Perspectives on Periocular Asymmetry

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ABSTRACT

Eyelid, orbit, and eye position asymmetry may adversely affect overall facial aesthetics. Armed with the knowledge of important periocular measures and landmarks, asymmetries can be easily identified and consideration may be given to correction or camouflage.

KEYWORDS: Periocular, eyelid, orbit, asymmetry

As an infant acquires awareness of self and others, first the face then the body is viewed as a harmonious synchronization of pairs: two eyes, two ears, two halves of a central nose, two nostrils, two arms, two legs, and so on. Whether the desire for symmetry, for both sides of a central sagittal plane to serve as a comparative mirror, is innate or the product of nurture has long been debated. In fact, both may be true. Nevertheless, symmetry is often associated with health and vigor. Not surprisingly, in the very moment that a newborn fills her lungs with first breath, her parents are quickly surveying her, counting and comparing limbs and appendages. If one side does not closely reflect the other, there is doubt, concern, and perhaps even alarm. Whether for good or ill, a similar process of new encounter initial assessment will follow the infant forever through puberty, maturity, and advanced age onto death. Everyone she encounters will develop first impressions, and symmetry, or lack thereof, plays an important role.

True symmetry, however, is a fallacy. Beneath the skin, the mirror image dissolves with two lobes of the lung on one side, three on the other, liver on the right, spleen on the left. And as facial aesthetic surgeons, we know that true symmetry isn't even skin deep. The trained observer quickly recognizes disparities in nearly everyone (Fig. 1). Still, the human subconscious apparently often registers these subtle differences, and sym-

metry becomes an essential feature of what most cultures perceive as beauty, youth, and overall health.^{1,2} Even the conscious lay mind can be highly discriminating. A difference of 0.4 mm in pupil size or 2 mm of relative enophthalmos may draw attention from the casual observer.^{3,4} Regardless of custom or creed, pigmentation or race, the cultures of humanity prize symmetry. This article describes some common causes of periocular asymmetry, reviews how to recognize and categorize these variances, and makes suggestions about how to advance a more symmetric appearance by either addressing foundational differences or camouflaging architectural disparities.

Periocular asymmetry may be separated into two broad categories: congenital and acquired. More severe forms of congenital asymmetry may result from an embryological insult or a facial clefting anomaly. Some cases have extended facial structural abnormalities and may even incorporate features of incomplete orbital developmental rotation with resultant exorbitism and hypertelorism. In some situations, a multidisciplinary approach involving neurosurgery, ophthalmology, otolaryngology, pediatrics, and plastic surgery may be beneficial; whereas more modest, far more common asymmetries of the underlying bone and ocular adnexa may be addressed in isolation. Congenital problems involving just the soft tissues around the eye include blepharoptosis, epiblepharon, telecanthus, epicanthus

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Figure 1 (Top) Cropped, two-eye view of a highly symmetrical face with preferential lighting from the left to help distinguish laterality. (Middle) Mirror image generated by replicating the right side of the face and flipping at the midsagittal plane to create a face with two “right sides.” (Bottom) Mirror image generated by replicating the left side of the face and flipping at the midsagittal plane to create a face with two “left sides.” In the top image, one can note the left eye and brow are higher than the right; the head of the left brow is more in line with the medial canthal angle, whereas the right brow head is slightly more lateral; the nasolabial fold is more pronounced on the right than the left; the horizontal interpalpebral fissure on the left is smaller than that on the right, and overall shape of the nares is different.

(inversus, tarsalis, palpebralis, supraciliaris), and entropion with tarsal kink. Again, subtle asymmetries within the limits of “normal variance” also exist with far greater frequency and most commonly go unrecognized.

Acquired causes of orbital and periocular asymmetry are most frequently the result of trauma. Isolated soft tissue injuries may be obtained from a vast range of insults including motor vehicle, bike, or skateboard accidents, animal attacks, sharp instrument assaults, chemical burns, and so on. Typically, these injuries are

immediately obvious. Orbital fractures, on the other hand, may result in early enophthalmos and hypoglobus, as the eye and orbital contents sink into the adjacent maxillary and ethmoid sinuses, or may be delayed as orbital fat atrophy from concussion-induced ischemia may alter eye and concomitant eyelid position many months later. For example, enophthalmos may lead to upper eyelid pseudoblepharoptosis, whereas isolated hypoglobus more typically leads to upper eyelid pseudoretraction.

