Decreasing Complications in Lower Lid and Midface Rejuvenation: The Importance of Orbital Morphology, Horizontal Lower Lid Laxity, History of Previous Surgery, and Minimizing Trauma to the Orbital Septum: A Critical Review of 269 Consecutive Cases

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Background: Minimizing complications following surgical rejuvenation of the lower lid and midface continues to challenge plastic surgeons. The evolution of refinements of the authors' technique designed to identify high-risk patients and minimize morbidity is described.

Methods: The records of 269 patients having consecutive transorbital, endoscope-assisted lower lid and midface rejuvenation were reviewed and complications identified. High-risk patients were defined based on orbital morphology, degree of horizontal lower lid laxity, and history of previous lower lid or midface surgery.

Results: The authors found that patients with enophthalmic orbits and significant horizontal lower lid laxity were at increased risk of postoperative lower lid malposition. They found that identifying these patients preoperatively, combined with intraoperative correction of laxity when indicated, minimized the risk. They also confirmed that patients with a previous history of lower lid manipulation were at increased risk.

Conclusions: Minimizing trauma to the orbital septum of the lower lid and correction of horizontal lower lid laxity when present are effective techniques in lowering the risk of postoperative lower lid complications. Trauma is minimized by eliminating dissection in the plane between the orbicularis muscle and orbital septum. The passive septal tightening that occurs with this technique combined with fat micrographs to the tear trough and over the inferior orbital rim has rendered more traumatic open surgical manipulation of the septum or postseptal fat almost universally unnecessary. (*Plast. Reconstr. Surg.* 123: 1037, 2009.)

Characteristics of midface and lower lid aging are well known to plastic surgeons. Hamra[1] has emphasized the vertical elongation of the orbit that occurs as the lid/cheek junction descends. Coleman[2,3] and Lambros[4] believe that loss of volume is the more important factor. The authors believe that both occur and, depending on individual genetics, one or the other may dominate. The youthful lower lid and midface is full, elevated, and smooth; the aged is deflated, descended, and irregular (prolapsed postseptal fat, deep nasojugal groove, deeper nasolabial fold) (Fig. 1).

The senior author (T.R.H.) began using translower lid blepharoplasty, subperiosteal midface dissection for rejuvenation of the lower lid and midface in 1994.[5] The technique evolved from experience in craniofacial surgery and the influence of Psillakis et al.,[6] Tessier,[7] and Ramirez,[8] who

From Paces Plastic Surgery.
Received for publication May 15, 2008; accepted October 2, 2008.

DOI: 10.1097/PRS.0b013e318199f671

Disclosure: *The authors have no financial interest to declare in relation to the content of this article.*

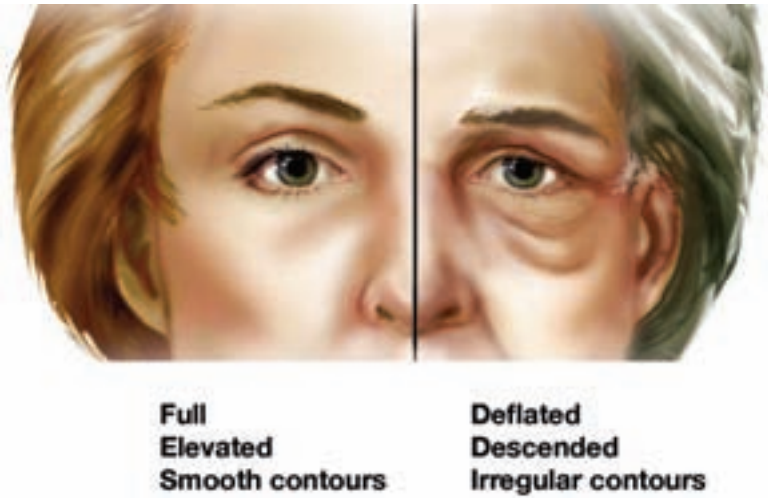

Fig. 1. Contrasting the youthful (*left*) and aged midface (*right*).

described techniques of facial rejuvenation that incorporated the use of subperioteal dissection and release of the midface and brow. The incorporation in our technique of the Hamra[9] principle of vertical vector elevation of the midface has been from the beginning a key to improved outcomes. We initially utilized an "open" lower lid approach because it provided direct access to the midface and allowed for concomitant lower lid rejuvenation.

The open technique has been well described previously.[10,11] In summary, the technique includes dissection of a standard lower lid skin/muscle flap with postseptal fat excision or redraping. Subperiosteal dissection, release, and elevation of the midface are performed. A lateral canthoplasty and conservative excision of excess lower lid skin complete the procedure.

