Dry Eye Syndrome and Cataract and Refractive Surgery

The importance of maintaining a healthy ocular surface.

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In recent years, advances in cataract and refractive surgery have dramatically improved patients’ postoperative quality of vision. The benefits of these advances may be lost, however, when the ocular surface deteriorates, even slightly. This article explains how to optimize the ocular surface before and after surgery to minimize dry eye symptoms and achieve the best visual outcomes.

IMPACT OF CATARACT AND REFRACTIVE SURGERY

Tear Film

Because the tear film is the most important refracting surface of the eye, a healthy ocular surface is a requisite component of successful cataract and refractive surgery, especially with premium IOLs. Multifocal IOLs, for example, achieve their effect through an apodized diffractive surface or varying refractive zones. An irregular ocular surface induces distortion that is magnified by these lens designs. Postoperatively, patients may experience an intensification of unwanted visual phenomena like starbursts, glare, and halos.1

After ocular surgery, almost every patient will initially have findings consistent with dry eye, and a fair number will report persistent symptoms. In patients who underwent cataract surgery, Li et al reported that postoperative dry eye peaked at 1 month and persisted for at least 3 months.2 Hovanesian et al reported that the incidence of dry eye symptoms within 6 months of PRK and LASIK was 41% and 45%, respectively.3 In a prospective study of patients who underwent bilateral LASIK, Battat et al found that corneal and conjunctival sensitivity and the severity of symptoms were significantly worse for up to 16 months postoperatively. Schirmer’s scores were also significantly lower after 1 month, and punctate corneal fluorescein staining was significantly elevated at 1 week but normalized by 12 months.4

The health of the ocular surface hinges on a balanced tear film composed of lipids, mucin, and aqueous tears. The adequate production of aqueous tears largely depends on an intact sensory-autonomic reflex loop, consisting of normal corneal sensation and lacrimal gland function. A normal blink reflex and normally positioned eyelids maintain the tear volume and dis-
Corneal Nerves

Damage to the corneal nerve plexus during cataract and refractive surgery may lead to neurotrophic dry eye. In the course of cataract surgery, the nerves are severed by the clear corneal and limbal relaxing incisions (Figure 1). During LASIK surgery, the nerve bundles entering the anterior stroma and epithelium are cut when the flap is created. The excimer laser further damages the deep stromal nerve trunks under the flap (Figure 2). Moreover, the suction ring’s application damages the mucin-secreting goblet cells and microvilli. Dry eye symptoms after refractive surgery are often accompanied by punctate epithelial erosions, which resolve in 6 to 8 months as the nerves reinnervate the corneal epithelium and re-establish normal corneal sensation (Figure 3).

Epithelium

Epithelial toxicity caused by topical medications can delay healing of the ocular surface after surgery. Commonly implicated medications include topical analgesics, nonsteroidal anti-inflammatory drugs, antibiotics, and preserved artificial tears. These agents may be necessary to control the healing process or provide temporary comfort, but their prolonged or excessive use should be avoided.

MANAGING AT-RISK PATIENTS

Preoperative Testing

In the framework of the Dysfunctional Tear Syndrome Guidelines, clinical experience suggests that cataract surgery will increase the severity of dry eye disease by about one level and that LASIK will increase the syndrome’s severity by about two levels. The importance of recognizing at-risk patients and controlling their dry eye preoperatively is clear.

An appropriate medical history is required. Systemic inflammatory diseases, such as Sjögren’s syndrome and rheumatoid arthritis, often make patients poor surgical candidates. Clinicians should inquire further regarding patients’ concurrent use of systemic medications, the frequency with which they use artificial tears, and the humidity of their living environment.

