

# Preventing and Managing Dry Eyes after Periorbital Surgery: A Retrospective Review

Adam H. Hamawy, M.D.  
Jordan P. Farkas, M.D.  
Steven Fagien, M.D.  
Rod J. Rohrich, M.D.

Dallas, Texas; and Boca Raton, Fla.

**Background:** Dry eye syndrome is a common sequela associated with periorbital surgery. As more patients seek periorbital rejuvenation, understanding the pathophysiology, diagnosis, and treatment of this condition perioperatively is essential for managing patient expectations and maximizing outcomes.

**Methods:** A retrospective review of charts for 202 consecutive patients (180 women and 22 men) who underwent upper and/or lower blepharoplasty was performed. Additional facial cosmetic procedures were performed in 91 percent of patients. Data were collected identifying associated risk factors and the incidence of persistent dry eye symptoms. Key elements of perioperative care are described and algorithms for detection of those at risk, prevention, and management are outlined.

**Results:** Dry eyes persisting longer than 2 weeks after surgery were noted in 22 patients (10.9 percent) and longer than 2 months in only four patients (2 percent). In most cases, dry eyes resolved with conservative management, including artificial tears, lubrication, topical and systemic steroids, and night taping. One patient (0.5 percent of all studied patients) eventually needed surgical correction of lower eyelid retraction after failure of the punctate plug. Persistent chemosis occurred in 15 patients (68.2 percent) who had symptomatic dry eyes ( $p < 0.01$ ).

**Conclusion:** Recognizing and addressing risk factors before surgery and an algorithmic approach to prevention and management of patients undergoing periorbital surgery are essential for minimizing the occurrence of dry eye syndrome. (*Plast. Reconstr. Surg.* 123: 353, 2009.)

**D**ry eye syndrome is a well-recognized sequela that every surgeon performing blepharoplasties will encounter.<sup>1,2</sup> Management of this common entity should start with the preoperative evaluation and continue through the operation and into the postoperative recovery period.<sup>3</sup> The surgeon must be aware of preexisting conditions that produce tear film abnormalities and that may place patients at higher risk of having a lasting postoperative complication. In addition, the consultation and preoperative evaluation can aid in the detection of those patients who might be predisposed to symptoms postoperatively. During the procedure, an approach with the intent of main-

taining the functional anatomy of the eyelid is essential for preserving tear film physiology and reducing ocular exposure. A methodical postoperative regimen for preventing corneal exposure and minimizing inflammation is the final stage to aid in a satisfactory recovery. In this article, we evaluate the development of dry eyes in patients who had upper and lower blepharoplasties and emphasize key elements of patient workup, surgical technique, and postoperative care. Algorithms for detection, prevention, and management of dry eyes are outlined.

*From the Department of Plastic Surgery, University of Texas Southwestern Medical Center, and Aesthetic Eyelid Plastic Surgery.*

*Received for publication January 15, 2008; accepted July 9, 2008.*

*Presented at the Texas Society of Plastic Surgeons Annual Meeting, in Austin, Texas, September 28 through 30, 2007. Copyright ©2008 by the American Society of Plastic Surgeons*

DOI: 10.1097/PRS.0b013e31819346ea

**Disclosure:** *None of the authors has any commercial association or financial relationships that might pose or create a conflict of interest with the information presented in this article. The views and conclusions expressed are those of the authors and do not reflect the official policy or position of the Department of the Army, the Department of Defense, or the United States government.*

**PATIENTS AND METHODS**

Charts were reviewed for 202 consecutive patients who underwent upper and/or lower blepharoplasty by the senior author (R.J.R.) from October of 2003 to August of 2006. There were 180 women and 22 men, with ages ranging from 27 to 80 years. Ninety-one percent of patients had additional facial cosmetic surgery at the same setting. Data were collected identifying associated risk factors and the incidence of persistent dry eyes. We reported “dry eyes” in any patient who admitted to irritation, foreign body sensation, or epiphora or who was known to have “dryness.” A detailed history was taken noting current medical conditions, menopausal status for women, use of medications or hormone replacement, past periocular and intraocular operations, and use and tolerance of contact lenses. Upper and lower blepharoplasties were performed using an atraumatic technique. The orbicularis oculi muscle was spared in all cases and its innervation preserved. Upper lids were addressed by skin excision with fat removal if necessary. The lower lid was addressed through a transconjunctival approach. Minimal fat was removed based on preoperative assessment and the lid then supported with a lateral canthopexy in all cases. This was performed by securing the anterior lamella of the lateral canthus to periosteum on the inside of the lateral orbital rim at the level of the upper limbus with a 5-0 temporary or permanent suture using a modified technique as described by Fagien (Table 1).<sup>4</sup> This was adjusted and titrated on the basis of the patient’s preoperative orbital morphology, with careful attention to place the suture inside the orbital rim (posteriorly) to avoid tenting the lower lid over the eye. Skin was excised using “pinch” technique. No skin or skin-muscle flaps were performed on any patients. A cheek lift was performed in select cases through a standard periauricular face-lift incision and superficial musculoaponeurotic system support by plication.

