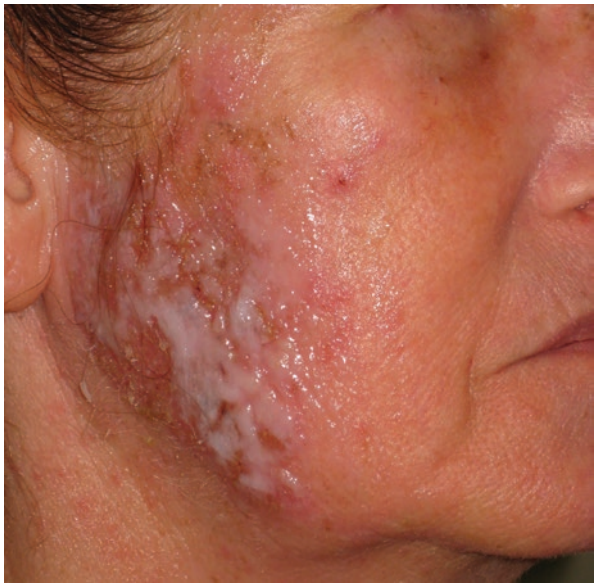

Fig. 27.3 MRSA infection presenting with caramel colored crusts and pain. Topical Bactroban ointment (mupirocin) was applied. This infection healed with no scarring after treatment with both doxycycline and Bactrim DS for 10 days

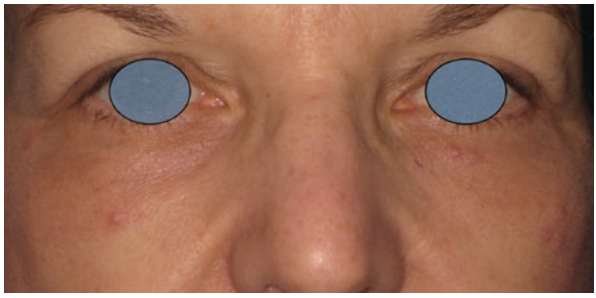

Fig. 27.4 Presentation of acid-fast atypical mycobacteria 5 weeks after laser treatment. These can be confused initially with milia

bacteria can take up to 42 days to grow. Therapy requires 4–6 months of antibiotics that must be managed by the Infectious Disease specialist.

Fungal infections are very rare, especially with good hygiene. They may present as white plaque-like lesions in the perioral area 7–14 days after laser [3]. The most common etiology is *Candida*. After cultured, they can be treated with Diflucan®. The Infectious Disease team can be helpful with management in these cases.

Ectropion

Ectropion occurs when scarring causes severe contraction of the anterior and middle lamella. Overall, it is reported to occur transiently (<4 month) up 3% of patients and permanently up to 2% of patients undergoing ablative laser therapy and in the periorbital region [9]. Prevention is the best technique to avoid cicatricial ectropion, as mentioned in the previous sections. A good balance between

tightening enough to soften rhytids but not aggressively contracting the lower lid skin must be achieved.

With ablative lasers, a feathering technique is used where the first pass is applied from the subciliary line to the festoon or malar eminence. The second pass is placed from beneath the tarsal plate to about 5–10 mm above the inferior border of the first pass, and then if a third pass is placed, it is localized mainly over the festoon. A single pass just below the punctum is important to avoid epiphora from cicatricial punctal eversion.

If ectropion is severe enough that there is scleral show or the eyelid margin does not oppose the globe, then a full-thickness skin graft with a tarsal strip may be necessary. Daily upward massage can improve the situation in some cases. A posterior graft with cartilage or a banked biocompatible product may be helpful as well. Upper eyelid skin is the best match for a skin graft, but often, these patients have had an upper blepharoplasty, so there is no available matching donor site. Using the skin from the far lateral upper eyelid extending into the temple is the next best match in this scenario.

Pigmentary Changes

Hyperpigmentation and hypopigmentation are risks of any laser or energy-based device. Hyperpigmentation is fairly common with an occurrence rate of up to of 32% [12]. It is distressing to the patient, but usually resolves with time and patience. Sunscreen is important for all patients undergoing laser treatments. Hypopigmentation is rare with proper technique, and it is due to mild fibrosis and scar.

Postinflammatory hyperpigmentation (PIH) should be on the consent form for all laser patients. Those with Fitzpatrick Skin Type 3 or darker are at increased risk, although it may occur in all skin types. All laser surgeons should be familiar with the topical and oral agents to treat it. PIH usually begins at about 3–4 weeks post treatment. Current popular compounds and their mechanism are listed in Table 27.1.

There are many topical agents that are used to decrease skin pigmentation. They work as skin lighteners or as topical bleach. The lightener action is either to prevent new melanin production, or to block the transfer of melanin from the melanocyte to the keratinocyte. Common over-the-counter compounds include hydroquinone (HQ) 2%, licorice extract, retinol, kojic acid, ascorbic acid, arbutin, tranexamic acid, cysteamine 5%, and beta-carotene, among others [15].

