Evaluation of Eyelid Function and Aesthetics

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KEYWORDS

• Aesthetics • Face • Beauty • Aging/physiology • Eyelids/surgery • Preoperative evaluation

KEY POINTS

- The eyes and periocular area are the central aesthetic unit of the face.
- Facial aging is a dynamic process that involves skin, subcutaneous soft tissues, and bony structures.
- An understanding of what is perceived as youthful and beautiful is critical for success.
- Knowledge of the functional aspects of the eyelid and periocular area can identify preoperative red flags.

INTRODUCTION

> *The beauty of a woman must be seen from in her eyes, because that is the doorway to her heart, the place where love resides*
>
> *Audrey Hepburn*

Appearance has an important role in self-perception as well as perception by others. No area is more important in self-perception than the face, which research has shown to have a profound effect on overall well-being.[1,2] As the center of the face, the functional and aesthetic importance of the periocular region cannot be overstated. Not only is the periocular area the core aesthetic unit of the face, it is also responsible for protection and function of the eye and thus the visual system. Periorbital aging changes are among the earliest to present in the face, which can cause patients distress with even small changes to this area.[3,4]

Patient attention to the periorbital region has driven cosmetic blepharoplasty to become one of most commonly performed surgical procedures in the world.[5] Although complication rates with periorbital aesthetic treatments are generally low, visually threatening events can occur. Given the intricate relationship of the periorbital area with the visual system, an intimate understanding of anatomy combined with a thorough preoperative evaluation and meticulous surgical technique are essential to provide the highest patient outcomes.[6,7] The preoperative evaluation is crucial to assessing patient goals, establishing the surgical plan, setting realistic expectations, and identifying any risk factors that could lead to poor outcomes. The following is our standard approach to evaluating the functional and aesthetic issues in the periorbital area.

THE BEAUTIFUL EYE

Symmetry

Symmetry is of paramount importance in the perception of facial beauty.[8,9] Humans have a sensitive perception of symmetry, the ability to detect perfect symmetry, and to discern very small amounts of asymmetry. The correlation between

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symmetry and attractiveness is significant,[10–12] with studies finding digitalized mirror-image faces perceived as more attractive than the unaltered original images.[13] Thus, the importance of symmetry to oculofacial plastic surgeons cannot be overstated.

The periocular region frequently has visible asymmetry in the brow, eyelid height, amount of skin redundancy, cheek projection, and globe prominence. Although there is no general consensus on the amount of asymmetry that is clinically significant, previous studies have found significant asymmetry in up to 30% of patients.[8,14] Many patients are unaware of their asymmetries, which leads to poor surgical outcomes if not addressed properly addressed at surgery.[15] Surgeons must review with their patients, document all asymmetry, and factor its role into the treatment plan. Patients must be counseled that at least a small degree of asymmetry will persist postoperatively. Unrealistic expectations can lead to marked patient dissatisfaction.[16]

Aging

Ideally, balanced and diffuse fat distribution, a well-rounded three-dimensional structure, and good projection are hallmarks of a healthy and youthful facial appearance.[17] Little[18] described the youthful face as an ogee-shaped profile, with anterior oblique surfaces that undulate in graceful curves.

Facial aging is a dynamic process that involves skin, subcutaneous soft tissues, and bony structures. The bony remodeling of the orbit results in orbital elongation, loss of projection, and change of the bone–soft tissue relationship (**Fig. 1**), which likely contributes to the fat prolapse, hollow sulci, ptosis, brow descent, and lateral upper eyelid hooding that is commonly seen in aging.[4,19] The skin and subcutaneous tissues around the periocular area become increasingly hollow, allowing the underlying bone, muscle, remaining fat, and blood vessels to become more apparent.[17] The gradual descent and atrophy of subcutaneous tissue alters the smooth ogee curve of the youthful face.[18]

Older surgical techniques for periocular rejuvenation are generally purely subtractive, with the removal of fat and skin, which led to an increasing hollow appearance. However, the increased understanding of the aging process has resulted in the amelioration and development of new techniques leading to more successful rejuvenation outcomes.[20–22]