Inflammatory conditions are the second most common cause of significant, acquired periocular asymmetry with thyroid-related immune orbitopathy leading the list. This is a systemic disorder that affects both eyes, but asymmetric expression and findings are the norm. Although often associated with a concurrent disturbance in thyroid hormone levels, this condition can occur in a euthyroid state or precede or succeed a hyper- or hypothyroid hormone level. Characteristic, essentially diagnostic changes in the upper eyelids include lateral flare in resting, primary gaze, and transient retraction on down gaze. However, the eyelid changes can range from very subtle to clearly severe, with attendant findings of mild keratopathy sicca to severe corneal ulceration. Similarly, the exophthalmos can be mild, suggesting only an “enlarged eye” appearance, or profound, with globe prolapse beyond the eyelids, ocular dysmotility, and/or optic neuropathy with vision loss. Other causes of orbital inflammation, such as the very disparate family of so-called “orbital pseudotumors” and orbital lymphomas, most commonly respond well to treatments and do not produce persistent changes in the periocular region. Two relatively rare disorders, linear scleroderma and Parry-Romberg syndrome, however, can create both permanent enophthalmos and alteration in the upper and lower eyelids on one side.⁵ We exclude from this discussion rapid changes due to other primary malignant neoplasia or metastatic disease.

Changes in the sinuses can secondarily impact the orbit and eyelids as well. Benign tumors of the sinuses, even if removed, can leave behind pressure-induced bone remodeling. Similarly, allergic fungal granulomas or “aspergilomas” can create exophthalmos and hypertelorism. In contrast, periorbital sinuses may collapse upon themselves, as occurs in silent sinus syndrome, and produce enophthalmos.^{6,7}

Iatrogenic influences also may produce significant periocular asymmetry. External beam irradiation, as was common in the treatment of retinoblastoma, can retard orbital and thus hemifacial development, as can removal of an eye in early childhood without introduction of an expanding replacement. Orbital irradiation in adulthood can also lead to orbital fat atrophy. And secondary, asymmetric changes may be introduced by either prior periocular reconstructive procedures or incompletely successful previous cosmetic surgery.

Finally, involutional influences need not result in symmetric periocular alterations. Levator aponeurosis dehiscence blepharoptosis may be unilateral or bilateral but unequal. Brow ptosis may be asymmetric, leading to disparate amounts of apparent upper eyelid dermatochalasis. Differences in lower eyelid lateral or medial canthal tendon laxity can result in distinct amounts of lower eyelid retraction or sag, as can disparities in midface support. The tone of the orbicularis oculi muscle can play a very important role in determining how much fat pseudoherniation occurs, especially in the lower eyelids. The obvious extreme example occurs in the setting of facial nerve palsy in which the ipsilateral lower eyelid appears to have more of a fat bulge than the contralateral lower eyelid. Even solar ultraviolet irradiation exposure and the resultant skin damage and rhytids may differ from one side of the face to the other.

The management of periocular asymmetries during aesthetic or reconstructive procedures is a three-step process. First, asymmetry must be recognized. Second, the cause of the asymmetry should be determined and addressed, if possible. Finally, the component parts of the asymmetry should be defined and corrections performed with a goal toward overall balance.

Although large disparities in periocular appearance are easily appreciated during a preoperative evaluation, more subtle inequalities may not be, and as soft tissue padding and skin redundancies are removed, underlying asymmetries may come to light postoperatively. Thus, not only is "same surgery" inappropriate across individuals but it is often inappropriate for both sides of the same patient.

Patient evaluation is meticulously described elsewhere in this issue, but the assessment of periocular symmetry is somewhat unique and bears brief mention as review. Within the first few moments of a preoperative encounter, a general, subjective impression of facial and periocular symmetry should be made and recorded. This is critical. The eyes are the primary focal point of the face, and first impressions often influence overall impression of the entire visage and even the persona. With extended exposure and conversation, these impressions may become modified and forgotten, so documenting the initial impression as quickly as possible is helpful.