**Table 1. Indications for Permanent Suture Canthopexy\***

- Negative vector orbit
- Male gender
- Revision eyelid surgery
- Significant lower lid laxity (delayed snapback)
- Significant lateral canthal slant
- History of dry eyes on medication

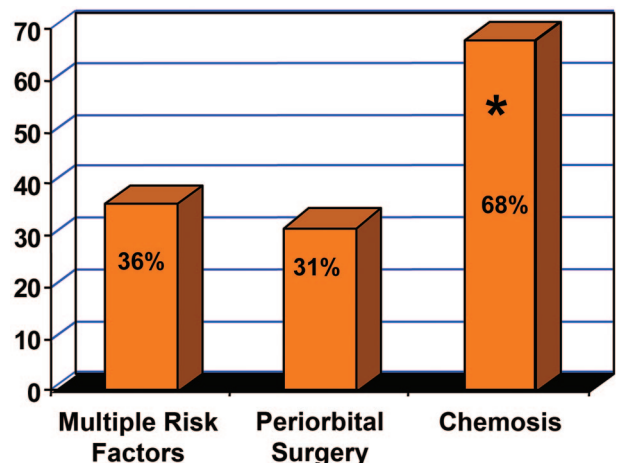
\*A permanent 5-0 polyester fiber suture was used in patients who had one or more of the listed factors. Otherwise, a temporary absorbable suture was the standard.

**RESULTS**

Dry eyes persisting longer than 2 weeks after surgery were noted in only 22 patients (10.9 percent). This was 13.6 percent of men and 10.6 percent of women (three men and 19 women). The difference was not statistically significant. The patients’ ages ranged from 41 to 66 years, and 77 percent of patients with persistent symptoms were 55 years or older. Symptoms in 21 patients (95.5 percent of patients with dry eyes) resolved with conservative management, including artificial tears, lubrication, topical and systemic steroids, and night taping within 8 weeks. Only four patients (2 percent) had dry eyes persist more than 2 months and were eventually referred to an ophthalmologist. Of these four patients, one (0.5 percent of patients undergoing lid surgery, 4.5 percent of patients with dry eyes) eventually needed surgical correction of lid retraction after failure of punctate plug. Persistent chemosis was present in 15 patients (68.2 percent) who had symptomatic dry eyes, which was statistically significant ( $p < 0.01$ ) using Fisher’s exact test. Seven patients (31.8 percent) with dry eyes persisting longer than 2 weeks had previous periocular or ophthalmic surgery (i.e., blepharoplasty, laser-assisted in situ keratomileusis, or cataract removal/lens replacement). Eight patients (36.4 percent) had multiple additional risk factors (Fig. 1).

**DISCUSSION**

Dry eye syndrome is a group of disorders/deficiencies of the tear film caused by reduced tear production or excessive tear evaporation and may cause disease of the ocular surface.<sup>5</sup> This can have a significant impact on the patient’s vision-related



**Fig. 1.** Risk factors for postoperative dry eyes (\* $p < 0.01$ , Fisher’s exact test).

activities, including professional work and computer use, reading, and night driving.<sup>6</sup> Symptoms can include mild irritation and itching and foreign body sensation, and can progress to intolerable pain. Other complaints may suggest a vague soreness or “awareness of my eyes” (not previously noted), ocular fatigue, and changes in visual function (blurred vision). Currently, up to 12 percent of men and 17 percent of women in the general population are reported to have dry eyes.<sup>7</sup> However, after eyelid surgery, this sequela can be expected in every patient, at least temporarily. In most cases, this is limited to a few days during the recovery period; however, patients who are at high risk or who already have the components of the syndrome or frank disease before surgery can have long-term morbidity if not identified preoperatively and if appropriate measures are not taken.<sup>3,8</sup> Use of contact lenses, premenopausal state, or history of laser-assisted in situ keratomileusis vision correction are just a few of the common risk factors that predispose patients to persistent dry eyes. Successful surgery and prevention of persistent dry eyes entails (1) proper understanding of tear film anatomy physiology, (2) preoperative recognition of risk factors through the history and physical examination, (3) intraoperative maneuvers to maximize prevention, and (4) immediate and aggressive postoperative management.