Lignin peroxidase is the only topical compound that can break up existing melanin in the keratinocyte via a 2-step application. After the lignin peroxidase is absorbed, a weak alcohol (hydrogen peroxide) is applied on top of it to create an enzymatic reaction that breaks the melanin into nontoxic compounds that are carried away. As the skin surface returns to normal pH level of approximately 5.5, the enzyme reverts to an inactivated state.

Prescription topical medications include HQ 4%, Tretinoin, azelaic acid, HQ + tretinoin + steroid combinations, or Kligman's solution (combination of

Table 27.1 Compounds to treat hyperpigmentation and their mechanisms

Proposed mechanism of action	Compound
Tyrosinase inhibition	Hydroquinone, mequinol, azelaic acid, arbutin/deoxyarbutin, licorice extract, rucinol, reservatrol, 4-hydroxy-anisole, 2,5-dimethyl-4-hydroxy-3(2H)-furanone, N-acetyl glucosamine, tetrahydrocurcumin (turmeric), kojic acid, niacinamide, cysteamine
Stimulation keratinocyte turnover	Retinoids, HEPES (hydroxyethylpiperazine ethane sulfonic acid)
Reduction melanosome transfer	Retinoids, soybean trypsin inhibitor, niacinamide B3
Interaction with copper, anti-inflammatory	Kojic acid, ascorbic acid
Inhibition of melanosome maturation	Arbutin/deoxyarbutin
Inhibition of protease-activated receptor2 in keratinocyte to accept melanin	Soybean trypsin inhibitor
Inhibition of plasmin, which blocks PGE and AA	Tranexamic acid
Reduction of α-melanocyte-stimulating hormone-induced melanin production	Beta-carotene
Enzymatic breakdown of melanin	Lignin peroxidase

HQ + vitamin C, tretinoin + triamcinolone). Physicians should be aware of the risks of using these agents as well, such as malignancy, adrenal complications, ochronosis, and risk during pregnancy.

In recent years, oral tranexamic acid 325 mg PO QD or BID has gained popularity to improve PIH and melasma [16]. The FDA indication is to treat menorrhagia and hemophilia with doses of 1000 mg to 4000 mg, while the aesthetic dose for pigmentation is significantly lower. In the 1980s, it was noted to improve pigmentation. Patients considered for this therapy should be first screened for risks for deep vein thrombosis (DVT) and pulmonary embolism.

PIH is extremely stressful for the patient and improvement is slow, usually 4–6 months. The use of a reflectometer such as the Mexameter® or the handheld Dermacatch® can be helpful to document objective measurements that can be encouraging for the patient during this process [17].

Contact Dermatitis

Contact dermatitis is caused by delayed type 4 hypersensitivity reaction that usually presents on day 4 or 5 after using a topical product or ointment. If severe, this has the potential to scar facial tissues. A history of itching when wearing wool sweaters can be a contraindication to using a barrier ointment that contains lanolin. In general, bland ointments with minimal ingredients are the best way to avoid

contact dermatitis in the immediate postprocedure period, as substances normally well tolerated on the skin surface may now trigger contact dermatitis. Use of any ointment before re-epithelialization is complete (usually 10 days) may produce contact dermatitis in as many as 10% of treated patients [9]. If contact dermatitis occurs, immediate cessation of the product and replacement with topical petroleum is advised. An oral prednisone taper will quickly reduce the inflammation and make the patient feel better quickly. Patients often present with a fear that they have an infection. Bilateral involvement, itching, and lack of pain are signs that distinguish this from infection.

Occasionally, a patient may develop prolonged erythema after an episode of contact dermatitis. Topical steroids or L-ascorbic acid may help it resolve. Oral steroids and either IPL or 590 LED light therapy may help with more severe cases, but over time, typical cases generally are self-limiting.

Acne

An acne flare is not uncommon, reported in up to 80% of patients after laser or energy-based device treatment, due to disruption or occlusion of follicles with barrier ointments [18]. A course of oral doxycycline 100 mg PO BID is usually a successful treatment.

Milia

Milia often occur a few weeks after a laser treatment in about 14% of patients [18]. They can usually be unroofed and expressed with a 25-gauge needle followed by a single dose of topical antibiotic with good resolution. If they are inflamed and do not resolve easily, a diagnosis of atypical mycobacteria should be considered (Fig. 27.4).

Keratoacanthoma

Rarely, a keratoacanthoma may arise about 1–2 months after laser. This can spontaneously resolve or be removed by the surgeon for pathologic diagnosis [19].

Recall Phenomenon

Focal areas of edema can form weeks after ablative or nonablative procedures. It can be triggered by heat and is sometimes noted when the patient takes a shower. Recall phenomenon is due to a histamine/mast cell mechanism, and usually resolves in 48 hours without sequelae [20].

Delayed Petechia or Purpura

This may occur days to weeks after a laser procedure [21]. The tight junctions between forming cells are initially very weak, so mild abrasions to the skin may result in bruising. The patient may be alarmed, but can be assured that these will self-resolve.

Ocular Injury

CO_2 and erbium lasers are absorbed by water and therefore have the potential to penetrate or perforate the cornea, thus causing an open globe [22]. Proper steel eye shields should be inserted to prevent this. If such an injury occurs, the wound should be examined in a slit lamp with fluorescein dye to check to see if it is Seidel positive, that is, leaking aqueous fluid out of the wound. If so, an anterior segment surgeon may need to glue the wound or place a suture in the defect. Vision loss due to severe astigmatism can occur if a suture is placed. It is critical to close such wounds quickly to avoid endophthalmitis.