Next, we like to examine the position of the pupils, looking in particular for clues that one eye may be higher than the other or farther away from the midline of the nose. Palpation of the anterior projection of the inferior orbital rims is also helpful. A higher inferior orbital rim ipsilateral to a higher eye is suggestive of a congenital issue or a long-standing posttraumatic issue. Although it is not uncommon for one eye to be slightly higher than the other, it is rare to find a significant inequity in medial canthal tendon vertical position and if seen, almost always indicates a long-standing or congenital process. The worm's-eye and

Figure 2 The patient's relative enophthalmos is suggested in the top photograph by the left superior sulcus deformity, or hollowing in the upper eyelid. Blepharoplasty with hollowing out the fat in the right upper eyelid may be one way to partially camouflage the profound enophthalmos seen in the bottom worm's-eye view.

45-degree lateral views are particularly helpful in assessing relative enophthalmos, tear trough deficiencies, and malar projection or retrusion (Fig. 2).

Careful note should be made of the relative positions of the eyebrows, the distance from the midpoint of the eyebrow to the upper eyelid crease, the distance of the upper eyelid crease to the eyelid margin, the amount of pretarsal show (apparent distance between the upper eyelid crease and the eyelid margin) in the resting position, the shape and medial extension of the major upper eyelid crease, whether or not there are multiple eyelid creases, the height and width of the interpalpebral fissure, the primary lid-margin-reflex distance (distance from the center of the pupil or light reflex to the lower margin of the upper eyelid), the position of the medial and lateral canthal tendon attachments with acknowledgment of mongoloid or antimongoloid slant, and description of the upper and lower eyelid contours or shapes (e.g., acute curve, gentle slope, lateral flattening, etc.). In planning surgical correction, it is also important to appreciate the amount of levator palpebrae function and the degree of existing midface support.

Once asymmetries are noted, reviewing the medical history is worthwhile to determine the cause of each

difference. Many patients are unaware of facial and periocular asymmetries, and old photographs can often add insight into the chronicity of particular issues. Although close-up, straight on pictures may be difficult to unearth, even off-angle and group photographs can be revealing if they demonstrate consistent abnormalities of head position, such as a head tilt, face turn, or chin up posture, all of which may be compensations for periocular eyelid or orbit problems. Carefully defining each asymmetry is not only critical for insightful surgical planning but it is also important for preoperative patient appreciation of the existing issues and the intended corrections. Similarly, careful preoperative photographs not only document preexisting issues but patients often find it easier to recognize asymmetries in pictures than they do in dynamic images seen in mirrors.

If globe position abnormalities are identified or there is clear difference in the amount of orbital fat pseudo herniation on one side versus the other, then consideration should be given to obtaining neuroimaging. We generally prefer computed tomography (CT) scans to magnetic resonance imaging (MRI), as the CT data more closely represent actual relative sizes, provide excellent assessment of bone contours, clearly demonstrate any previously placed metallic hardware, and are usually more readily available, faster to perform, and less expensive than MRI. Most often, the CT scans are obtained as 3-mm axial and coronal sections. Finer cuts, three-dimensional reconstructions, sagittal sections, and intravenous contrast generally are not necessary.

Once the asymmetries are recognized and the etiologic evaluation is completed, surgical planning should be divided into three parts: foundation modification, ocular alignment, and eyelid trim work. Although only one part may be required, if all three parts are needed, it is important to address them in the order above, because foundation modification can impact both ocular alignment and eyelid, and ocular alignment, in turn, can impact eyelid appearance.

PROPTOSIS

When one eye is more protuberant than the other and all pathological processes have been addressed, a decision must be made whether to bring the enophthalmic eye forward, to place the exophthalmic eye backward, or both. If it is appropriate to reposition an eye, there are categorically three types of procedures available to accomplish this goal: orbital expansion, orbital extension, and orbital contents reduction.

Orbital expansion procedures involve removal or thinning of the bones that comprise the orbit, thus expanding the orbit into the nasal vault and adjacent sinuses and/or the temporalis fossa. The more ocular repositioning required, the more bone that needs to be removed. More posterior orbital expansion leads to

axial change in globe position, whereas removal of the anterior orbital floor may create downward movement of the eye.