### Anatomy

The trilamellar precorneal tear film is produced by three sets of glands: the tarsal and limbal goblet cells that produce a mucopolysaccharide that covers the cornea; the main lacrimal and accessory glands of Kraus and Wolfring in the subconjunctival tissues that produce an intermediate aqueous layer; and the oil-producing meibomian glands and the palpebral glands of Zeis and Moll.<sup>3,9</sup> This three-layered film is reestablished between blinks. Smooth function depends on adequate tear production, precise eyelid closure, and a normal blinking rate. Surgical modification of the periocular anatomy can alter the eyelid closure and blinking mechanism enough to aggravate a subclinical condition of dry eye syndrome into a clinical one.<sup>10</sup>

The ocular surface and lacrimal glands function as an integrated unit to refresh the tear supply and to clear used tears.<sup>11</sup> Any process that causes dysfunction of this unit results in an unstable, unrefreshed tear film that causes ocular irritation and the epithelial disease. When basic lacrimal secretion is inadequate, corneal and conjunctival

desiccation stimulate lacrimal gland output, leading to the paradoxical response of increased tearing in a dry eye state.

### Preoperative Recognition of Risk Factors

Risk factors can be divided into systemic, pharmacologic, environmental, and anatomical (Table 2). Systemic and pharmacologic conditions act by disrupting the normal functional anatomy of eyelid or efferent cholinergic nerves that are involved in tear production and clearing. These can lead to an inflammatory response by the ocular surface that causes the symptoms of dry eye.<sup>11</sup>

A thorough history and physical examination is essential. The patient should be asked about signs and symptoms of dry eyes and their successful (or not) use of contact lenses. Exacerbating conditions such as wind, air travel, decreased humidity, and prolonged visual efforts associated with decreased blink rate such as reading or prolonged periods in front of computer monitor should also be elicited. Use of eye drops and their effect on symptoms such as artificial tears and

**Table 2. Risk Factors**

Systemic disease
● Rheumatoid arthritis
● Sjögren syndrome
● Rosacea
● Aqueous tear deficiency
● Hemochromatosis
● Amyloidosis
● Stevens-Johnson syndrome
● Neuromuscular disorders (Parkinson's disease, Bell's palsy)
● Viral infections (HIV, human T-cell lymphotropic virus type 1, hepatitis C, and Epstein-Barr)
Medication
● Hormone replacement therapy
● Diuretics
● Antihistamines
● Anticholinergics
● Antidepressants
● Systemic retinoids
Environmental
● Reduced humidity
● Wind
● Drafts
● Air conditioning
● Heating
● Allergens
Anatomical
● Negative vector orbit
● Negative lateral canthal tilt
● Scleral show
● Lower lid laxity
● Blepharitis
● Ocular surface disease
● Periorbital surgery (e.g., blepharoplasty, LASIK, PRK, cataracts)

HIV, human immunodeficiency virus; LASIK, laser-assisted in situ keratomileusis; PRK, photorefractive keratectomy.

antihistamines are important. Smoking history should be ascertained because of its damage to the lipid layer of the ocular surface.<sup>12</sup> Women should be queried with regard to the timing of menopause if it has occurred, and whether they take oral contraceptives or hormone replacement.<sup>13,14</sup> Medical history should be elicited, with particular interest in diseases associated with dry eyes and previous ophthalmic or periocular surgery including laser corrective surgery such as laser-assisted in situ keratomileusis, photorefractive keratectomy, and previous eyelid surgery. There are an increasing number of reports implicating refractive surgery with subsequent dry eye syndrome that relate mostly to corneal denervation that is a known sequela of some of these surgical procedures.<sup>15,16</sup>

Physical examination in addition to visual acuity measurements should document signs of dry eyes, including erythema, epiphora, frequent blinking, and generalized ocular fatigue. Morphologic risk factors including proptosis, lower lid laxity, scleral show, negative vector orbit, and lateral canthal dystopia have been described previously and should be noted.<sup>17,18</sup> The presence of any of these factors should lead one to consider delaying the operation or possibly not proceeding with surgery, depending on the degree of symptoms and risk (Figs. 2 and 3).