The results of our 5-year experience in 757 patients were published in 2000.[12] Although results were satisfactory overall, a troubling 1.3 percent (10 patients) had significant lower lid malposition that required complex correction, including repeated canthoplasty and the use of lower lid spacers.

The fragility of the lower lid is well appreciated by plastic surgeons. In several reports, even patients having so-called standard lower lid blepharoplasty (without concomitant midface rejuvenation) have a significant risk of postoperative malposition.[13–17] Among others, McCord and Shore,[13] Flowers,[18] Jelks and Jelks,[19,20] and Codner et al.[21] have long advocated canthal support as a routine in all lower lid blepharoplasties. Also, as interest in improving aesthetic results in the midface increased in the late 1990s, numerous surgeons described techniques designed to accomplish that goal while minimizing lower lid complications.[22–28] In 1999, we began to incorporate our own modifications designed to minimize postoperative morbidity.[12,29,30]

PATIENTS AND METHODS

Anatomy

Because dissection and release of midfacial soft tissue are in the subperiosteal plane, anatomical concerns related to sensory or motor nerve damage are minimized. The endoscope is introduced through a minimal myotomy lateral to the canthus (Fig. 2, *above*). All motor branches of the facial nerve are above the plane of dissection and "out of harm's way." There is no denervation of the orbicularis muscle. The sensory nerves of concern are shown in Figure 2, *below*. It is important to avoid excess trauma to the infraorbital nerve to prevent the occasional occurrence of an aggravating parasthesia over the cheek and lateral nose. The smaller, more lateral zygomaticofacial nerve is usually divided during the dissection, with only an occasional patient noticing an inconsequential parasthesia over the zygoma.

Evolution of Technique

The first technique modification to be incorporated was to limit lower lid dissection (trauma) in the critical preseptal plane. Limiting lower lid dissection made visualization of the levators of the upper lip, the zygomaticus muscles, and the infraorbital nerve more difficult. This problem was overcome by utilizing the endoscope inserted via the lateral myotomy (Fig. 2, *above* and *below*). An

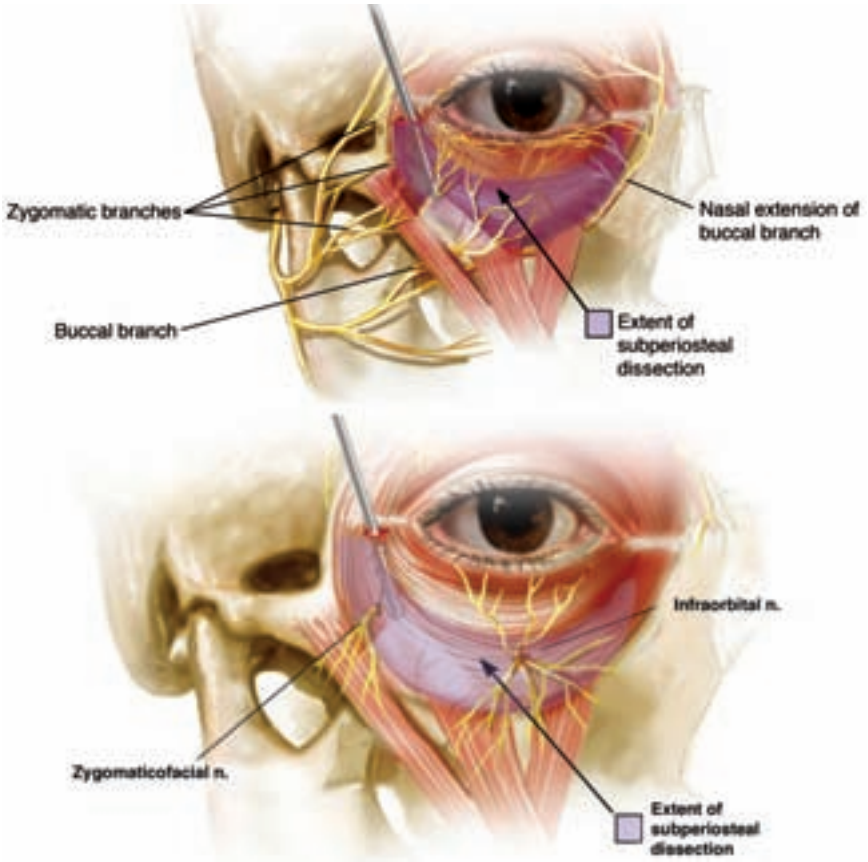

Fig. 2. (*Above*) Endoscope-assisted dissection and release of the midface through a minimal lateral orbicularis myotomy, illustrating that motor branches of the facial nerve are above the plane of dissection and "out of harm's way." (*Below*) Sensory nerve branches encountered in subperiosteal dissection of the midface.