Perhaps the most popular method of orbital expansion today is a transconjunctival approach for removal of the orbital floor that lies medial to the infraorbital groove and canal. Anteriorly, bone removal is generally conservative with more aggressive expansion posteriorly toward the apex. This maintains globe support and vertical position while permitting posterior egress of fat and extraocular muscles. When further volume is needed, the medial wall, specifically the lamina papyracea of the ethmoid bone, may be removed from either an orbital or endonasal approach. Care is usually given to maintaining the "anterior medial strut," a segment of bone between the medial wall and the anterior orbital floor. This prevents occlusion of the maxillary sinus os by orbital contents and also keeps the eye in a well-supported and defined position. If even more volume expansion is required, then the lateral orbital wall may be removed, canted outward, and reattached. Thinning of the posterior portion of the lateral wall abutting the cranial fossa is also possible.

Orbital extension procedures increase the orbital volume by extending the orbit anteriorly. This is achieved by augmenting the inferior and lateral orbital rims with real or synthetic bone. Such an approach often requires midface augmentation or suspension as well. By orbital extension, we are in essence building the face out to meet the eye. A similar but less extensive procedure may be required on the contralateral side to gain symmetry. The effect may be further enhanced by building up the lower eyelid through repositioning orbital fat over the orbital rim and into the suborbicularis oculi fat pad plane. This inflates the lower eyelid and achieves a more youthful appearance in addition to enhancing the proptosis reduction.

Orbital contents reductions are procedures that decrease the amount of orbital fat. Extraconal fat removed from below the eye will drop the eye down, whereas extraconal fat from the anterior lateral recess contributes to direct backward movement. To obtain maximal effect, intraconal fat must be removed. Our favored technique is as follows. A transconjunctival approach to the lower lid retractors is performed with reflection of the retractors superiorly. Preseptal dissection and downward retraction of the tarsal plate exposes Lockwood's ligament. Entering just above Lockwood's ligament, the orbital septum is penetrated and the intraconal fat is accessed. Using meticulous dissection, the important neural and vascular conal and intraconal structures are avoided while the intraconal fat is teased forward. The experienced surgeon can achieve significant reduction in proptosis with this elegant fat removal technique. As intraconal fat is brought forward, it may be resected or tucked as a tissue pedicle into the tear

trough deformity or along the infraorbital rim to further camouflage the degree of exophthalmos. Orbital fat reduction may be combined with any number of the other procedures described above to achieve even greater repositioning of the globe.

ENOPHTHALMOS

In addressing enophthalmos, a decision must be made whether or not concomitant hypoglobus correction is required. Compared with repositioning the eye, bringing the eye straight out is more complicated, as ideally this requires volume augmentation behind the globe at the orbital apex or within the muscle cone, areas of high risk for both direct and vaso-occlusive optic nerve injury. Still, correction can be obtained by volume augmentation in the anterior lateral recess of the orbit with nearly any of a wide variety of materials from autogenous, allogeneous, or synthetic sources. If volume augmentation behind the globe is desired, this is probably most safely achieved with specially designed implants tapered posteriorly to minimize the chance of optic nerve compression (Fig. 3). Volume enhancement, however, should only be considered if the orbital floor and walls are stable.

HYPOGLOBUS

There are two requirements for the successful correction of hypoglobus. First, there must be ample space between the eye and the orbital roof to accommodate the desired tissue movement. If insufficient space is available, correction may become much more complicated, as reconstruction may now involve the frontal sinus or skull base. If ample room exists, however, then the raising the eye is generally achievable by placing volume augmentation in the anterior orbital floor, usually through a transconjunctival approach. If the augmentation rises above the inferior orbital rim, the reconstruction must be firmly anchored with rigid fixation devices, such as screws or plates, to prevent anterior migration of implants through the lower eyelid. As is true with the volume augmentation for enophthalmos as well, care must be taken to avoid a "tight orbit" syndrome where orbital pressure is so great that the eye no longer moves easily.

SOFT TISSUES

Once the periocular foundational architecture, specifically the orbital bones, eyebrows, and cheeks, are positioned as desired, the soft tissue work of the eyelids may be addressed. As in all aesthetic surgery, both form and function must be respected, and the eyelids are no exception. The primary function of the eyelids is to protect the ocular surface and manage the spread and evacuation of the tear film. Eyelids that do not blink

Figure 3 (Top) Cartoon of sagittal slice through the eye and orbit with orbital implant (marked *) moving the globe upward and outward, filling the superior sulcus deformity of the upper eyelid as indicated by the single, solid black arrow. Note the tapered posterior edge of the implant avoiding optic nerve compression. (Bottom) A commonly used porous polyethylene, prefabricated enophthalmos wedge implant tapered both posteriorly and anteriorly.

well, do not fully appose, or stand away from the eye may create problems with devastating consequences to both vision and the health of the eye.