Intense pulsed light (IPL) and broad band light (BBL) should also always be used with eye shields. The provider should be aware that many of the wavelengths emitted are absorbed by pigment in the iris and choroid. IPL and BBL light spreads in a more diffuse manner than a laser where the rays are unidirectional, because they are coherent. Inadequate eye shields may fail to protect the eyes as IPL and BBL light diverges. This can cause a perforation of the iris, corectopia, or choroid and retinal injury [23] (Fig. 27.5). This is often accompanied by iritis, uveitis and can be complicated by glaucoma in the long term. These injuries need to be treated by an ophthalmologist.

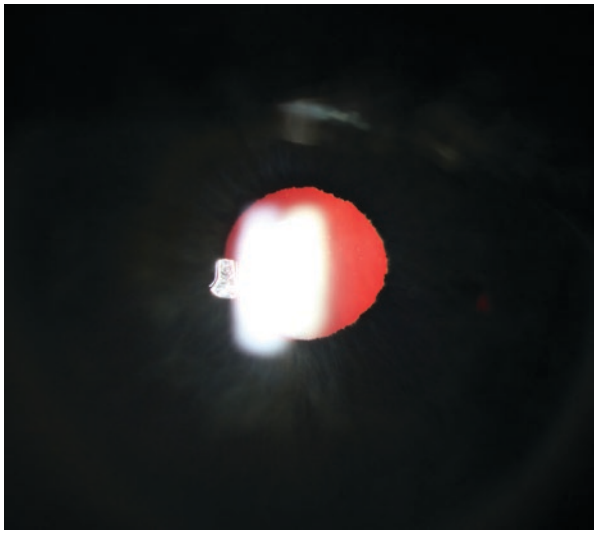

Fig. 27.5 A full-thickness iris defect at the 3:15 clock position occurred after treatment with IPL with no ocular shields placed. The patient awoke at 3 AM with severe aching pain due to iritis. Topical steroids resolved the iritis

Treatment to the cheeks and even directly to the eyelid margin for dry eyes has been popularized in recent years. One company provided a special small spot size and high-quality gold eyelid shields to protect the eye during lid margin treatments; however, the surgeon should always remain vigilant.

Other Risks

The occupational Safety and Health Administration (OSHA) outlines standards for laser safety to protect the patient and staff. Fire prevention includes wet drapes, aluminum foil to protect the patient during ablative lasers. No supplemental oxygen should be used. A warning sign on the door warns others that a laser procedure is taking place. Eye lenses that are labeled for protection from the specific wavelengths of the laser being used are required for all staff as well as patients. Risks of anesthesia toxicity should also be considered from injectable anesthetics as well as topical. Anesthesia toxicity may present with agitation, anxiety, light-headedness, palpitations, and nausea. Use of a cardiac monitor during longer painful procedures is prudent. Topical anesthetics should be applied in the office rather than given to the patient to apply at home, and only small surface areas should be covered. This is particularly true given the reports of systemic toxicity and four deaths associated with topical anesthetic preparations, especially when used under occlusion with laser procedures and on large areas for laser procedure [24].

Conclusion

Although lasers and energy-based devices can provide significant aesthetic results, they can also cause severe damage to patients and staff. The regulations on who can perform these devices are set by individual states. Some states lack rigid qualifications, allowing users with minimal education and training in patient care to perform operations using such devices. Physicians seeking to hire such extenders should ensure that proper training to avoid such complications is prioritized.

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Psychological Management of the Unhappy Post-blepharoplasty Patient

28

Robert A. Goldberg and Karyn S. Goldberg-Boltz

Introduction

One of the most difficult challenges in aesthetic surgery is dealing with the unhappy postoperative patient. Unhappy patients are unpleasant in any field of medicine. Surgeons by and large are perfectionists, deeply engaged and heavily invested in their work, and immersed in the responsibility of getting the best possible result for their patient. Therefore, we are disappointed and personally affected by any patient who is unhappy with their result. But I believe that in aesthetic surgery, the stakes are particularly high. The patient doesn't start out with a life-threatening problem: they typically come in healthy. Their expectations are high. They have paid a lot of money out of pocket and therefore feel entitled to a good result. Therefore, when things go awry in the postoperative course, the stage is set for a very bumpy ride. The surgeon must be most masterful in order to guide the patient through this part of their journey, and achieve as good a result as possible both physically and psychologically.

There is another aspect to the aesthetic surgery patient. In medicine, we are trained to achieve objective outcomes. In ophthalmology, this is very seductive, because we can measure outcomes so clearly: even patients know what 20/20 vision is. However, in aesthetic surgery, the objective outcome is much harder to define and, to a significant extent, less important. The patient experience is a key factor in how they perceive their surgical outcome. I have encountered on the same day consecutive post-op patients with very similar objective results. One may be ecstatic, gushing about how the surgery changed her life, and then other dismally unhappy,

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Table 28.1 The unhappy post-blepharoplasty patient

Disappointed
Angry
Fixated
Depressed
Symptomatic
Financially tapped out

sorry they went through the procedure. The difference between the two patients often relates substantially to their experience of the surgical episode starting with the first visit to the office. Managing the patient experience before and after surgery is a critical component of aesthetic surgical practice and must be embraced by the surgeon and all the staff who interact with the patient.