additional change was to eliminate the surgical division of the lateral canthal angle when performing canthoplasty to reduce the incidence of postoperative healing deformities.[12] Serendipitously, we found that in most cases the tightening of the pretarsal orbicularis muscle that occurs with these modifications provided excellent lower lid support and eliminated the need for a more formal canthoplasty. Also, as first suggested by Fogli,[31] we found that because the muscle was not dissected off the septum, orbicularis redraping passively tightened the septum, reducing postseptal fat herniation without the necessity of direct septal manipulation. Early on, we began using fat micrografts to better cover the inferior orbital rim and add indicated volume to the tear trough and nasojugal groove (Fig. 3).[32–34] Conversely, we found it helpful in patients with deep nasolabial folds to reduce volume in the medial edge of the fold by suctioning with a small 1- to 2-mm cannula (Fig. 4).

We published our initial results using these modifications in a report of 140 consecutive cases performed between 2000 and 2002.[30] Although the incidence of the most severe form of malposition was decreased when compared with the open technique, it was noted that in six patients (4 percent) anterior displacement (with or without minimal vertical descent) of the lateral superior lid margin away from the globe occurred. All six had uncorrected horizontal lower lid laxity and four were distinctly enophthalmic.

Jelks and Jelks[35] and Wolfe and Kearney[36] have noted the potential of increased lower lid morbidity in patients with exophthalmus. Our experience suggested that patients with enophthalmic orbits combined with horizontal lower lid laxity are also at increased risk.[30] For these two reasons, beginning in early 2002, all patients had preoperative assessment of orbital morphology, intraoperative assessment of lower lid laxity, and intraoperative correction when indicated.

Orbital morphology was determined before surgery by using the Hertel exophthalmometer. This instrument measures the distance in milli-

Fig. 3. Restoration of volume in the upper midface with correction of tear trough depression using autologous fat injections.

meters from the most anterior point of the lateral orbital rim and the anterior border of the globe (Fig. 5, *above* and *below*).[37] The 269 patients included in this study had measurements ranging from 12 to 22 mm. For the purposes of this article, we have defined enophthalmic as 14 mm or less (11 patients; 4 percent). Most had midrange measurements from 15 to 18 mm (231 patients; 86 percent). The remainder had exophthalmic measurements from 19 to 22 mm (27 patients (10 percent) (Table 1).

All patients also had intraoperative assessment of horizontal lower lid laxity. Lower lid laxity can be assessed using the snap back or more accurate distraction test.[38] The upper border of the lower lid is grasped as is crosses the base of the limbus. If the lid can be pulled 6 mm or more away from the globe, significant laxity is present (Fig. 6). When indicated, a 2- to 4-mm full-thickness wedge of the ciliary margin and the tarsal plate is excised. This maneuver is similar to the classic Kuhnt-Symanoski procedure, except the excision is more lateral.[39] A 2- to 3-mm segment of the tarsal plate and ciliary margin is maintained laterally (Fig. 7, *above*). Retention of this lateral segment allows for anatomical repair of the lower lid and eliminates the necessity for a potentially angle-distorting lateral canthotomy (Fig. 7, *below*). Vertical elevation and fixation of the cheek and orbicularis to the periosteum of the inside of the lateral orbital rim and temporal fascia, followed by conservative excision of excess lower lid skin, conclude the procedure (Fig. 8).

Most patients also had indicated endoscope-assisted brow repositioning[40–43] and neck rejuvenation. Details are not included; however, it should be noted that the rejuvenation of the midface as described in this article eliminates the need for extensive lateral to medial subsuperficial musculoaponeurotic system dissection in the cheek and lower face.

Fig. 4. Suction of medial edge of prominent nasolabial fold.

Patient Selection

The records of 269 consecutive patients were reviewed (195 primary and 74 secondary patients). Primary patients had not had previous lid or midface surgery. Secondary patients had a previous blepharoplasty with or without some version of midface rejuvenation. Patient ages ranged from 36 to 78 years; 262 were female and seven were male. Follow-up ranged from 6 to 60 months.

