

CORNEA AND CONTACT LENS CONSIDERATIONS IN GLAUCOMA



Preventing dropout depends on addressing the ocular surface and other issues.

BY KAREN LEE, OD, FAAO, FSLs

Not a day goes by in practice when I don't come across at least one patient struggling to stay in his or her contact lenses due to worsening dry eye. Successfully fitting these patients into a comfortable contact lens is not only challenging but, when victory is achieved, incredibly gratifying. An additional layer of difficulty is present if the patient is also being treated for glaucoma.

PRESERVATIVE PROBLEMS

Glaucoma patients often manifest dry eye signs and symptoms secondary to commonly prescribed topical ocular hypotensive therapy. A large majority of these medications are preserved with benzalkonium chloride (BAK), a compound that indiscriminately destroys cell membranes of both pathogens and normal ocular surface cells. Long-term

chronic use of these medications results in homeostatic imbalance and signs of ocular surface toxicity such as tear-film instability, superficial punctate keratitis (SPK), conjunctival injection, and staining manifest.¹ The effects of preservative toxicity may be compounded if patients are taking multiple medications or are self-medicating with a BAK-preserved artificial tear.

Purite (Allergan), also known as Ocupure (Johnson & Johnson Vision), and SofZia (Alcon), often called "soft preservatives," are BAK alternatives used in some IOP-lowering drops. In solution, Purite/Ocupure generates free radicals to oxidize bacterial and viral components. Once this preservative comes in contact with the ocular surface and is exposed to air, it quickly breaks down into nontoxic byproducts such as sodium, oxygen, water, and chloride. SofZia

is another oxidizing preservative that transforms into gentler components in the presence of ocular surface cations.

A significant reduction in both ocular surface inflammation and patient symptomatology has been noted when patients were switched from a BAK-preserved medication to one preserved with SofZia or Purite.^{2,3} At present, Purite is available in both IOP-lowering medications and artificial tears, and SofZia is found only in glaucoma medications (Table).

Although strict drug formularies and rising health care expenditures may pose obstacles, medications containing gentler preservatives should be considered if ocular surface toxicity is observed in glaucoma patients who are unable to attain preservative-free formulations. For a list of BAK-free glaucoma medications, see the table on page 40 of Dr. Leslie E. O'Dell's article, "When Dry Eye and Glaucoma Overlap."

MATERIAL MATTERS

Practitioners may also experience increased contact lens dropout among their glaucoma patients, especially if preserved drops are instilled while the patient is wearing contact lenses. In the past, hydrogel (HEMA) lenses dominated the contact lens market, and this material's strong affinity for low-molecular weight (≤ 500 g/mol) preservatives such as BAK has been well documented.⁴

Silicone hydrogel (SiHy) lenses now account for approximately 64% of the US contact lens market, and this material's preservative interactions are actively being researched.⁵ SiHy lens characteristics differ greatly depending on material

**TABLE.** Artificial Tears and Glaucoma Medications Preserved With Soft Preservatives

MANUFACTURER	ARTIFICIAL TEARS	GLAUCOMA MEDICATIONS
Allergan	Refresh Repair (Purite) Refresh Optive (Purite) Refresh Optive Advanced (Purite) Refresh Tears (Purite) Refresh Contacts (Purite)	Alphagan-P (Purite)
Johnson & Johnson Vision	Blink Tears Lubricating Eye Drops (Ocupure) Blink Gel Tears Lubricating eye Drops (Ocupure)	
Novartis		Travatan Z (SofZia)

polymerization processes and surface optimization technologies. Likewise, preservative uptake and release also vary among SiHy lenses, and these characteristics can be affected by lens porosity, water content, charge, surface treatments, and material hydrophobicity.⁶

One of the most effective ways to prevent soft lenses from becoming preservative depots is to prescribe daily disposable lenses and to educate patients to remove their lenses before using drops.

TIMING, TIMING

The FDA labeling for many topical medications recommends that patients wait at least 15 minutes after using the drops before putting contact lenses back in. To some of our patients, this may feel like a lifetime. Fortunately, most topical drugs have a contact time of 5 minutes or less on the ocular surface due to tearing, blinking, spillage, and nasolacrimal drainage.⁷ One study found that applying a contact lens 5 minutes after drop instillation was no different from not wearing a lens at all.⁸

If a patient is instilling glaucoma medications over his or her contact lenses, consider prescribing a lower-water-content daily disposable hydrogel lens; these materials exhibit less uptake of BAK and less on-eye dehydration than higher water content hydrogel lenses.⁴ Also stress the importance of waiting at least 15 minutes after drop instillation before applying lenses and take comfort that patients will probably be okay even if they wait only 5 minutes.

SURGERY AND LASER

In the lifelong course of their disease, many glaucoma patients will undergo laser procedures, minimally invasive glaucoma surgery (MIGS), or incisional surgeries such as trabeculectomy or tube shunt if their IOPs are not well controlled pharmacologically.⁹ Some of these procedures will have an effect on contact lens wear, but not all.

A successful laser trabeculoplasty or MIGS procedure could reduce the number of IOP-lowering drops needed and should also allow patients to continue wearing their contact lenses because negative refractive outcomes of these procedures are minimal. Furthermore, these procedures can help to reduce compliance issues.

It is well known that noncompliance is common among glaucoma patients, with almost 50% self-discontinuing IOP-lowering medications despite the risk of vision loss.¹⁰ I consider referring patients for laser trabeculoplasty

or a MIGS procedure when they are taking multiple glaucoma medications daily, struggling with a treatment regimen, or showing signs of severe ocular surface toxicity and yet unresponsive to treatment. A noninvasive ocular hypotensive surgical intervention may improve disease prognosis while also enhancing contact lens comfort as ocular surface toxicity is diminished.