Blepharoplasty is rarely a symmetrical procedure, and surgeons are well served to remember that the final surgical result is defined not by the tissue that is resected but by that which is left behind. In other words, when making preoperative markings, one should not necessarily expect the intended skin ellipses to appear as mirror images. Similarly, the amount of fat removed should be more dependent upon the preoperative asymmetries and intraoperative results obtained than upon the amount of adipose sitting on a back table. The most challenging

and yet most important part of an upper or lower eyelid blepharoplasty is the preoperative planning and marking. It is during this stage that preoperative inequities are compensated to achieve the best overall balance. Upper eyelid position, lower eyelid laxity, tear trough deformities, and festoons are often asymmetric and require thoughtful, planned intervention.

Soft tissue manipulation can also often help to camouflage residual underlying asymmetries. One should be mindful of both the reality and the perceptual appearance of a patient's situation. For example, a droopy or blepharoptotic upper eyelid may manifest itself as both a lower position of the eyelid relative to the pupil as well as an apparent elevation of the upper eyelid crease. Keep in mind that the crease difference may be only apparent and not real. If measured, one might find identical eyelid margin-to-crease distances, but as the plane of the tarsus drops from a more horizontal position to a more blepharoptotic vertical position, the eyelid crease may appear higher, and it is this difference that draws the attention of most patients, not the disparity in actual eyelid height. Thus, changing the height of the eyelid crease may alter the perception of eyelid height.

By manipulating observer perception, much can be accomplished to improve apparent symmetry. If residual proptosis remains on one side, for example, this might be hidden by raising the lower eyelid, lowering the upper eyelid, anteriorizing the lateral canthal angle, performing a very small lateral tarsorrhaphy, undersculpting the fat from both upper eyelids (especially the contralateral), grafting or draping fat into the lower eyelid, or elevating the cheek muscles and fat. For patients with a relatively enophthalmic eye, the opposite can be employed: lowering the lower eyelid, raising the upper eyelid, opening and more posteriorly positioning the lateral canthal angle, or aggressively sculpting the fat from the contralateral upper eyelid.

Conceptually more challenging are the patients with multiple, solution-conflicting asymmetries. For example, a patient with both relative blepharoptosis and ocular proptosis on the right side provides a management dilemma. Elevating the upper eyelid may cause the right eye to appear even more exophthalmic and may exacerbate an already dry eye situation. Thus, perhaps one solution might be to lower the upper eyelid crease on the right side or raise the crease on the left side while also performing a small lateral tarsorrhaphy. There are, of course, no hard and fast rules about what will achieve the maximum benefit for all patients. However, a skilled

surgeon with a plethora of techniques up his or her sleeve and creative imagination can accomplish much.

Finally, there are many nonsurgical solutions to modest periocular asymmetries. Thoughtful eyebrow plucking can dramatically alter the shape and position of the brows. Similarly, cosmetics can be profoundly helpful in hiding periocular differences. A slightly lighter shadow used in the upper eyelid of a patient with mild superior sulcus syndrome or mild relative enophthalmos can make the hollow less pronounced if a slightly darker shadow is used on the contralateral side. Spectacle lenses can also make a big difference, magnifying or shrinking an eye, making an eye wider or narrower, elongating or compacting a vertical fissure, or moving the entire eye up or down on the face. Observer-appreciated corrections achieved with a spectacle lens may be reversed with a contact lens over the same eye to maintain normal vision.

In summary, the eyes, eyelids, and brows are the focal point of the face and are responsible for conveying a myriad of subtle messages. Periocular symmetry has long been believed to be essential in communicating health, vitality, and attractiveness, whereas asymmetry suggests trauma or disease. Surgeons operating in the complex central area of the face may achieve greater rejuvenative success if they remain mindful of the importance of overall perceptual symmetry, even when that often means performing disparate surgery on either side of the face.

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