RESULTS

The most troublesome complication following lower lid and midface rejuvenation is malposition (ectropion). Malposition is defined as inferior descent of the lid related to the limbus in neutral gaze, usually with a component of anterior displacement away from the globe. In this study, we defined lower lid malposition as follows: grade I, minimal; grade II, less severe; and grade III, severe. Grade I included patients with minimal nonfunctional aesthetic asymmetries of canthal or lower lid position. Correction required canthoplasty with the occasional use of a spacer. Grade II is characterized by minimal descent and anterior displacement without septal scarring or skin deficiency. Correction required canthoplasty, correction of any residual horizontal laxity, and a spacer when indicated. Grade III malposition is characterized by lower lid descent with severe ectropion, septal scarring, and possible skin deficiency. Correction in these patients is complex and often requires multiple procedures, including the use of a spacer and occasionally skin replacement (Table 2).

Class I malposition occurred in nine of 269 patients (3.3 percent), class II in four of 269 patients (1.5 percent), and class III in no patients.

We also examined the incidence of malposition related to whether or not the patient had previous lower lid and/or midface rejuvenation

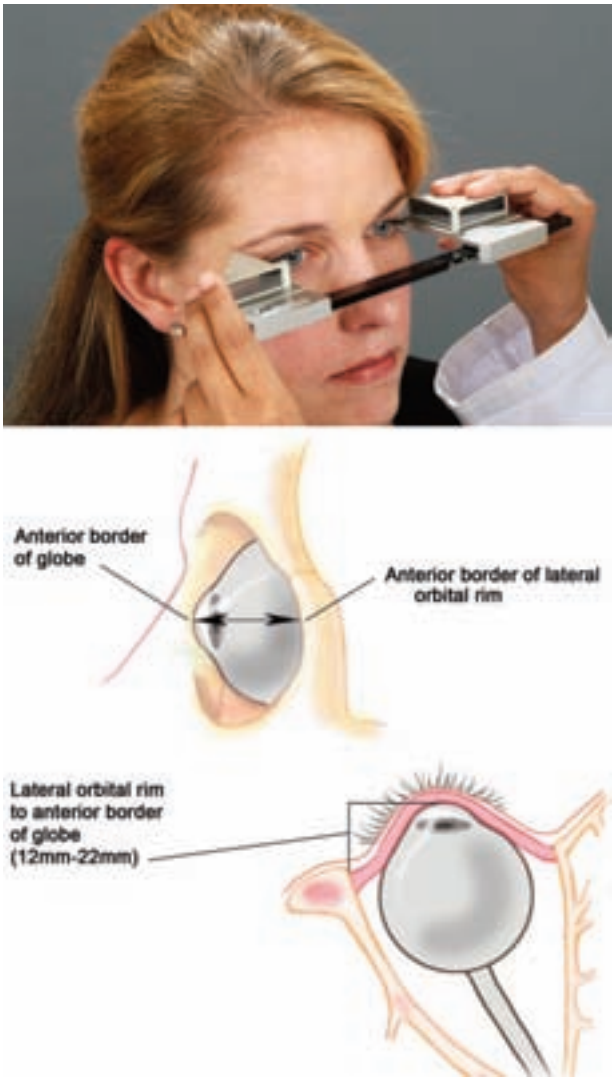

Fig. 5. (*Above*) Measurement of orbital volume using the Hertel exophthalmometer. (*Below*) The Hertel device measures the distance in millimeters from the anterior surface of the most posterior point of the lateral orbital rim to the most anterior point of the globe.

Table 1. Hertel Measurement of Orbital Morphology: 269 Consecutive Patients

Morphology	No. of Patients
Enophthalmic (12–14 mm)	11 (4%)
Midrange (15–18 mm)	231 (86%)
Exophthalmic (19–22 mm)	27 (10%)

(secondary). The total number of patients requiring at least one procedure for correction of any degree of malposition was 13 of 269 patients (4.8 percent). Four of 195 were primary patients (2.1 percent) contrasted with nine of 74 secondary patients (12.2 percent).

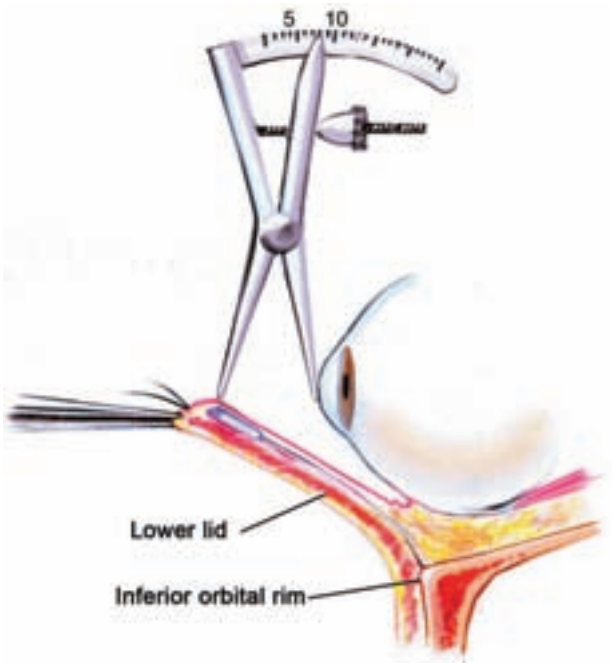

Fig. 6. Distraction test for horizontal laxity.