Table 28.1 lists some of the key features of the unhappy post-blepharoplasty patient.

They are disappointed, self-pitying, perhaps embarrassed. These patients are inclined (and need) to extensively describe their disappointment with their experience and with their surgical result. “My friend had this surgery and she looks perfect.” “If I had known I could have had this result, I never would have had the surgery.”

They are angry at the surgeon. Now, I don’t think that patients often consult cosmetic surgeons if they are not interested in surgery, and I hope there are not many surgeons who talk patients into procedures that they don’t want. Yet, I hear very frequently from unhappy patients “I didn’t want this surgery, the surgeon did it without my even asking for it” or “I didn’t realize that he was going to operate on my eyelids.” “The surgeon didn’t listen to me.” Their memories and interpretation of the experience are colored negatively, and they only remember (or perhaps embellish) negative vignettes. “The nurse was mean to me.” “The operating room didn’t seem clean.” “No one talked to me or answered my questions.” “The suture was too tight/too loose, it came out too soon/too late, it hurt.” “The surgeon was not interested in me, she was on the phone during the surgery.”

They are depressed, overwhelmed, and incapacitated by their fixation on the eyelids.

They are also physically symptomatic. Eyelids are particularly delicate when it comes to postoperative functional problems: patients are telling the truth when they describe their misery with the pain and decreased vision precipitated by poor eyelid closure or blink abnormalities.

They are financially distressed and worried about additional cost, feeding into their anger at the surgeon. They already paid a lot of money for the surgery, perhaps going into debt, and now they are looking at more potential expense for the required reconstruction. The expense may represent a substantial financial burden, adding to their stress and anxiety.

Preexisting Psychological Disorders

Preexisting psychological disorders are ideally identified before surgery but unfortunately are sometimes unveiled only after surgery. Patients with untreated depressive or anxiety disorders, obsessive-compulsive disorder, borderline personality disorder, or body dysmorphic disorder may be poor candidates for cosmetic surgery [1–8]. They are at risk for a more difficult postoperative course, even when things go well, but especially when things go badly. It behooves the practitioner to become familiar with the presenting signs and symptoms of these conditions.

Body Dysmorphic Disorder

The aesthetic surgeon should have a good understanding of body dysmorphic disorder (BDD), and it may be as common as 1 in 14 patients seeking aesthetic surgery [9–11]. The chief characteristic is a painful, disabling preoccupation with appearance [12–15]. Typically, these patients focus on one area which they believe is disfiguring – the periorbital area is common. They have an unrealistic view of themselves, for example, drawing self-portraits that emphasize the imagined defect. They are consumed with a problem that you don't see. They won't believe anyone who tells them that they look fine.

Now, a certain degree of narcissism is, of course, present in all of us and particularly patients seeking aesthetic surgery. What differentiates BDD patients is the overwhelming preoccupation that leads to decreased ability to function. They are often unable to work or go to school or maintain normal relationships.

Certain other behaviors can help suggest the diagnosis and can be part of history taking. Frequent mirror checking, more than hourly, is common. Efforts to conceal the imagined defect such as covering with a hand, hat, or hair are also common. Touching, grooming, and picking at the area can be seen. These patients scrutinize the appearance of others. They typically seek surgery and not infrequently come with a portfolio of surgeries that have already been done.

The first thing to do if BDD is suspected is to not operate on the patient. These patients are poor surgical candidates. They are highly likely to be unsatisfied with surgery, fixate on minor complications, and have a rocky postoperative course. There is a measurable risk of suicide and, even rarely, physician homicide.

These patients are best managed by a skilled mental health professional. They can respond to psychotherapy and medical management with psychotropic medications such as the SSNI and SSRI classes. Unfortunately, it can be difficult for the aesthetic surgeon to make the referral: not all patients with BDD have self-awareness that they have the illness, and even if they do, a suggestion for mental health can be interpreted as dismissive or insulting. Help them recognize that they have become a prisoner to their obsessive condition and explain that treatment can help to free them of their preoccupation, suffering, and anxiety and regain control over their life. The

practitioner can try to emphasize that psychotherapy can reduce emotional turmoil and improve self-image and self-confidence. You can compassionately add that therapy can create a deeper sense of self-worth and lasting well-being. Another image that may be helpful is to point out that brain studies have shown that patients who get treated show normalization of their brain patterns. Provide the image that the brain heals and neural pathways develop as people learn to improve their self-image, outlook, and sense of well-being through psychotherapy.

