

PRE- AND POSTOPERATIVE THERAPEUTIC STRATEGIES FOR PATIENTS WITH OSD

Ocular surface health can affect the visual outcomes of refractive surgery.

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Corneal refractive surgery in the form of PRK or LASIK is safe and effective; however, postoperative complications can be observed after these procedures. The most frequent of these is dry eye disease (DED).¹ In

fact, corneal refractive surgery is one of the major causes of iatrogenic DED, according to the recent report from the Tear Film & Ocular Surface Society (TFOS) Dry Eye Workshop II (DEWS II).² (*Editor's note: For more information on the DEWS II study, see Dry Eye Disease Redefined, pg 28.*)

Between 50% and 90% of patients may experience symptoms of dryness immediately after LASIK, and these symptoms have been reported to persist in 28% to 40% of patients at 3 to 6 months.^{3,4} In one study of patients dissatisfied with LASIK, poor vision (63.1%) and DED (19.1%) were identified as the major complaints.² Indeed, ocular surface health greatly affects the visual outcomes of refractive surgery, rendering early identification and proper management crucial.

ETIOLOGY OF DRY EYE AFTER REFRACTIVE SURGERY

The proposed mechanisms of LASIK-associated dry eye include the following:

- **Transection and severing of corneal nerves.** Transection and severing of corneal nerves during flap creation and stromal ablation leads to a decrease in corneal sensitivity. This, in turn, affects the homeostasis of the lacrimal functional reflex arc, decreasing blink frequency and tear output from the lacrimal gland. Hyperosmolarity, ocular surface inflammation, tear film instability, and a decrease in meibomian gland secretions can result.
- **Goblet cell loss.** Damage to goblet cells during the application of suction causes death of these cells, which disturbs tear stability and leads to hyperosmolarity.

- **Epithelial injury.** Epithelial injury during surgery is another proposed mechanism for increase of proinflammatory cytokines on the ocular surface.
- **Change in corneal shape.** Surgically induced change in corneal shape has been proposed to lead to tear-film instability.^{2,4}

Several studies have reported decreases in corneal sensitivity and corneal subbasal nerve density after LASIK and, to a lesser degree, after PRK or small-incision lenticule extraction (SMILE).^{2,4} Although corneal sensitivity usually recovers by 1 year, subbasal nerve density does not recover to preoperative levels until 5 years postoperatively.^{4,5}

RISK FACTORS FOR DRY EYE AFTER REFRACTIVE SURGERY

The primary risk factor for DED associated with refractive surgery is preexisting tear dysfunction. Most DED symptoms that occur prior to refractive surgery are due to evaporative tear dysfunction.² Schirmer testing values of less than 10 mm, older age, Asian ethnicity, female sex, and long-term contact lens wear are associated with increased risk of developing DED after surgery.^{2,6} However, DED is also becoming more prevalent among young people: In one report, 19% of healthy Chinese myopic teenagers performing strenuous near-vision tasks were diagnosed with DED, with meibomian gland dysfunction (MGD) playing an important role.⁷

Surgical factors such as intraoperative use of mitomycin C, greater ablation depth, wide and/or nasal flap hinge, and relifting the flap for retreatment may predispose patients to DED.² Some studies have suggested that PRK and SMILE induce less DED than LASIK in the early postoperative period, as PRK tends to damage only the nerve endings and SMILE spares more superficial nerve fibers due to the use of smaller vertical flap cuts.^{2,8,9}

Each patient should be questioned about his or her use of systemic medications that can cause dryness, such as allergy medications and antidepressants.² Patients may not think to mention their use of over-the-counter eye drops, so be sure to

ask about these as well; find out which ones, how often they are used, and whether they contain benzalkonium chloride.

Any history of lid surgery should be identified to rule out lagophthalmos. History of rosacea, allergies, autoimmune diseases, or diabetes also must be elicited. Rosacea is frequently associated with MGD, and DED is twice as frequent in patients with diabetes, both men and women.

History of contact lens wear is also important; if the patient is a past contact lens wearer, ask why he or she discontinued their use and whether he or she experienced any discomfort.

CHECK BEFORE YOU LEAP

Before committing to performing refractive surgery, surgeons should evaluate every patient for signs and symptoms of ocular surface disease (OSD). The components detailed below should be part of a routine evaluation.

Query for symptoms. Symptoms should be assessed with a dry eye questionnaire, such as the Ocular Surface Disease Index, which is available in many languages. A recent large study suggested that DED symptoms are highly prevalent among refractive surgery candidates and that 44% to 55% of these patients can be identified at baseline with the use of a questionnaire.³ Systematic identification of symptoms before surgery helps us to better assess patient complaints and satisfaction after surgery.

Examine the lids and meibomian glands. Careful examination of the eyelids and meibomian glands is important. Anterior blepharitis is not rare, and MGD is the most frequent type of DED and can be present at any age. Lids should be everted to examine the orifices of the meibomian glands using an applicator or fingers; slight pressure should be applied on the lids and the quality of the meibum observed at the slit lamp to assess meibomian gland function.

Observe the tear meniscus height first, and then evaluate tear film stability using fluorescein tear breakup time (TBUT). Vital staining of the ocular surface should follow, using prepackaged strips of lissamine green for the conjunctiva and fluorescein for the cornea. Further tests such as meibomian gland imaging and tear osmolarity testing can also be used, depending on the practice setting and the findings of the tests already described; however, the tests just listed should be included in every examination.