Preoperative and intraoperative risk factors for dry eye with LASIK include the depth of laser treatment, degree of preoperative myopia, female gender, contact lens use, diabetes, and eyelid disorders, including blepharitis and meibomian gland dysfunction. Preoperative evaluation should include an examination of lid anatomy and function, blink rate, tear volume, tear breakup time, conjunctival and corneal staining with supravital dyes, and Schirmer’s testing (Figure 4). A patient’s risk of exacerbated dry eye can be based on his or her history and clinical findings. Patients with mild dry eye symptoms with no effect on their vision are often good surgical candidates. Those with fluctuating vision associated with dry eye symptoms may be candidates if there is adequate treatment of their condition. Those with persistently decreased vision due to ocular surface disease are not candidates unless their condition improves with therapy. Similarly, patients with conjunctival staining alone using rose bengal or lissamine green are moderate candidates. Those with conjunctival and central corneal staining are not candidates without treatment.

Preoperative Therapy

Optimizing the ocular surface prior to surgery is preferable to addressing dry eye issues afterward. Preoperative treatment decreases the severity of postoperative dry eye disease and hastens visual recovery. In addition, an optimized ocular surface improves wavefront assessments and the accuracy of keratometry.
thereby augmenting the accuracy of laser treatment or IOL calculations.

Baseline therapy should be aimed at supporting the tear film.5,10 A patient with mild dry eye can be transiently treated with preserved artificial tears applied less than four times a day. Moderate-to-severe dry eye should be treated with unpreserved tears applied more than four times a day. Gels and ointments may be used at night to supplement this regimen. Eyelid conditioning using hot compresses and/or eyelid scrubs is often required to treat blepharitis and meibomian gland dysfunction.

Nutritional supplements have been shown to decrease inflammation and increase tear production. Fish oil containing eicosapentaenoic and docosapentaenoic polyunsaturated fatty acids reduces inflammation.15 Omega-3 fatty acids contained in flax seed oil decrease inflammation, increase tear production, and may potentiate the regeneration of nerves.16

The production and quality of tears may be improved through the control of inflammation.17 Although not appropriate for long-term use, patients may use loteprednol etabonate four times a day for 2 weeks and then taper administration to twice a day for 2 weeks. Clinicians can also consider prescribing oral doxycycline to decrease inflammation and lid margin disease.10 A typical regimen is 50 mg twice a day for 2 weeks, followed by a maintenance dose of 50 mg daily for at least 3 months. Topical cyclosporine 0.05% (Restasis; Allergan, Inc.) improves multiple aspects of dry eye and ocular surface disease, including tear production, corneal staining, visual acuity, and meibomian gland function.5,10,18 Treatment has been shown to significantly reduce signs of dry eye and improve quality of vision after the implantation of a multifocal IOL.19 Topical azithromycin 1% gel (AzaSite; Inspire Pharmaceuticals, Inc.) suspended in DuraSite (InSite Vision, Inc.) provides excellent tissue penetration and has been shown to have anti-infective and anti-inflammatory properties, which are beneficial for the treatment of posterior blepharitis.20 By altering meibomian gland lipid structure and phase transition temperature, topical azithromycin relieves the signs and symptoms of dry eye when associated with meibomian gland dysfunction.21 After lid margin disease and ocular inflammation are controlled, punctal plugs may be an option.10

In severe or refractory cases of dry eye disease, autologous serum drops, moisture chamber goggles, and tarsoorrhaphy should be considered.

Postoperative Therapy

After surgery, dry eye management should follow the same steps as for preoperative treatment. Because patients are instructed to avoid getting water in their eyes, those with prior lid margin disease may experience exacerbated symptoms. They should be reminded to resume cleaning their eyelids at the appropriate time.

CONCLUSION

As patients’ expectations increase with advances in ocular surgery, clinicians’ management of the ocular surface becomes a critical component of cataract and refractive surgery. The evaluation of patients’ surgical candidacy and preoperative optimization of the ocular surface are necessary for maximizing quality of vision and minimizing dry eye symptoms. With adequate counseling and tailored ocular surface treatments, addressing dry eye issues prior to surgery increases the patients’ postoperative outcomes and satisfaction.
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