Depression and Anxiety Disorders

Mood, anxiety, and eating disorders may be common in patients seeking aesthetic surgery. Patients' mood, affect, and overall presentation will provide important clues to the presence of a mood disorder. Neurovegetative symptoms such as disruption of appetite, sleep, and concentration should be queried. If patients report difficulties in any of these areas, they should be asked about the frequency of crying or irritability, social isolation, feelings of hopelessness, and the presence of suicidal thoughts to rule out major depression. Such individuals should be referred for immediate mental health care. More mild mood, anxiety, and eating disorders, however, are not necessarily a contraindication to blepharoplasty. Ideally, patients should be treated first to improve outcomes and decrease unrealistic expectations. The patient and surgeon should be aware that anxiety and depression can present as somatization, undervaluation and dissatisfaction of the self, and perceived judgment and devaluation by others and counseled that changing one's appearance will not necessarily relieve their angst or social relationships. Additionally, they should be alert to possible exacerbation of symptoms in the perioperative period, as the stress of surgery can aggravate anxiety and depression.

Borderline Personality Disorder

The borderline personality disorder is characterized by a sense of loneliness and emptiness, fear of abandonment, irritability, sensitivity to rejection, and resultant rage reactions and unpredictable mood swings.

Patients with features of borderline personality disorder may be difficult to identify until they are threatened or hurt. They can present as warm and engaging, but their perceptions are marked by black and white thinking, and they tend to take things personally and make assumptions. Their emotions are marked by extremes, and they are easily triggered and highly reactive. Thus, their behavior can quickly shift from friendly to passive-aggressive or hostile. When this happens, it is helpful for the physician to remember that it is likely that the patient misunderstood intentions. Attempt to reassure them that your objectives are to meet their needs, and compassionately address what the disconnect might be and make a strategy to achieve your agreed-upon goals.

Narcissistic Personality Disorder

The narcissistic personality, while based on a fractured sense of self, presents as self-centeredness and a feeling of superiority to others, regardless of actual achievements. They often have an inflated self-esteem, expect special treatment from office staff and the surgeon, and wear flashy clothing or makeup and behave in a way that is designed to draw special attention to themselves. They interrupt frequently and demonstrate extreme resistance to active listening. Narcissistic individuals are defensive and extremely sensitive to criticism and can be hostile.

Obsessive-Compulsive Personality Disorder

Obsessive-compulsive personality disorder is hallmarked by a consistent pattern of perfectionism, preoccupation with orderliness and details, a pattern of stubbornness and rigidity, and a pervasive need for mental and interpersonal control. While such individuals might be difficult to manage and please, they may be fine candidates for surgery.

However, patients with an obsessive-compulsive disorder, which is marked by the presence of obsessive thoughts and behavioral compulsions with fear of drastic outcomes if ignored, are poor candidates for surgery. First of all, these symptoms are based on unconscious underlying issues and anxiety, so no matter what the reality or how perfect the outcome of surgery, the patient will not likely be relieved, but find more flaws on which to focus. Additionally, if the patient develops compulsions about touching or looking at the wound, they may have difficulty complying with postoperative instructions.

It may be helpful for physicians and their staff to be prepared with a protocol for understanding and identifying when patients with a personality disorder are becoming triggered and how to handle them. Understanding that the individual has become psychologically triggered and emotionally overwhelmed and that their behavior is an unconscious strategy they have developed to protect the wounded parts of themselves. Imagining the person as a baby who is suffering and frightened and has no way to protect itself or communicate its needs can help us avoid becoming emotional ourselves or engaging in conflict with them, but rather to remain focused on calming them down so that potential rational strategies can be explored.

Management of the Unhappy Post-blepharoplasty Patient

Successfully managing the unhappy post-blepharoplasty patient requires a masterful combination of technical and psychological skill. Facial appearance is an intimate subject, and change in facial appearance, especially around the eyes, can be an overwhelming experience for our patients. The unhappy patient has post-traumatic stress and is grieving. Remembering that grief can include phases of denial, anger,

Table 28.2 Principles for dealing with the distressed or unhappy patient

Rise to the occasion: do not get frustrated or angry. Instead of personalizing their reaction or becoming defensive, maintain a posture of compassionate understanding
Be supportive and generous with your time; see the patient often. Resist the natural inclination to minimize interactions with an unhappy patient
Be nonconfrontational (e.g., not showing photos). Instead, listen, accept, and validate the patient's feelings
Demonstrate commitment to helping the patient through the healing process
Consider getting a second opinion from trusted colleague: control the referrals to avoid the patient seeing an unknowledgeable practitioner or, worse, your enemy

bargaining, depression, and acceptance can be helpful in understanding and managing the patient.

To effectively take care of these patients, you have to be prepared to address the fragile psychology and manage expectations. Table 28.2 suggests principles for healing the unhappy patient.

These patients need to buckle up for a rocky ride: instead of a quick fix, they are going to be looking at a slow road to psychological and physical improvement. The relationship between the physician and the patient will be critical in this journey. Although the dynamics are different if it is your own patient or a patient seen by referral from another surgeon, the underlying principle of management is the same: the treatment will have to start with a trusting relationship.

Empathy and good communication skills are paramount. The patient experience should be maximally optimized, including interactions with front office, billing, and nursing staff. The physician should demonstrate empathy with good reflective listening [16–20], nonconfrontational techniques, and body language that emphasizes compassion and care (sit facing the patient with relaxed open posture, make appropriate eye contact, and avoid distractions such as your devices and computer).