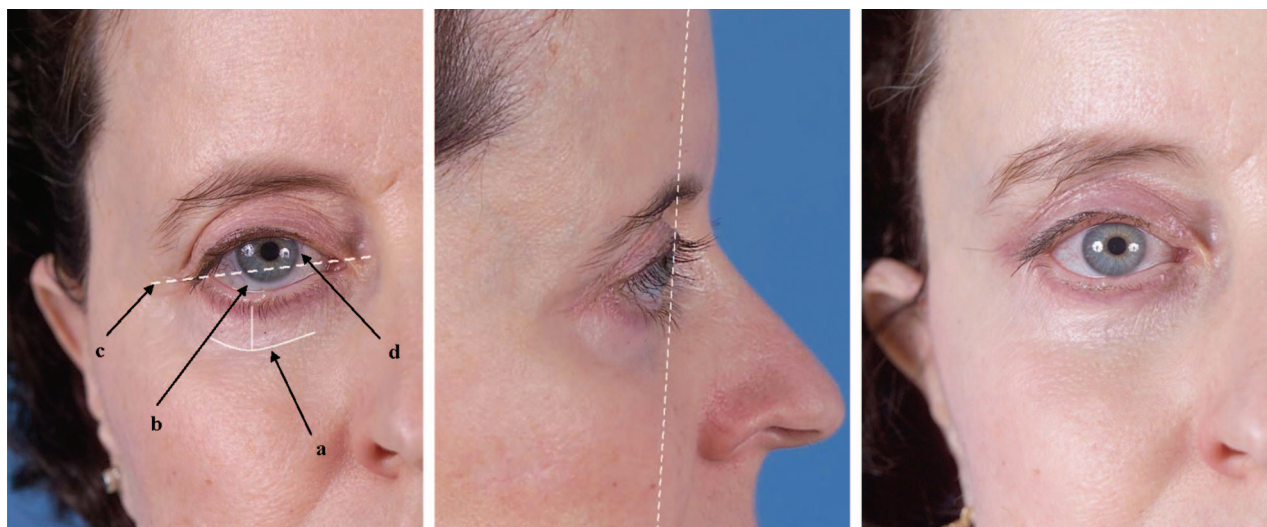
### Intraoperative Prevention

There are numerous methods with which to optimize the surgical approach to rejuvenating

the upper and lower eyelids.<sup>19–25</sup> However, when working with a high-risk patient, a less invasive approach can help avoid many unnecessary complications. Staging the upper and lower blepharoplasties in two separate operations may be considered. Once the decision to proceed with surgery has been made, certain principles should be adhered to. Corneal protection is an obvious, often overlooked aspect of blepharoplasty. Trauma or, more importantly, prolonged exposure can lead to corneal abrasion or ulceration. In the postoperative setting with inflammation, decreased tear production, and increased evaporative loss caused by a small degree of lagophthalmos, this can be disastrous. Use of lubrication and a corneal protector is a simple measure for protecting the eyes from such an occurrence.

Conservative excision is critical. This entails accurate measurement with a caliper and leaving 8 to 9 mm in the pretarsal fold when performing an upper blepharoplasty. Postoperative lagophthalmos should mostly be nonexistent and certainly less than 2 mm<sup>21</sup> in the presence of edema. Skin resection in the lower blepharoplasty should be more conservative, taking into account that even if there is no lower lid retraction after resection, postoperative healing and scarring may eventually pull a lax lid down.

The orbicularis oculi muscle should be preserved in both upper and lower blepharoplasty. Spe-



**Fig. 2.** (Left and center) A classic patient who exhibits multiple risk factors. This woman of postmenopausal age has a shortened lower lid (a) with scleral show (b), conjunctival injection, and a negative lateral canthal tilt (c) and is wearing contact lenses (d). The lateral view confirms a negative vector orbit. (Right) Appearance after excision of 3 mm of redundant upper eyelid skin; the new supratarsal fold was set at 8 mm. A lateral reticular canthopexy was performed to correct the lateral canthal sag and the negative vector aspect of her lower eyelid. This was performed with permanent 5-0 Mersilene suture (Ethicon, Inc., Somerville, N.J.) bilaterally and symmetrically.