Biomarkers. Point-of-care testing for specific biomarkers such as matrix metalloproteinase-9 is now available. These minimally invasive tests, using a small tear sample, may provide useful metrics to better classify the etiology and severity of DED. Use of these tests appears to be the future of personalized eye care.

TREAT NOW, DON'T BE SORRY LATER

We always talk to our patients and explain the findings of our preoperative ocular surface evaluation. We want patients to understand that DED symptoms increase in

PEARLS OF WISDOM

- Consider the health of the ocular surface and the possibility of DED before any refractive surgical procedure to maximize postoperative visual outcomes and patient satisfaction.
- Discuss postoperative DED with every patient before refractive surgery, explaining that any preexisting DED will worsen postoperatively.
- Treat DED aggressively before surgery and follow patients closely after surgery.
- Prescribe postoperative topical unit-dose artificial tear drops to every patient who undergoes refractive surgery and consider punctal plugs with or without topical cyclosporine in patients with mild to moderate DED.
- Consider neuropathic pain in any patient with symptoms lasting past 6 months to 1 year; in the absence of significant ocular surface findings, prescribe pain medication accordingly.

nearly all patients in the early postoperative period, depending on the severity of their OSD preoperatively.

We aggressively treat MGD with lid hygiene, meibomian gland expression, systemic doxycycline and/or topical azithromycin, bacitracin ointment, and antibiotic–soft steroid combinations. We prescribe unit-dose, preservative-free artificial tears and/or ointments for the ocular surface. Depending on the mechanism or mechanisms of action, we may prescribe two different formulations—for example, for a patient with both evaporative and aqueous-deficient DED. We may also recommend oral omega-3 fatty acid supplementation because this can have a positive influence on ocular surface health in the perioperative period.¹⁰

We insert punctal plugs whenever we diagnose mild to moderate DED. In a controlled study, the use of punctal plugs in all patients with mild OSD improved visual recovery and decreased postoperative haze after LASIK.¹¹

When ocular surface staining is observed, we prescribe surface-acting steroids, topical cyclosporine ophthalmic emulsion 0.005% (Restasis; Allergan), or lifitegrast ophthalmic solution 5% (Xiidra; Shire). Autologous serum can also be considered in patients with staining.²

Any patient who is being treated for DED preoperatively should be counseled properly. Indeed, the fact that DED is a common complaint following uneventful refractive surgery in preoperatively normal eyes should be discussed with patients in advance.

POSTOPERATIVE CARE

When patients complain of dry eye postoperatively, treatment typically involves efforts to maintain ocular surface

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moisture, improve tear film quality and stability, and reduce inflammation.

We start at the beginning and listen closely to the patient while assessing his or her symptoms. Next, we carefully examine the ocular surface for the presence of DED signs. Then we revisit the treatment options: Patients can be managed postoperatively using the conventional therapies used to treat preoperative DED, as described previously.

Generally, we prescribe unit-dose artificial tear drops to every patient, to be used four times daily for at least 1 month after surgery. The use of these drops can be extended to 1 year and even longer if necessary. Patients with surface staining can be given short courses of topical surface-acting steroids and topical cyclosporine or lifitegrast for longer periods if needed to suppress inflammation and improve the health of the goblet cells. A combination of punctal plugs and topical cyclosporine has been reported to improve dry eye over the long term after LASIK.⁴

During patients' follow-up visits, we always keep medication in mind and ask whether we may have prescribed too many drops. Additionally, we reassess the content of the drops to ensure that they do not contain benzalkonium chloride.

IS THIS NEUROPATHIC PAIN?

In some patients with minimal corneal staining and normal TBUT, persistence of DED symptoms over 6 months to 1 year after refractive surgery may suggest the presence of neuropathic pain. In these patients, the development of neuropathic ocular pain is likely a result of neuroplastic changes that occur after the nerve injury induced by LASIK.^{5,12} This pain is often described as a burning, shooting, electric-like sensation that is of neuropathic quality. There is usually an obvious discordance between these symptoms and ocular surface signs, which are typically nonexistent or minimal.⁵

Patients who exhibit signs of neuropathic pain should be questioned about their history of depression or chronic pain syndromes such as fibromyalgia, as neuropathic pain is more

frequent in such cases. Confocal microscopy can be used to visualize the corneal nerves and can demonstrate abnormal subbasal nerve morphology (increased tortuosity, beading, inflammatory cells) and decreased density.¹³ However, because the pain can originate in the central nervous system, no neural findings may be visible in some patients.

Proparacaine testing may help to diagnose peripheral neuropathic pain. This test is done before any drops are placed on the eye. The patient is asked to rate his or her pain on a scale of 0 to 10. Then a drop of proparacaine (or equivalent) is placed on the ocular surface. After 15 seconds, the patient is asked to rate the pain from 0 to 10 again. If his or her pain score decreases, the pain is likely originating from the ocular surface, and the patient should be treated accordingly. If his or her pain score does not change, the pain may be of central neuropathic origin. Scleral lenses, autologous eye drops, and/or specific pain management in the form of gabapentinoids, opioids, or antidepressants are indicated in the management of neuropathic pain.^{4,5,12}

CONCLUSION

Refractive surgery patients have high expectations. Addressing their needs requires thorough knowledge of the ocular surface, the mechanisms and presentations of DED after refractive surgery, and proper and timely pre- and postoperative management. ■

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