The patient likely needs to vent their anger and disappointment, and compassionate reflective listening is valuable. Avoid reacting defensively to the patient's concerns (particularly if it is your own patient). Minimizing the patient's concerns will not be productive. The goal should be to diffuse the anger as quickly as possible, so that the patient can be encouraged to move forward instead of focusing on the past. If the patient is seen by referral after surgery elsewhere, joining the patient in criticism of the original surgeon is immature, unprofessional, and feeds the anger of the patient, worsening their situation: the anger should be deflected, and professional respect for colleagues always maintained.

When it comes to treatment, there is for unhappy post-blepharoplasty patients great value in a minimally invasive approach. These patients have post-traumatic stress related to the surgery, and avoiding another trip to the operating room, at least early on, is valuable. In particular, the stakes for revision surgery are even higher than for the original procedure, so that reoperative surgery should be very carefully considered in light of the potential risks and benefits. Fillers and neurotoxins can often be helpful in early management and, with low risk, make the patient feel attended to. Skin care and spa-like treatments such as lymph massage can also be recommended and can provide a sense of forward progress. For some patients,

alternative medical treatments including meditation, nutrition management, and other stress management techniques can be helpful.

When surgery is recommended, a focus on small-incision, minimally invasive technique is appropriate in an effort to minimize additional iatrogenic damage.

Summary

Appropriate patient selection, optimal communication, careful building of a trusting relationship, attention to controlling the patient experience starting with the first visit, and skillful, conservative safe surgery are the ingredients to minimize the risk of the unhappy post-blepharoplasty patient. However, there is no way to achieve 100% success, and the most skillful, compassionate surgeons will have unhappy patients. In a referral practice, unhappy post-blepharoplasty patients are in hardy supply. Acquiring and mastering the skill set required to manage these patients and guide them to the best possible final result should be an aspiration of every aesthetic surgeon. These are difficult patients, and proper management requires expertise, maturity, dedication, and investment of time. These patients are genuinely suffering and should bring out our deep instincts as physicians to enable their healing. With a careful, considerate approach, utilizing other members of an interdisciplinary team as required, identifying psychological conditions, and providing mental health referrals when indicated, most of them can be guided over time to a place of substantial improvement physically and psychologically. Taking on this challenge, and executing treatment successfully, can be as rewarding as any difficult challenge of medicine.

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Psychological Management of the Unhappy Patient: Perspective 2

29

Jonathan Sykes, Allison Jarvis, and Amanda Dilger

Patient satisfaction is the ultimate measure of success in cosmetic facial plastic surgery. Achieving a successful outcome in aesthetic surgery is dependent on numerous factors that include patient selection, procedure choice by the patient, technical performance by the surgeon, and postoperative patient care. Patient perception of results can be influenced by all physician-patient interactions, starting from the patient's first communication with the practice and continuing throughout consultation, procedure, and post-procedure visits.

Patient Selection

The most effective way to manage unhappy and angry patients is to, as much as possible, avoid operating on patients who are likely to be dissatisfied with their surgical outcome. The decision of when not to operate is rarely discussed in surgical training and requires the use of the surgeon's judgment and experience. In addition to evaluating the patient from a medical and aesthetic perspective to determine if cosmetic surgery is safe and appropriate in each particular case, the surgeon must from the earliest encounter be attuned to the psychological fitness of the patient.

In the bestseller *Blink: The Power of Thinking Without Thinking*, Malcolm Gladwell argues that in many instances the sub-cognitive perception of the trained

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individual is often much more valuable and accurate than an in-depth quantitative analysis. That is, sometimes we should with our gut reaction.

It is well known that patient selection plays a key role in successful outcomes in plastic surgery [1–4]. While it may seem like an easy task, various factors can obscure the patient selection process, including the surgeon's financial motivation, ego, and ineffective communication styles which can contribute to poor decision-making when deciding who to operate on and who to avoid [1]. Careful patient selection along with effective communication styles and evidence-based patient interviewing techniques are critical skills for the facial plastic surgeon.

The first step in patient selection for successful outcomes in facial plastic surgery is using effective communication skills during the initial consultation to determine the specific patient's expectations and motivation for surgery [2]. The surgeon must screen patients to determine who is appropriate for surgery and who could be problematic and, therefore, excluded [1, 2]. Understanding the patient's personality type early in the consultation helps determine if he or she can tolerate the emotional stress of plastic surgery. Using open-ended questions during the initial consultation can help unveil the patient's psychological tendencies [2]. For example, "How much time do you spend thinking about your appearance in a day?", or "How does your dissatisfaction with your appearance affect or disrupt the quality of your life?". Less than ideal patients are often able to hide their personality flaws in order to gain the surgeon's understanding of his/her reasons for surgery. Furthermore, their true character often manifests in the postoperative healing process [2].

The decision not to operate is a learned skill that requires a surgeon to use his or her "gut reaction" or trusted instincts during the initial consult [2]. Selecting patients for plastic surgery that are likely to be satisfied with their results is a challenging process due to various, masked factors. The surgeon must exclude difficult patients that could be potentially dangerous and/or impossible to satisfy based on personality type [1, 2]. Specifically, plastic surgery patients who display the following characteristics should be avoided: unhappy patients, patients with unrealistic expectations, patients with poor self-image, over-flattering patients, perfectionists, rude patients, and VIPs (very important persons, patients with unfocused desires, patients with body dysmorphic disorder (BDD) [2].