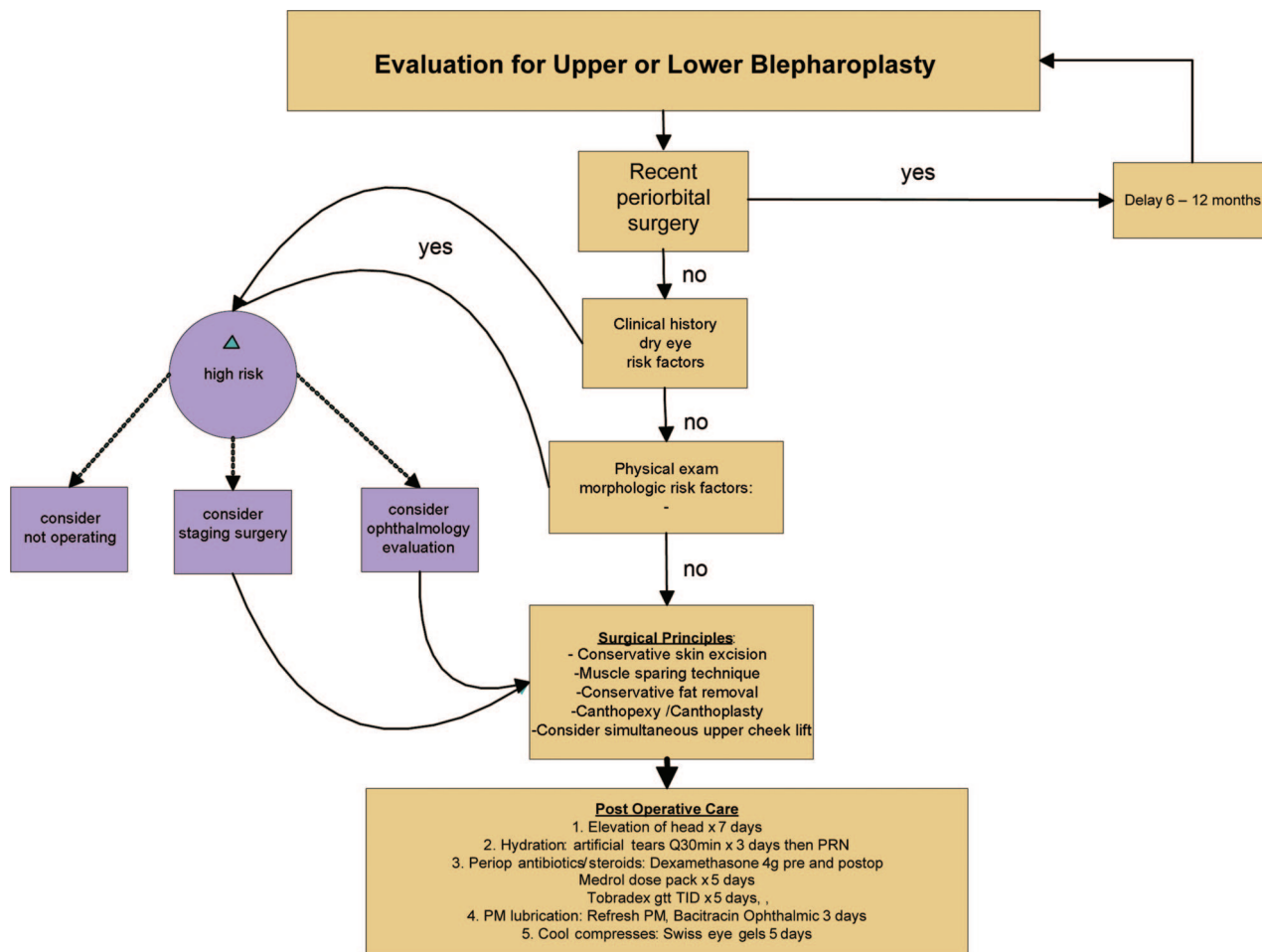


Fig. 3. Algorithm for prevention of dry eye syndrome.

cial attention is paid to not injure the innervation as well. Disruption may lead to a decreased blink rate and is a setup for evaporative tear loss.<sup>8,10</sup>

Control of inflammation by minimizing dissection, trauma, and denervation should also result in a lesser likelihood of developing chemosis.<sup>26</sup> Chemosis is thought to develop or worsen in part because of exposure and lymphatic dysfunction caused by disruption to lymphatic channels during surgery. The exact cause of chemosis is probably multifactorial and can include denervation, conjunctival inflammation (worsened by a transconjunctival incision), and a host of other causes. Although not commonly reported, recent literature and our own observations have shown that chemosis after blepharoplasty is not as rare as has been described and is closely associated with dry eyes.<sup>2,26-29</sup> Development of chemosis may begin the vicious cycle leading to dry eyes, which may lead to more chemosis, and so on. A preoperative intravenous dose of dexamethasone (8 mg) may

also limit the inflammatory response.<sup>30</sup> Other maneuvers that aid in the “exposure” contribution to chemosis are also useful, such as frequent lubrication, temporary tarsorrhaphies, and postoperative Frost-type (traction) sutures.