SKIN

Skin is the largest organ in the human body. Healthy skin tone, a smooth appearance, and brighter complexion are associated with increased attractiveness, youth, and health.[23] Because wrinkles are a sign of aging, youthful skin should be smooth. Ideally, the pigment is uniform and skin is free of blemishes with a consistent appearance (**Fig. 2**).[24,25]

UPPER EYELID

The upper eyelid margin naturally has a gently curved contour. Medially, the curve has a sharper

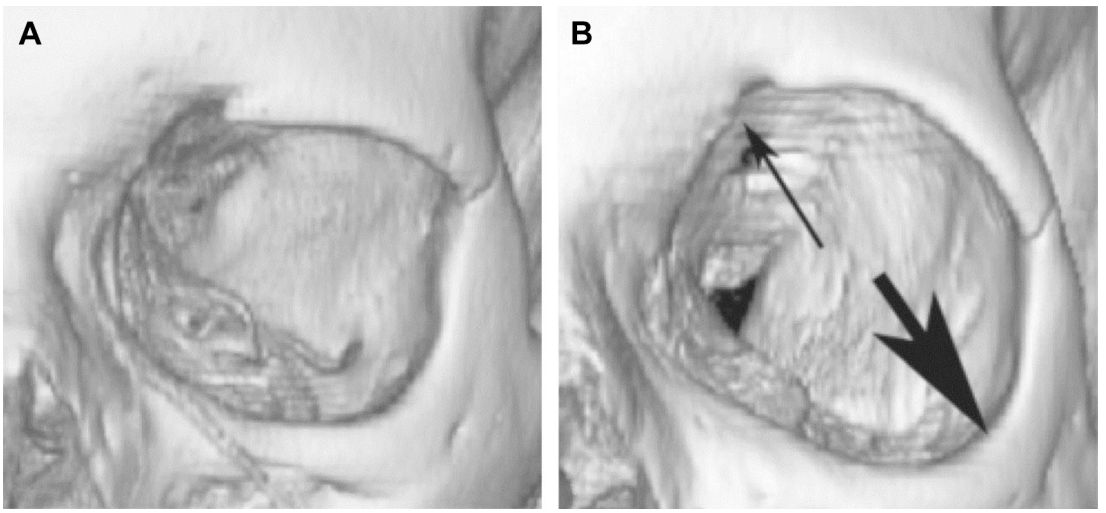

Fig. 1. Computed tomography scan of a male patient in the young age group (*A*) and a male patient in the old age group (*B*). The image from the old age groups shows significant bony remodeling (*arrows*) both superomedially and inferolaterally. (*From* Kahn DM, Shaw RB Jr. Aging of the bony orbit: a three-dimensional computed tomographic study. Aesthet Surg J 2008;28:258–64; with permission.)

Fig. 2. Oblique view of the right brow and eyelids of a woman in her mid-30s. The skin is without rhytids or dyschromia, with uniform texture, quality, and contour. (*From* Buchanan AG, Holds JB. The beautiful eye: perception of beauty in the periocular area. In: Massry GG, editor. Master techniques in blepharoplasty and periorbital rejuvenation. Springer Science + Business Media, LLC; 2001; with permission.)

angle with the peak height located between the pupil and lateral limbus in the Western eyelid (**Fig 3**). The central height of the upper eyelid should be just below the limbus, without excessive droop or scleral show.[26] The ideal upper eyelid should not have excess fat, or skeletonization with hollowing of the sulcus (**Fig. 4**). The youthful aesthetics of the Asian upper eyelid are different in numerous ways, including the eyelid fold, lower marginal position, and more temporal peak in the lid height.