According to the DSM-5, body dysmorphic disorder (BDD) is defined as an unhealthy preoccupation with one or more nonexistent flaws in physical appearance [5]. BDD occurs in approximately 1% of the general population, but in aesthetic surgery patients, it accounts for a much higher incidence (6–16 times higher) [2]. These patients often request multiple procedures while hiding their true desires. Surgeons should refer these patients to therapy and avoid operating on them as they are likely to be unsatisfied with their results due to wanting large changes in their face or body [1, 6]. Patients with BDD can present with mild to obsessive manifestations of their appearance in which effects their personal and professional lives [7].

A "difficult patient" can be defined as one who does not assume the patient role and obstructs the clinician's ability to establish a therapeutic relationship [1, 8]. Physician surveys have shown that one in six patients are considered difficult [1, 9, 10]. Patients rated as difficult were more likely to have psychiatric illness (including substance abuse) such as multisomatoform, panic disorder, dysthymia, generalized anxiety, or major depression compared to non-difficult patients [1, 10, 11]. In addition, these patients had more functional impairment and threatening personalities and reported lower levels of satisfaction with their caregiver [11].

At the same time, the personality and economic pressures of the clinician can impact the understanding and management of the difficult patient in difficult doctor-patient relationships [1]. Lack of psychosocial training and effective communication skills can lessen the physician's ability to recognize and diagnose a difficult patient [1, 12]. Facial plastic surgeons need to understand the patient's perspective and develop awareness of negative responses to difficult patients [1]. Using effective communication techniques and responding empathetically to difficult patients are skills needed to handle the psychosocial needs of the patient [1]. Listening skills, such as the evidence-based NURS (Name it, Understand it, Respect, and Support the patient) patient-centric interviewing method, are helpful in conveying empathy and compassion in difficult clinician-patient encounters [1, 13].

Refusing Surgery to Potential Patients

Aesthetic surgery is, in almost all instances, elective, and therefore if a patient is not a suitable candidate for medical reasons or psychological reasons, the surgeon is tasked with refusing surgery to the potential patient. This can be a sensitive issue, as the surgeon may be confident that a procedure will objectively improve the patient's appearance. There may also be financial factors that motivate the surgeon to recruit potential patients. Additionally, the patient who is seeking aesthetic surgery is likely to be disappointed or angry with the outcome of the consultation if surgery is not recommended. It is important that in the case of refusing surgery to a patient, the surgeon is open about their concerns and provides referrals to other potential surgeons. An approach that may help to diffuse the situation is to place the onus on the surgeon by saying, for example, "I am concerned about my ability to achieve your desired result." This directs the blame away from the patient's difficult personality characteristics and toward the surgeon. Although these conversations can be difficult, it is far easier to dissuade a difficult patient from undergoing surgery than it is to manage patient dissatisfaction and anger in the postoperative setting.

If concerns regarding a patient's ability to psychologically tolerate aesthetic surgery are raised during the initial preoperative consultation, the first option for management is to schedule a second consultation. This allows both the patient and the

surgeon to re-evaluate the situation and address lingering questions or concerns from the initial encounter. If the surgeon's concerns are alleviated by the second consultation, then surgery can be scheduled with greater confidence that the outcome will be satisfactory to the patient. However, if the patient continues to exhibit difficult or dangerous personality characteristics, then the second consultation was of great value in that it provided additional evidence to support the decision to avoid surgery in a potentially problematic patient [13].

Managing Patient Dissatisfaction

Cases of patient dissatisfaction in aesthetic surgery can be devastating to both the patient and the surgeon. These instances represent a minority of the surgeon's practice; however, they can occupy a significant amount of clinical time, energy, and thoughts. Communication is essential in management of dissatisfaction in the postoperative cosmetic surgery patient, and the key to effective communication is *listening*. There are several techniques for optimizing listening skills in order to maximize the value of the physician-patient relationship. Listening with curiosity and genuine interest will help the surgeon to better understand the etiology of the patient's concerns. It is also important to give the patient adequate time and space to express their concerns freely, and listening in silence provides this opportunity. Reflective listening, which involves paraphrasing what the patient says back to them, can help the patient understand that the surgeon is listening and understanding their points. Phrases such as "if I could summarize what I am hearing…" or "it sounds like you are saying" followed by "is this correct?" or "have I properly characterized your complaints?" can be helpful in these conversations.

Because plastic surgeon's success is measured by economic success as well as successful patient outcomes, patient dissatisfaction often makes the surgeon feel that he or she has performed poorly which can negatively affect the surgeon's self-esteem. Plastic surgeons should remember to not take the negativity personally and understand that the patient is expressing himself/herself [1].