Canthopexy to correct lateral canthal depression and protect against ectropion is a safe measure that may be performed. Although many methods have been described, we prefer the placement of a suture that will be subtle and will resolve over time while supporting the lid during the postoperative course.<sup>4,21</sup> Severe preoperative lower lid laxity should be corrected with a canthoplasty. Depending on the patient’s morphology, a simultaneous upper cheek lift may be appropriate to protect against lower lid complications later.<sup>31</sup> This may be performed through the lower blepharoplasty incision; however, this may result in excessive retraction on the lower lid and orbicularis. An approach to the upper cheek through the preauricular face-lift incision when possible avoids this additional trauma.

**Postoperative Management**

Postsurgical prevention of dry eyes should be aimed at limiting edema, hydration, and lubrication; controlling inflammation; and preventing infection. Edema may be controlled with head elevation and periorbital cool compresses.<sup>32</sup> Immediately after surgery, normal tear film production is disrupted and may take several days to recover. Liberal use of artificial tears during the day and lubrication at night protect the eyes during this period. Topical antibiotic and steroid (TobraDex; Alcon Labs, Fort Worth, Texas) drops help in reducing the inflammatory response and preventing conjunctivitis. The systemic steroids are also continued by tapering oral corticosteroids over 5 days (Medrol Dosepak; Upjohn Co., Kalamazoo, Mich.).<sup>30</sup>

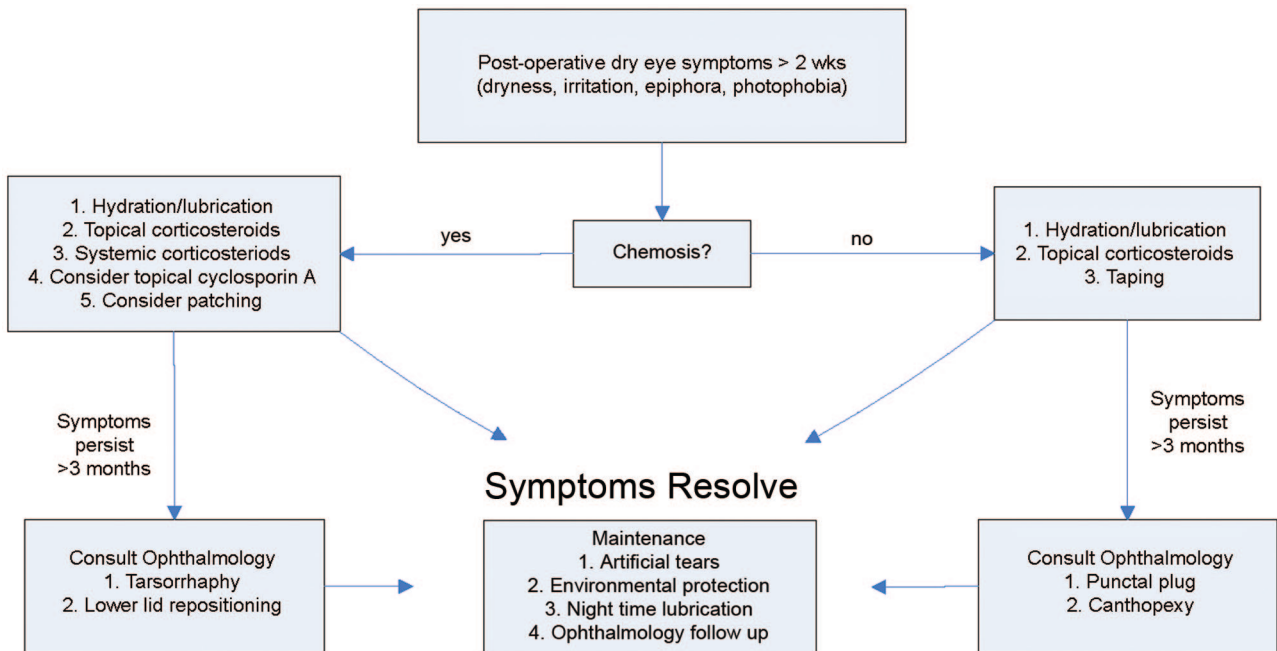
**Treatment of Persistent Postoperative Dry Eyes (Longer than 2 Weeks)**