The patient seen in Figure 9 illustrates type I malposition. She was 64 years old with enophthalmus (15 mm) and horizontal lower lid laxity (distraction test, 7 mm). In Figure 9 *left* and *center*, she is shown before and after lateral wedge excision with lower lid and midface rejuvenation. A decrease in size of the lateral white triangle with medial drift and blunting of the lateral canthal angle is seen. In Figure 9 *right*, she is shown at 3 months with partial correction after the lateral canthal tendon was sutured to the inside of the orbital rim.

The patient seen in Figure 10 illustrates class II malposition. She was 62 years old with an enophthalmic globe (15 mm) and horizontal lower lid laxity (distraction test, >6 mm) not corrected at the time of her primary procedure. In Figure 10 *left*, she is shown before surgery. In Figure 10 *center*, she is shown 3 weeks after surgery with anterior displacement of the right lower lid away from the globe with minimal descent. She is shown in Figure 10 right after lateral wedge excision to correct horizontal laxity.

The patient shown in Figure 11 was a 43-year-old woman with postoperative severe (class III) malposition 3 months after translower lid superiosteal midface rejuvenation. She was referred to our facility for correction. The lid was immobile, with severe septal scarring and skin deficiency. Correction required two procedures: reelevation of the cheek to recruit skin, with release of septal

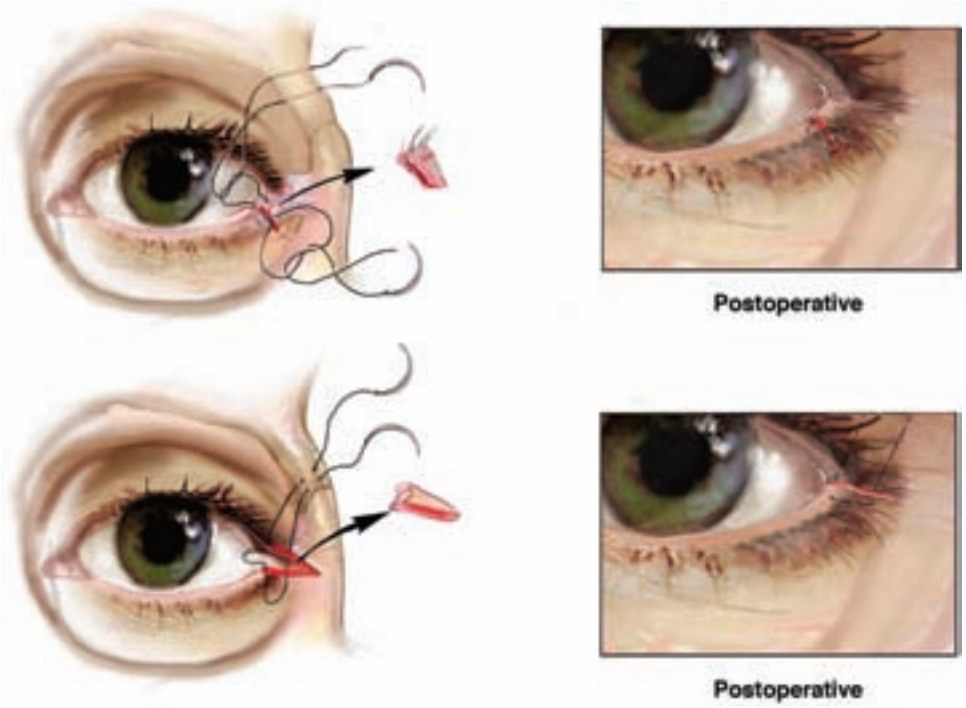

Fig. 7. (*Above*) Current technique: correction of horizontal lower lid laxity using lateral wedge excision without division of lateral canthal angle. (*Below*) Previous technique: correction of horizontal lower lid laxity utilizing lateral angle canthotomy.

scarring and placement of a spacer, and drill-hole canthoplasty. In Figure 11 *right*, she is shown 4 years after correction.