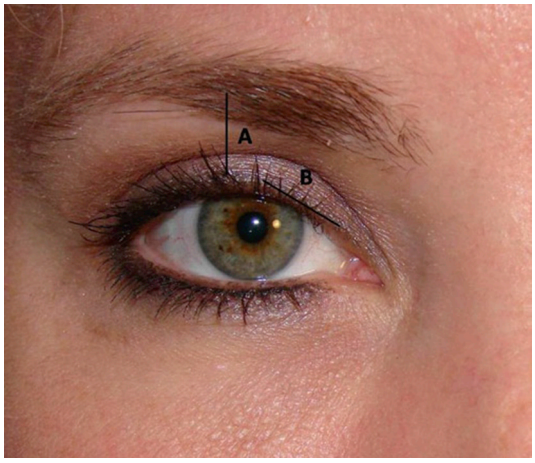

Fig. 3. The ideal upper eyelid displaying a gently curved contour. Notice (A) the peak height located between the pupil and lateral limbus just below the superior limbus, and (B) a sharper angle medially. (*From* Buchanan AG, Holds JB. The beautiful eye: perception of beauty in the periocular area. In: Massry GG, editor. Master techniques in blepharoplasty and periorbital rejuvenation. Springer Science + Business Media, LLC; 2001; with permission.)

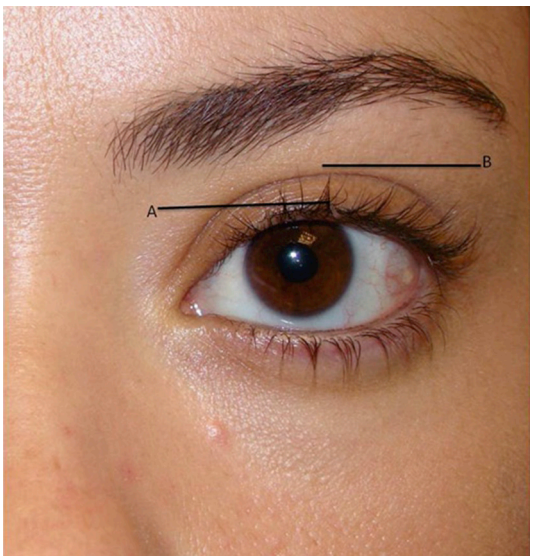

Fig. 4. (A) The superior eyelid margin is just below the limbus, and (B) the upper sulcus has no excessive fat or skeletonization. (*From* Buchanan AG, Holds JB. The beautiful eye: perception of beauty in the periocular area. In: Massry GG, editor. Master techniques in blepharoplasty and periorbital rejuvenation. Springer Science + Business Media, LLC; 2001; with permission.)

Upper Eyelid Height

Described by Putterman and Urist[28] in 1975, the margin reflex distance (MRD) is a widely used and specific way to evaluate upper eyelid position. MRD can replace palpebral fissure because palpebral fissure does not examine the upper and lower eyelid heights independently. To determine the MRD, the surgeon shines a light held at the surgeon's eye level toward the patient's eyes in primary gaze, looking at the corneal light reflex. The MRD1 is the measurement from the corneal light reflex to the central upper eyelid margin. The MRD2 is similarly the measurement from the corneal reflex to the central lower eyelid margin. To ensure accurate measurement, surgeons must ensure that the patient's brow is in a natural position and that the surgeon's and patient's eyes are at the same level.[27,28]

Although there is variability between ethnic groups, the normal Western MRD1 is 3.5 mm to 4.5 mm.[29–31] Any asymmetry between the 2 eyes, or an abnormal MRD1, must be addressed. Many patients are unaware preoperatively and a blepharoplasty in the setting of blepharoptosis

makes the ptotic eyelid position more apparent.[32]

Levator Function

Levator function is the measurement of upper eyelid excursion from downgaze to upgaze. Ensuring that eyebrow excursion does not contribute to the levator function is key to an accurate measurement and is accomplished by manually holding the eyebrow in its normal position.[33] Normal levator function is greater than 12 mm, with an average of 15 mm. A significant decrease in levator function can indicate congenital or myopathic ptosis.[34]