When symptoms continue for longer than 2 weeks after an upper or lower blepharoplasty, patients should be examined for the possible cause. In most cases, additional supportive care will resolve the problem. The presence of chemosis is important to note and may alter management (Fig. 4). If ocular symptoms are significant but chemosis is not present, lubrication and the topical steroids should be continued and taping the lower lid if necessary should be considered. Other maneuvers that can be beneficial, especially if the

patient’s symptoms are relieved only short term with topical emollients, is to consider maintaining ocular lubrication by reducing lacrimal outflow with the use of tear duct occlusion (i.e., punctal plugs). If with time this fails to resolve symptoms that are deemed related to lid malposition, improved canthal support by means of canthopexy/plasty or lower lid repositioning may be necessary. If chemosis persists, this should be addressed aggressively. Hydration and lubrication should be continued along with topical and/or oral steroids, with the consideration of the use of diuretics. Patching and topical cyclosporin A 0.05% two times per day (Restasis; Allergan, Inc., Irvine, Calif.) and a temporary suture tarsorrhaphy should be considered. Failure of these measures may mandate conjunctivotomy for resolution of the chemosis (especially when chemosis contributes to lid malposition and/or lower lid repositioning.<sup>28,29,33</sup> An ophthalmologist is often consulted to help manage these patients with persistent dry eyes postoperatively.

**CONCLUSIONS**

Dry eyes are a known sequela of periorbital surgery. Although usually self-limited, a review of our series showed that, despite protective surgical approaches, it persisted for longer than 2 weeks in over 10 percent of patients. During the consultation and preoperative evaluation, it behooves the operating surgeon to discuss with the patient the risk factors that might lead to symptomatic dry eye syndrome



**Fig. 4.** Algorithm for treatment of persistent dry eyes.

even if the operation is performed to perfection. Recognizing and addressing risk factors before surgery and an algorithmic approach to detection, prevention, and management during and after periorbital surgery may help minimize the occurrence of chronic dry eye syndrome in these patients because of an enhanced overall understanding of the problem, optimal surgical maneuvers, enhanced patient compliance, and ultimately improved results.

**Rod J. Rohrich, M.D.**

Department of Plastic Surgery  
University of Texas Southwestern Medical School  
1801 Inwood Road, 4th Floor  
Dallas, Texas 75390-9132  
rod.rohrich@utsouthwestern.edu

### ACKNOWLEDGMENT

The authors thank Jessica Howard for administrative assistance with the institutional review board.