The patients shown in Figures 12 and 13 are illustrative of acceptable results achieved in the large majority of the 269 patients reported.

The 52-year-old woman shown in Figure 12 typifies patients with an increased risk for postoperative malposition. Her exophthalmometer measurement was distinctly enophthalmic (12 mm), and the lid distraction was 8 mm. She had lower lid and midface rejuvenation with lower lid wedge resection for correction of laxity. She also had brow and neck rejuvenation and volume replacement utilizing 2 cc of fat injected bilaterally under the tear trough and over the inferior orbital rim and 2 cc injected in the cheek (nasojugal groove). Postseptal fat was not manipulated. In Figure 12 *center*, she is shown 1 year after the procedure. The left Hamra view (Fig. 12, *right*) confirms restoration of smooth, youthful contours. Although the patient did not perceive it, in the postoperative views there appears to be a slight narrowing of the horizontal palpebral fissure.

The 56-year-old woman shown in Figure 13 typifies patients with less risk for postoperative malposition. Her exophthalmometer measurement was high/normal (18 mm) and she had lid distraction of less than 6 mm (4 mm). She also had brow and neck rejuvenation and volume replacement utilizing 1.5 cc of fat injected bilaterally under the tear trough and over the inferior orbital rim and 3 cc injected in the cheek (nasojugal grove). Postseptal fat was not manipulated. In Figure 13 *above, right*, she is shown 16 months after the procedure. The lateral preoperative and 16-month postoperative views are shown in Figure 13 *below, left* and *center*. The right Hamra view (Fig. 13, *below, center*) confirms restoration of smooth, youthful contours.

DISCUSSION

This article documents our 5-year experience with technical refinements designed to minimize the incidence of postoperative lower lid malposition. We found that patients with horizontal lid laxity of 6 mm or greater with an exophthalmometer measurement of 18 mm or less were at increased risk. Eighty of 269 patients (30 percent) had intraoperative correction of lid laxity. The percentage of patients requiring lid shortening increased as orbital prominence decreased (Table 3).

From a statistical standpoint, when the patients were divided into the three groups, there

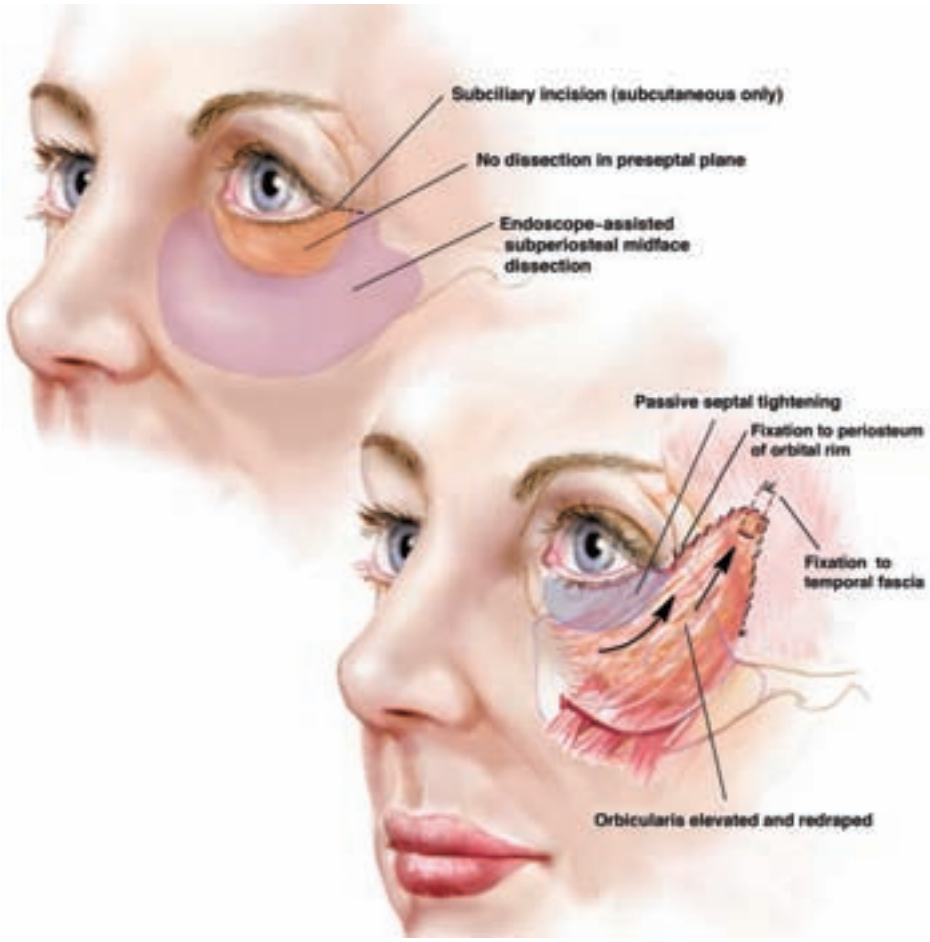

Fig. 8. Elevation and fixation of midface emphasizing: (1) no dissection in critical preseptal plane of the lower lid, (2) redraping of the orbicularis with passive septal tightening, and (3) vertical elevation and secure fixation of the midface.