Incisional surgeries, on the other hand, are highly invasive and therefore often reserved for more advanced glaucoma. After a filtering procedure, a bleb typically remains at the superior limbus, hidden behind the upper eyelid. Depending on the size and location of the bleb, contact lens wear may prove difficult after surgery, as mechanical irritation can cause leaks or infections.¹¹ In this situation, a low-modulus soft contact lens may conform to the bleb or a small, steep interpalpebral gas permeable lens may avoid the bleb altogether (Figure 1).¹²

AT A GLANCE

- ▶ Use of medications with soft preservatives may reduce corneal toxicity in patients taking glaucoma medications chronically.
- ▶ Be aware that soft contact lenses can become preservative depots if patients use drops with their lenses in.
- ▶ Use of scleral lenses in patients after incisional glaucoma surgery requires attention to lens geometry and design.

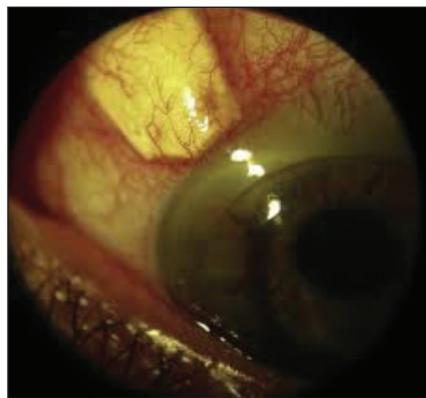


Figure 1. A small-diameter interpalpebral gas permeable lens on an eye with a filtering device.



Photo courtesy Greg DeHaeyer, OD

Figure 2. A notched scleral lens on an eye with a filtering bleb.

ROLE OF SCLERAL LENSES

Patients with corneal irregularities after glaucoma surgery may require a scleral lens to alleviate vision complaints. Contemporary scleral lens advances such as truncated designs, notching (Figure 2), and vaulting of the lens edge can help to minimize bleb interaction. Corneoscleral mapping (Figure 3) and prosthetic impression (Figure 4) can simplify the fitting process, facilitating the design of a customized back surface haptic for bleb alignment.¹³

A controversial topic that is undergoing heavy research is the impact that scleral lenses may have on IOP. Scleral lenses slowly sink on the conjunctiva and sclera and have the potential to decrease aqueous outflow by compressing the episcleral veins and Schlemm canal. A way to measure IOP while the patient is wearing a scleral lens continues to elude researchers. An alternative to measuring IOP is measuring peripapillary retinal nerve fiber layer thickness and other optic nerve head components before, during, and after scleral lens wear. These structures have been found to fluctuate morphologically

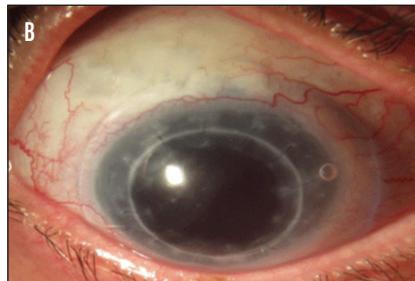
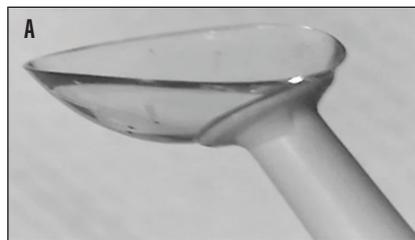


Photo courtesy Greg DeHaeyer, OD

Figure 3. Customized back surface scleral lens designed with corneoscleral topography (A) on an eye with a bleb (B).

with even minor changes in IOP. At this time, the jury is still out, and further research is needed.

TO THE FUTURE

An exciting possibility in the future is the introduction of ophthalmic drug delivery systems that can help improve patient compliance and minimize ocular surface toxicity. Clinical trials suggest that an investigational intracameral sustained-release bimatoprost implant (Bimatoprost SR, Allergan) appears to provide durable IOP control.¹⁴

Other approaches to drug delivery include soft lenses that elute drugs. The use of silicone hydrogel lens wetting agents combined with timolol maleate entrapment has been studied in vitro.¹⁵ Further testing and process refinement is required, as the drug release rate was dependent on multiple factors.

Until these new modes of ophthalmic drug delivery are available, my mainstays to prevent contact lens dropout among my glaucoma patients will include providing proper patient education, prescribing daily disposable soft lenses, recommending use of hydrogen peroxide-based solutions, and prescribing medications with soft preservatives or preservative-free formulations. ■

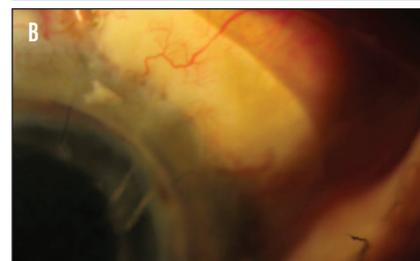
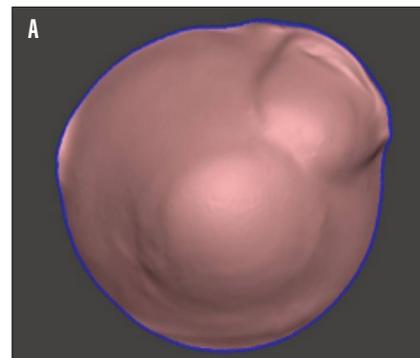


Photo courtesy Stephanie Woo, OD

Figure 4. Customized back-surface prosthetic designed with impression mold (A) on an eye with a bleb (B).

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