### REFERENCES

- Swartz RM, Schultz RC, Seaton JR. "Dry eye" following blepharoplasty: Cause or coincidence? *Plast Reconstr Surg.* 1974; 54:644–647.
- Morax S, Touitou V. Complications of blepharoplasty. *Orbit* 2006;25:303–318.
- Rees TD, Jelks GW. Blepharoplasty and the dry eye syndrome: Guidelines for surgery? *Plast Reconstr Surg.* 1981;68: 249–252.
- Fagien S. Algorithm for canthoplasty: The lateral retinacular suspension. A simplified suture canthopexy. *Plast Reconstr Surg.* 1999;103:2042–2053.
- American Academy of Ophthalmology. Dry eye syndrome: Preferred practice patterns. Available at: <http://one.aao.org/CE/PracticeGuidelines/PPP.aspx>.
- Nelson JD, Helms H, Fiscella R, Southwell Y, Hirsch JD. A new look at dry eye disease and its treatment. *Adv Ther.* 2000;17: 84–93.
- Moss SE, Klein R, Klein BE. Prevalence of and risk factors for dry eye syndrome. *Arch Ophthalmol.* 2000;118:1264–1268.
- Saadat D, Dresner SC. Safety of blepharoplasty in patients with preoperative dry eyes. *Arch Facial Plast Surg.* 2004;6:101–104.
- Spinelli HM, Farris RL. The tear film. In: Smith BC, ed. *Ophthalmic Plastic and Reconstructive Surgery.* Vol. 1. St Louis: Mosby; 1987:535–545.
- Abell KM, Cowen DE, Baker RS, Porter JD. Eyelid kinematics following blepharoplasty. *Ophthal Plast Reconstr Surg.* 1999; 15:236–242.
- Jelks GW, McCord CD Jr. Dry eye syndrome and other tear film abnormalities. *Clin Plast Surg.* 1981;8:803–810.
- Altinors DD, Akca S, Akova YA, et al. Smoking associated with damage to the lipid layer of the ocular surface. *Am J Ophthalmol.* 2006;141:1016–1021.
- Schaumberg DA, Buring JE, Sullivan DA, Dana MR. Hormone replacement therapy and dry eye syndrome. *JAMA.* 2001;286:2114–2119.
- Uncu G, Avci R, Uncu Y, Kaymaz C, Develioğlu O. The effects of different hormone replacement therapy regimens on tear function, intraocular pressure and lens opacity. *Gynecol Endocrinol.* 2006;22:501–505.
- Korn BS, Kikkawa DO, Schanzlin DJ. Blepharoplasty in the post-laser in situ keratomileusis patient: Preoperative considerations to avoid dry eye syndrome. *Plast Reconstr Surg.* 2007;119:2232–2239.
- Schallhorn SC, Amesbury EC, Tanzer DJ. Avoidance, recognition, and management of LASIK complications. *Am J Ophthalmol.* 2006;141:733–739.
- McKinney P, Byun M. The value of tear film breakup and Schirmer's tests in preoperative blepharoplasty evaluation. *Plast Reconstr Surg.* 1999;104:566–573.
- Jelks GW, Jelks EB. The influence of orbital and eyelid anatomy on the palpebral aperture. *Clin Plast Surg.* 1991;18:183–195.
- Fagien S. Advanced rejuvenative upper blepharoplasty: Enhancing aesthetics of the upper periorbital. *Plast Reconstr Surg.* 2002;110:278–291.
- de Castro CC. A critical analysis of the current surgical concepts for lower blepharoplasty. *Plast Reconstr Surg.* 2004;114: 785–793.
- Rohrich RJ, Coberly DM, Fagien S, Stuzin JM. Current concepts in aesthetic upper blepharoplasty. *Plast Reconstr Surg.* 2004;113:32e–42e.
- Flowers RS. Upper blepharoplasty by eyelid invagination: Anchor blepharoplasty. *Clin Plast Surg.* 1993;20:193–207.
- Barton FE Jr, Ha R, Awada M. Fat extrusion and septal reset in patients with the tear trough triad: A critical appraisal. *Plast Reconstr Surg.* 2004;113:2115–2123.
- Hamra ST. The role of the septal reset in creating a youthful eyelid-cheek complex in facial rejuvenation. *Plast Reconstr Surg.* 2004;113:2124–2144.
- Byrd HS, Burt JD. Achieving aesthetic balance in the brow, eyelids, and midface. *Plast Reconstr Surg.* 2002;110:926–933.
- Enzer YR, Shorr N. Medical and surgical management of chemosis after blepharoplasty. *Ophthalmic Plast Reconstr Surg.* 1994;10:57–63.
- Levine MR, Davies R, Ross J. Chemosis following blepharoplasty: An unusual complication. *Ophthalmic Surg.* 1994;25: 593–596.
- Thakker MM, Tarbet KJ, Sires BS. Postoperative chemosis after cosmetic eyelid surgery: Surgical management with conjunctivoplasty. *Arch Facial Plast Surg.* 2005;7:185–188.
- Weinfeld ABBR, Codner MA. The comprehensive management of chemosis following cosmetic lower blepharoplasty. *Plast Reconstr Surg.* 2008;122:579–586.
- Flood TR, McManners J, el-Attar A, Moos KF. Randomized prospective study of the influence of steroids on postoperative eye-opening after exploration of the orbital floor. *Br J Oral Maxillofac Surg.* 1999;37:312–315.
- Patipa M. Transblepharoplasty lower eyelid and midface rejuvenation: Part I. Avoiding complications by utilizing lessons learned from the treatment of complications. *Plast Reconstr Surg.* 2004;113:1459–1468.
- Fujishima H, Yagi Y, Toda I, Shimazaki J, Tsubota K. Increased comfort and decreased inflammation of the eye by cooling after cataract surgery. *Am J Ophthalmol.* 1995;119:301–306.
- Patel MP, Shapiro MD, Spinelli HM. Combined hard palate spacer graft, midface suspension, and lateral canthoplasty for lower eyelid retraction: A tripartite approach. *Plast Reconstr Surg.* 2005;115:2105–2114.