Upper Eyelid Crease, Tarsal Platform Show, and Brow Fat Span

A normal, properly defined eyelid crease for white people is 10 to 12 mm above the central eyelid margin in women, and 7 to 8 mm in men. There are notable variations among different ethnic groups.[35]

Tarsal platform show (TPS) is the amount of fixed pretarsal skin that is visible inferior to the skin overlying the eyelid crease, which is normally 3 to 6 mm in Western Europeans. Brow fat span is the distance between the skin fold overlying the eyelid crease (top edge of the TPS) to the inferior brow hairs (**Fig. 5**). Attention must be paid to the symmetry of these measurements (**Fig. 6**), because TPS symmetry may be more important than MRD1 in eyelid symmetry perception.[36]

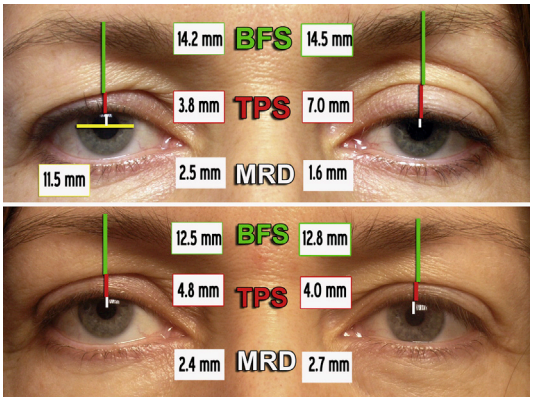

Fig. 6. (*Top*) Measurement of BFS, TPS, and MRD1 on standardized photographs (corneal diameter set at 11.5 mm for scale). (*Bottom*) In the same patient, following left ptosis surgery and bilateral asymmetric blepharoplasty, TPS symmetry has improved and BFS has shortened. (*From* Branham G, Holds JB. Brow/upper lid anatomy, aging and aesthetic analysis. Facial Plast Surg Clin North Am 2015;23(2):117–27; with permission.)

LOWER EYELID

The lower eyelid spans from the lateral to medial canthus. The lateral canthal angle is slightly higher than the medial canthus (**Fig. 7**). The lower eyelid continues with a gentle curve with the ideal position of the central margin at or slightly above the inferior limbus.[37] The thin eyelid skin transitions seamlessly to the thicker cheek inferiorly.