Table 2. Defining Lower Lid Malposition

Grade	Definition
I	Minimal, nonfunctional aesthetic asymmetry of lower lid or canthal position
II	Less severe descent or anterior displacement without septal scarring or skin deficiency
III	Severe descent with ectropion, septal scarring, and skin deficiency

was a statistically significant difference between the proportion of those who were corrected and those who were not corrected ($p = 0.027$). Analysis of the entire population demonstrated a difference between the ≤14-mm group and the 15- to 18-mm group ($p = 0.049$), and also a difference between the ≤14-mm group and the ≥19-mm group ($p = 0.032$). Using 14 mm as a stratifying value, there was a strong association between those who were corrected and those who were not ($p = 0.012$).

Of these 80 high-risk patients, only two (2.5 percent) developed class II malposition, leading one to conclude that if these patients had not had preemptive treatment, the overall incidence of malposition would have been greater.

Modern procedures used to correct horizontal lower lid laxity have commonly incorporated a lateral angle canthotomy with either advancement of a deepithelialized lateral tarsal or dermal strip or lateral wedge excision of the lower lid.[13,21,44–46] The senior author had extensive experience with the use of cantholysis and lateral wedge excision in the late 1990s. Although it is an effective way to correct lower lid laxity, division of the lateral canthal angle can result in a significant number of postoperative healing deformities, including lateral canthal webbing, rounding of the lateral canthal angle, and occasionally shortening of the width of the horizontal palpebral fissure.[10] For these reasons, we sought to eliminate incision through the lateral canthal angle. We noted that eliminating dissection and separation of the or-

Fig. 9. A 64-year-old woman with class I malposition. (*Left*) Preoperative anteroposterior view. (*Center*) Three-month postoperative view with class I malposition. (*Right*) Four months after canthoplasty with partial correction of malposition.

Fig. 10. A 62-year-old woman with class II malposition. (*Left*) Preoperative anteroposterior view. (*Center*) Three-week postoperative view with class II malposition. (*Right*) One month after lateral wedge resection for correction.

bicularis and septum in the body of the lid resulted in "passive" tightening of the lateral canthal tendon as the pretarsal orbicularis is redraped superiorlaterally. This dynamic rendered formal canthoplasty unnecessary. As noted above, however, 80 patients with excessive horizontal laxity had correction by lateral wedge excision. It is important to note that only a 2- to 4-mm segment is excised, leaving a lateral tarsal segment to ensure an anatomic closure. In the 80 patients having correction, excision of the 2- to 4-mm segment reduced laxity from 6 to 9 mm to 2 to 4 mm. Excision of a segment greater than 4 mm can result in the narrowing of the horizontal palpebral fissure (Fig. 9). Horizontal laxity is more of an issue in the presence of enophthalmus, because

Fig. 11. A 43-year-old woman with class III malposition. (*Left*) Preoperative anteroposterior view. (*Right*) Four-year postoperative anteroposterior view following correction utilizing repeated midface elevation, lower lid spacer, and canthoplasty.

Fig. 12. Results in 52-year-old woman with an exophthalmometer measurement of 12 mm. (*Left*) Preoperative anteroposterior view. (*Center*) One-year postoperative anteroposterior view. (*Right*) One-year postoperative left Hamra view.

the globe does not lie as snugly against the lid as it does when the globe is more prominent, increasing the risk that postoperative edema can result in anterior and/or inferior displacement.

Complications related to the wedge excision itself have been rare. Because the lateral segment has both lashes and the lateral edge of the tarsal plate, the repair is secure and camouflaged. Only two patients have required a revision for minimal notching (Fig. 7).

As noted, the primary purpose of this study was to determine whether decreasing septal trauma

Fig. 13. Results in a 56-year-old woman with an exophthalmometer measurement of 18 mm. (*Above, left and right*) Preoperative and 16-month postoperative anteroposterior views. (*Below, left and center*) Preoperative and 16-month postoperative lateral views. (*Below, right*) Sixteen-month postoperative right Hamra view.