Often times surgeons become defensive and want to fix the problem stated by the dissatisfied patient. However, a defensive stance can prevent effective communication between the surgeon and patient. Furthermore, this "find it/fix it" solution fails both the clinician and patient by preventing the patient from feeling heard and empathized with [1]. Again, reflective listening should be used by the clinician to allow the patient to feel understood [14]. Repeating what the patient says in summary phrases (e.g., "It seems what is bothering you…" or "If I could summarize what I'm hearing…") allows the patient to feel that the clinician is truly listening to his or her complaints. Additionally, follow-up questions such as "Have I correctly characterized your complaints?" can further demonstrate empathy and strengthen the physician-patient connection [2].

After using reflective listening to understand the complaint, the surgeon should ask if a management plan would be helpful in order to transition into a treatment plan that makes the patient feel heard (e.g., "Would it be reasonable to suggest possible solutions?"). The surgeon can also express disappointment with the surgical result if it is done without blaming the patient. Sometimes, though, the patient can grow angry and frustrated, losing confidence in the clinician [1].

The patient should know that the clinician is offering all possible solutions for the welfare of the patient; for example, he/she can be referred to get the opinion of another plastic surgeon or meet with patient advocates in the hospital. If the patient dissatisfaction continues, it is appropriate to consult with risk management specialists so that the surgeon is provided with legal protection. Refund of surgical fees can be applied in selected cases but only after consulting with legal advice and after the patient signs a release of liability [1].

Malpractice Litigation Cases

It is important to understand the factors influencing litigation and judiciary decisions given the nature of medical malpractice litigation in today's environment. When patient dissatisfaction persists, it is appropriate to consult risk management and the physician's liability insurance carrier in order to ensure legal protection in the event of malpractice litigation. In order to be liable for malpractice, the surgeon must fail to meet the community standard of care and produce direct injurious results. Additionally, surgeons may be held accountable for "breach of warranty" if the results produced are not akin to those that were guaranteed preoperatively [15].

Although there is no data in the literature to support this, it is very likely that poor communication and misunderstanding of expectations plays a significant role in malpractice litigation in cosmetic plastic surgery. In the largest study to date of rhytidectomy malpractice cases, 69% of cases cited "intraoperative negligence" as the cause for allegation [16]. This is a nonspecific complaint and does not reflect a particular outcome or injury; for example, facial nerve injury is listed as a separate allegation and was present in only 11% of these cases. As such, it is plausible that this complaint represents general dissatisfaction with the outcome and care provided [17]. Given the known detriment of unmet expectations on patient satisfaction, it is of utmost importance to communicate openly and practice empathetically. Maintaining a constructive physician-patient relationship is the key to successful practice and positive outcomes (Fig. 29.1).

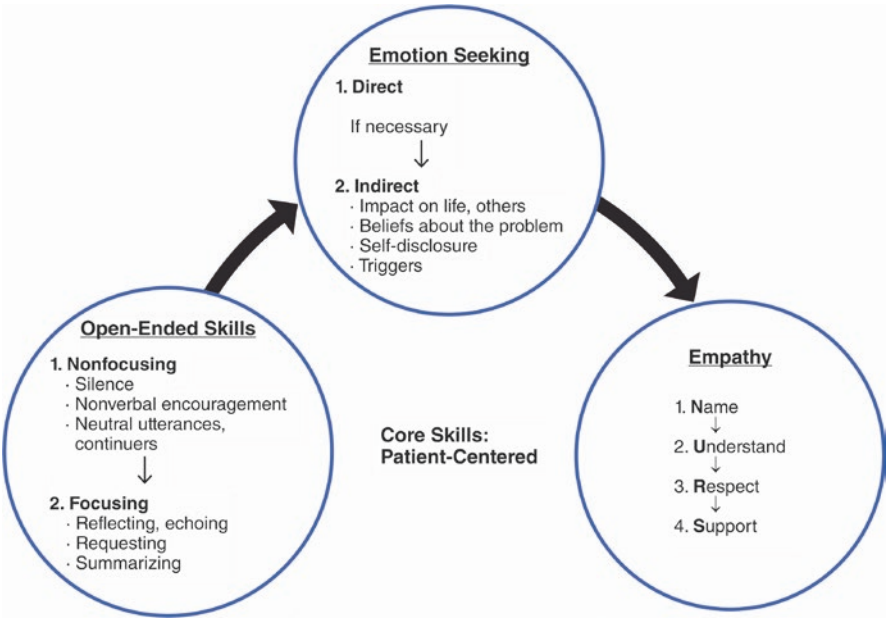

Fig. 29.1 Core skills: patient-centered. (Modified from Fortin AH, Dwamena FC, Frankel RM, Smith RC: Smith's Patient-Centered Interviewing: An Evidence-Based Method, 3rd Edition. The McGraw-Hill Companies, Inc.)

Summary

Successful plastic surgery requires effective communication skills and attention to patient selection. Surgeons need to understand the patient's personality type and adjust accordingly. In addition, physicians should be aware of their own egos and economic pressures that may act as a barrier to properly selecting and managing patients [1, 2]. Mastery of evidence-based communication styles will benefit plastic surgeons and aid in identifying potentially difficult patients who are likely to be unsatisfied with surgery.

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Appendix: Videos

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Cat Nguyen Burkat

The authors are pleased to include the following video material for surgeons who desire to learn more about the surgical techniques mentioned in the book.

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