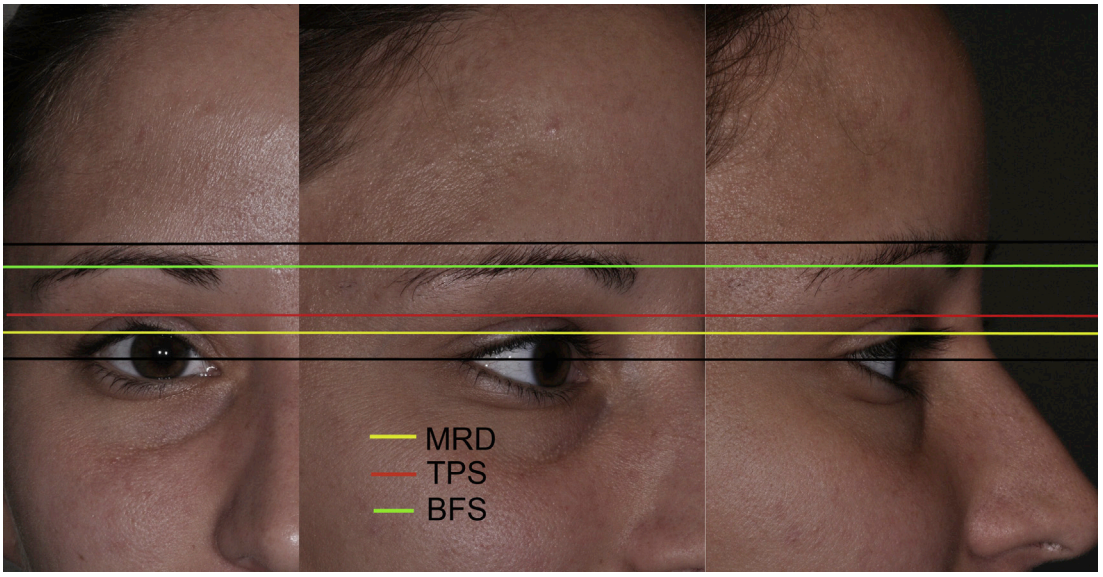

Fig. 5. Guide to eyelid, brow, and hairline position showing TPS/BFS ratio and hairline position from multiple angles. BFS, brow fat span. (*From* Branham G, Holds JB. Brow/upper lid anatomy, aging and aesthetic analysis. Facial Plast Surg Clin North Am 2015;23(2):117–27; with permission.)

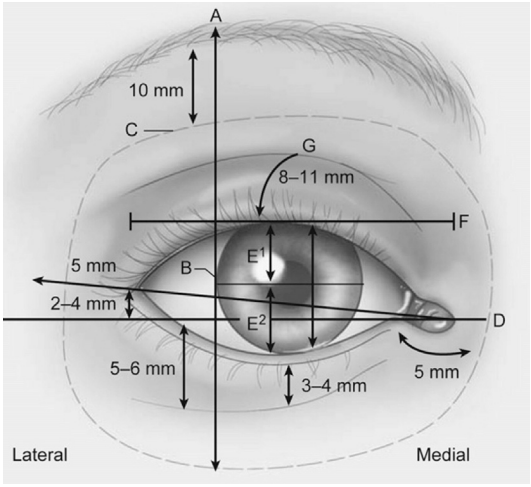

Fig. 7. Topography of the eyelid. (A) The highest point of the brow is at, or lateral to, the lateral limbus. (B) The inferior edge of the brow is shown 10 mm superior to the supraorbital rim. (C) Also shown are ranges for average palpebral height (10–12 mm) and width (28–30 mm), and (D) upper lid fold (8–11 mm, with gender and racial differences). Note that the lateral canthus is 2 to 4 mm higher than the medial canthus. (E) Intrapalpebral distance measures 10 to 12 mm. (F) Palpebral width. (G) Upper lid fold is 8 to 11 mm. E1, mean reflex distance 1; E2, mean reflex distance 2. (*From* Branham G, Holds JB. Brow/upper lid anatomy, aging and aesthetic analysis. Facial Plast Surg Clin North Am 2015;23(2):117–27; with permission.)

A small area of pretarsal orbicularis muscle just inferior to the lashes gives a healthy, youthful appearance.[38]

The transition between the eyelid and cheek, commonly referred to as the nasojugal fold or tear trough, should be a smooth, gradual transition without a hollow deformity (**Fig. 8**). Although complicated and multifactorial, a combination of facial volume loss, herniation of orbital fat, inferolateral rim remodeling, skin laxity, and ptosis of midface tissues contributes to the common tear trough deformity seen in the aging lower eyelid.[19,21,39,40]

Laxity and Lid Position

A small degree of inferior or superior scleral show is normal in some individuals; however, any eyelid retraction must be recognized preoperatively.[37] Retraction can be differentiated from entropion or ectropion by the orientation of the tarsal plate, which should be vertical.[41] The lower eyelid should have good tone, and quickly return to proper apposition against the globe after manual distraction (snap-back test). Ectropion, entropion, epiphora, and ocular irritation are frequently associated with excessive lower eyelid laxity.[42]