Table 3. Orbital Morphology in 80 of 269 Patients (30 percent) Having Intraoperative Correction of Lower Lid Laxity

Patients	<14 mm	15–18 mm	19–21 mm
80	7 of 11 (64%)	69 of 237 (29%)	4 of 21 (19%)

combined with the preemptive correction of significant horizontal lower lid laxity in morphologically prone patients would help minimize the incidence of postoperative lower lid malposition. Class II malposition occurred in only four of 269 patients (1.5 percent). Although the numbers are small, it is noteworthy that in the previous report of a series of 140 cases treated before preemptive correction of lid laxity was instituted, class II malposition occurred in six patients (4.3 percent).[29] Though not statistically significant, these numbers represent a trend toward decreased malposition with less septal trauma ($p = 0.082$). For class III malposition, it is worth noting that the most severe type of malposition did not occur (0 of 269) in the most recent set of patients, compared with 1.3 percent (10 of 757) reported in prior experience ($p = 0.058$).

An additional nine patients (3.3 percent) had minimal aesthetic asymmetries of the canthal or lower lid position. Although correction was relatively simple, these patients required secondary procedures and are included in the total number of patients having as least some degree of postoperative lower lid malposition. The total number of patients requiring revision for any degree of lower lid malposition was 13 (4.8 percent), a number that is gratifyingly low especially when compared with reports of up to 20 percent postoperative malposition in patients having blepharoplasty alone.[17]

Not surprisingly, a history of previous lower lid surgery increases risk [nine of 74 (12.2 percent) of secondary patients compared with four of 195 (2.1 percent) primary patients]. This finding is strongly statistically significant ($p = 0.001$, $\chi^2 = 11.9$). Secondary patients often present with uncorrected midface descent and have subclinical scarring in the plane between the orbicularis and septum secondary to the previous surgical trauma. In secondary patients, one should be very conservative when excising skin and muscle. In both primary and secondary patients, no matter how secure the midface fixation and canthal support, a deficiency of skin will invariably result in postoperative lower lid malposition. A guide for excision is as follows: from the medial canthus to the pupil, 0 to 1 mm; from the pupil to the lateral canthus, 1 to 3 mm; and lateral to the lateral canthus, 4 to 6 mm (Fig. 14). Overresection of lower lid skin will ensure that lower lid malposition will occur, and overresection on the nasal side of the pupil is the most problematic. These numbers are only a guide. The bottom line is that there is no vertical tension in the closure.

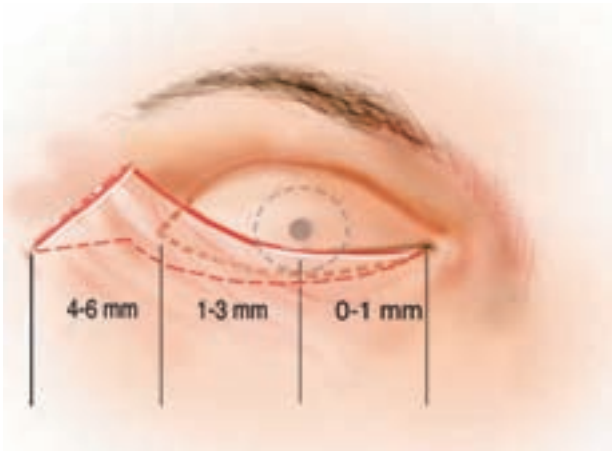

Fig. 14. Diagram of lower lid blepharoplasty, with conservative excision of excess skin.

Finally, it should be emphasized that the passive septal tightening that occurs is very effective in correcting postseptal fat prolapse without the trauma inherent in open lower lid procedures.[31,47] Only three patients had residual postseptal fat prominence requiring treatment. It should also be noted that temporary chemosis occurred in only five of 269 patients (1.8 percent). The very low incidence of this troublesome morbidity is probably related to the decreased trauma to the lid and lateral canthus inherent in the technique.

CONCLUSIONS

The authors report the data from a series of 269 consecutive procedures that strongly suggest that preoperative identification of morphologically high-risk patients, the intraoperative correction of significant horizontal lower lid laxity, and decreasing operative septal trauma are efficacious in lowering the risk for malposition following lower lid and midface rejuvenation. The principle of passive septal tightening[13,47] combined with the use of microfat grafting[3,4,32,34] for correction of the tear trough depression or to add additional cover over a skeletonized orbital rim has eliminated the need for more traumatic open manipulation of the orbital septum or postseptal fat.[48–56] A significant increased risk in secondary patients is also confirmed.

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