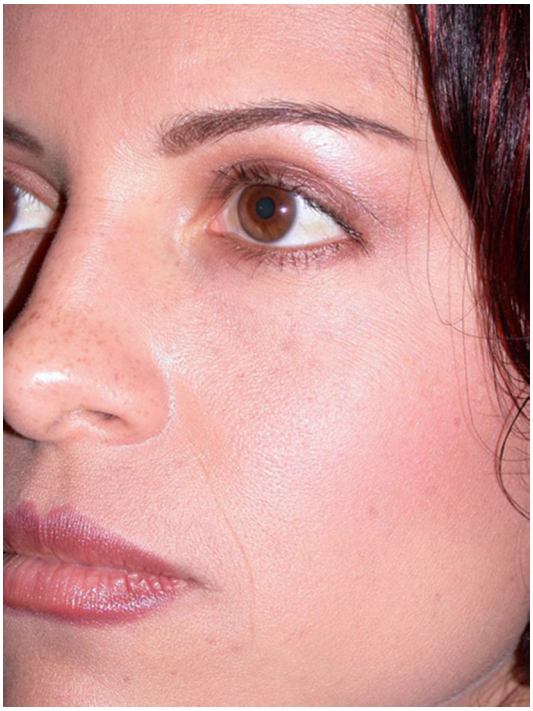

Fig. 8. Oblique view of a woman in her mid-30s. Note the smooth transition from the lower lid to the midface without contour irregularities. (*From* Buchanan AG, Holds JB. The beautiful eye: perception of beauty in the periocular area. In: Massry GG, editor. Master techniques in blepharoplasty and periorbital rejuvenation. Springer Science + Business Media, LLC; 2001; with permission.)

THE FOREHEAD AND EYEBROW

The eyebrow helps to frame the eye, and is an integral part of its beauty and perception. The head of the eyebrow is ideally positioned in a vertical line with the medial canthus and nasal ala and horizontally aligns with the tail of the brow. The female brow has a higher arc, with the maximal arch at an imaginary line drawn between the nasal ala and the lateral limbus (**Figs. 9** and **10**). The tail of the brow ideally terminates in an imaginary line drawn between the nasal ala and lateral canthus.[38]

The male eyebrow is flatter, thicker, and lower in relation to the superior orbital rim. Ideally, the male brow sits long the level of the superior orbital rim, whereas the female brow is several millimeters above the rim.[43] Eyebrow ptosis, particularly laterally, contributes to the appearance of excess lateral eyelid skin and is difficult to treat with blepharoplasty alone.[44]

The forehead is closely related to the eyebrow and eye. Its ideal width is twice the height, with a normal hairline superiorly.[45] Men may desire some furrowing of the brows, but women generally

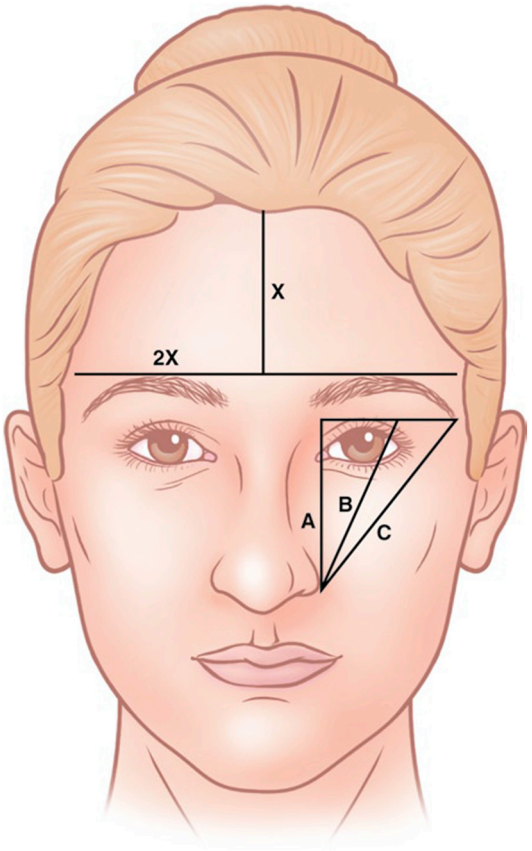

Fig. 9. The ideal female eyebrow. (A) Medially it is in line with the medial canthus and nasal ala. (B) The peak is along a line drawn from the nasal ala through the lateral limbus. (C) Laterally it ends along a line drawn from the nasal ala through the lateral canthus. The forehead is twice as wide as its vertical height. (*From* Buchanan AG, Holds JB. The beautiful eye: perception of beauty in the periocular area. In: Massry GG, editor. Master techniques in blepharoplasty and periorbital rejuvenation. Springer Science + Business Media, LLC; 2001; with permission.)

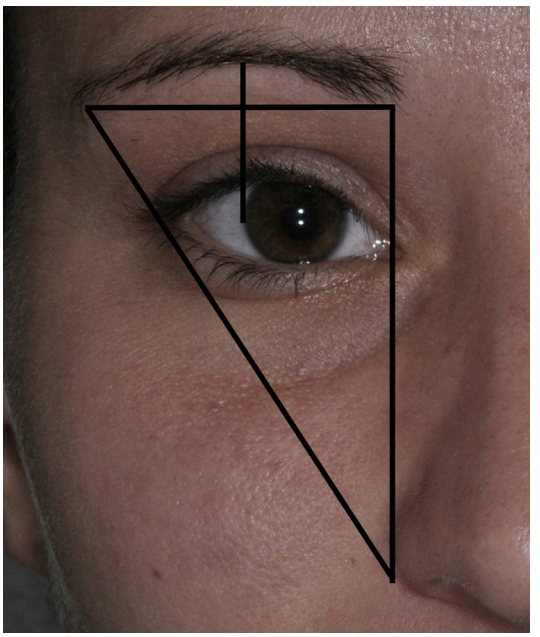

Fig. 10. Another example of the ideal brow position, showing high point of arch at lateral limbus and position of head and tail of brow. (*From* Branham G, Holds JB. Brow/upper lid anatomy, aging and aesthetic analysis. Facial Plast Surg Clin North Am 2015;23(2):117–27; with permission.)

desire a smooth forehead without wrinkles or rhytids.

CLINICAL HISTORY, REVIEW OF SYMPTOMS, AND SPECIFIC CONCERNS

All consultations begin with a detailed history of present illness, review of medical and surgical history, review of systems, and a review of medications and allergies. In addition to the standard medical evaluation ensuring that the patient is a surgical candidate, there are several specific considerations for the periocular region to minimize postoperative complications. The medical history should be meticulously reviewed for signs of thyroid disease, diagnosis of myasthenia gravis or other neuromuscular diseases, prior surgeries, hypertension, bleeding diseases, glaucoma, and risk factors for poor postoperative healing. Aberrant regeneration following a previous facial nerve palsy is an under-recognized cause of ptosis that is often overlooked by referring physicians.[46]

Risk of Bleeding

It is important to review medications and history of any hematologic disorder to identify an increased risk of bleeding. Many patients do not understand the potency and systemic effects of over-the-counter herbs, supplements, and nonsteroidal antiinflammatory drugs. Common herbal supplements that may increase bleeding include echinacea, ephedra, garlic, ginkgo, ginseng, kava, St John's wort, and valerian.[47] Retrobulbar hemorrhage, especially with vision loss, is an exceedingly rare complication of blepharoplasty, reported in 1 in 22,000 cases.[48] Failure to control blood pressure and hold blood thinners increases this risk.[49,50]

Cataracts

In middle-aged to elderly individuals, the authors recommend inquiry of the patient's cataract

status preoperatively, because cataract extraction occasionally causes postoperative ptosis. Eyelid surgery might be delayed if cataract surgery is planned in the near future.[51]

Contact Lens Usage

Inquiry of contact lens history is important, especially in the setting of ptosis. Both soft and hard contact lenses can cause ptosis via multiple mechanisms.[52] Some cases of ptosis are successfully treated medically, so ptosis in the setting of contact lens wear warrants an ophthalmologic examination preoperatively.[53,54] Patients are also warned that discontinuation of contact lens wear is necessary for 1 to 2 weeks postoperatively. In addition, a new contact lens prescription and fitting is occasionally required after upper eyelid surgery.[55]

Glaucoma, Topical Ocular Medications, and Prostaglandin-Associated Periorbitopathy

Glaucoma is a common ocular condition that is increasing in prevalence.[56] Patients with glaucoma present several potential risks to cosmetic eyelid surgeons. In patients with advanced disease potentially necessitating surgical intervention, ptosis is a common complication of trabeculectomy surgery, occurring in up to 19% of patients.[57,58] Thus, communicating with a glaucoma specialist to inquire about the patient's disease is advised.

In addition, several topical medications can affect eyelid position and appearance.

Brimonidine (Alphagan, Allergan)

Brimonidine and apraclonidine (Iopidine) are topical medications that can raise the upper eyelid. They are both alpha-adrenergic agonists that stimulate the Müller muscle, raising the lid temporarily. With a 1-mm to 3-mm elevation during use, this has garnered acceptance in aesthetic circles as a temporary medical treatment of Botox-induced ptosis.[59,60] Although apraclonidine is not a commonly used chronic glaucoma medication, brimonidine is. Clarification of a patient's continuing use of these medications and surgical expectations prevents postoperative concerns.

Prostaglandin-Associated Periorbitopathy

The low cost, effectiveness, and ease of use have helped prostaglandin analogues to become an increasingly popular first-line therapy for the treatment of glaucoma.[61–63] An early noticed effect was increased eyelash growth, which was applied for cosmetic purposes and has made bimatoprost (Latisse, Allergan) a popular option for eyelash enhancement.[64–66]

A more recently discovered negative effect of this class of therapeutic agents is a constellation of findings referred to as prostaglandin-associated periorbitopathy. Common findings include fat atrophy, deepening of the superior sulcus, decreased dermatochalasis, ptosis, enophthalmos, lower eyelid retractions, periocular edema, and thinning of the eyelid margins.[67–69] Patients using bimatoprost for cosmetic reasons have been increasingly observed to display these findings.[70] The fat atrophy is significant and may be reversible on the cessation of treatment, but can take months to years for maximum recovery.[71,72] In patients with these findings, communicating with a glaucoma specialist about switching to a different class of medication is advisable before considering aesthetic surgery.

Assessment of Tear Film and Dry Eye Syndrome

Dry eye syndrome, or keratoconjunctivitis sicca, is a common complication of blepharoplasty. Although most cases are mild and self-limited, severe cases can lead to corneal damage with associated visual limitation.[73] Failure to recognize preoperative tear deficiency can significantly worsen symptoms postoperatively.[74] Blepharoplasty is a safe operation in most of these patients; however, preoperative recognition and conservative surgical technique are paramount to ensure excellent results and avoid further exacerbations of symptoms.[75] Laser in situ keratomileusis (LASIK) surgery lessens corneal sensation, increasing the risk of dry eye syndrome and exposure complications. This history is important to elicit, and it is generally advisable to allow at least 6 to 12 months between LASIK surgery and upper eyelid surgery.[76]

Clinically, the authors' assessment includes patient history; Schirmer test with topical anesthetic (basic Schirmer); assessment of lid closure, Bell phenomenon, and lagophthalmos; and a slit lamp examination to assess the cornea.

Schirmer Testing

Schirmer testing after the application of a topical anesthetic measures the basal secretory rate, and is a commonly used preoperative screening tool.[77] After the instillation of topical anesthetic, the inferior fornicies are wicked dry and the testing strips are inserted adjacent to the puncta. Measurements of 10 mm to 30 mm are normal; measurements less than 10 mm are abnormal,

suggesting the presence of dry eyes, and less than 5 mm suggests severe dry eyes.[78,79] Although the diagnostic reliability of the Schirmer test has been criticized, it remains the most commonly used test of tear production.[80]

Bell Phenomenon

Bell phenomenon is the upward rotation of the eye on lid closure, which serves as a protection mechanism for the cornea.[81] To assess, the examiner attempts to open the patient's eyelids during lid closure. If the reflex is intact, the inferior sclera visible with the globe is rotated up and out. Patients with a normal Bell phenomenon show higher tolerance to mild postoperative lagophthalmos. An absent Bell phenomenon should encourage a conservative course.[82]

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