

Wills Eye Resident Series: An older woman suffers ocular trauma from a car accident, p. 59

REVIEW[®] *of* OPHTHALMOLOGY

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Clinical advice you can trust

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NEW!

Indicated for the treatment of the signs and symptoms of DED

Miebo[™]
(perfluorohexyloctane
ophthalmic solution)

MIEBO is the first and only Rx eye drop for DED that directly targets evaporation¹



Inhibits tear evaporation^{1-3*}

- Forms a monolayer at the air-liquid interface of the tear film which can be expected to reduce evaporation



Rapid and sustained relief[†]

- Improvement in tCFS and eye dryness as early as Day 15 continued through Day 57 in 2 pivotal studies



Excellent tolerability^{1,4-6‡}

- Low rate of burning or stinging on instillation
- Blurred vision and conjunctival redness were reported in 1%-3% of individuals

*The exact mechanism of action for MIEBO in DED is not known.¹

¹**Study design:** Two 57-day, multicenter, double-masked, saline-controlled studies (GOBI and MOJAVE) were conducted in adults ≥18 years old with a self-reported history of DED in both eyes. Across GOBI and MOJAVE, 614 patients received MIEBO and 603 patients received control with 591 and 575, respectively, assessed on Day 57. **Primary endpoints were change from baseline in tCFS and change from baseline in eye dryness score at Day 57.** Day 15 was the earliest time point at which signs and symptoms were evaluated in the trials. Day 57 was the last.^{1,5,6}

[†]In 2 pivotal studies of >1200 patients (614 patients received MIEBO), there were no incidences of serious ocular AEs with MIEBO. Most AEs were considered mild. The discontinuation rate for MIEBO was comparable to control (pooled: 0.2% vs 0.5%; GOBI: 0.3% vs 1.0%; MOJAVE: 0% vs 0%). 0.5% (pooled) of patients experienced instillation site pain AEs, such as burning or stinging (GOBI: 1.0%; MOJAVE: 0%). Blurred vision (pooled: 2.1%; GOBI: 3.0%; MOJAVE: 1.3%) and conjunctival redness (pooled: 0.8%; GOBI: 0%; MOJAVE: 1.3%) were reported in 1%-3% of individuals.^{1,4-6}

AE, adverse event; DED, dry eye disease; tCFS, total corneal fluorescein staining.

INDICATION

MIEBO[™] (perfluorohexyloctane ophthalmic solution) is a semifluorinated alkane indicated for the treatment of the signs and symptoms of dry eye disease.

IMPORTANT SAFETY INFORMATION

- MIEBO should not be administered while wearing contact lenses. Contact lenses should be removed before use and for at least 30 minutes after administration of MIEBO
- Instruct patients to instill one drop of MIEBO into each eye four times daily
- The safety and efficacy in pediatric patients below the age of 18 have not been established
- The most common ocular adverse reaction was blurred vision (1% to 3% of patients reported blurred vision and conjunctival redness)

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

Please see accompanying Brief Summary of full Prescribing Information for MIEBO.

References: 1. MIEBO. Prescribing Information. Bausch & Lomb, Inc; 2023. 2. Sheppard JD, Nichols KK. Dry eye disease associated with meibomian gland dysfunction: focus on tear film characteristics and the therapeutic landscape. *Ophthalmol Ther.* 2023;12(3):1397-1418. doi:10.1007/s40123-023-00669-1 3. Vittitow J, Kissling R, DeCory H, Borchman D. In vitro inhibition of evaporation with perfluorohexyloctane, an eye drop for dry eye disease. *Curr Ther Res Clin Exp.* 2023;98:100704. doi:10.1016/j.curtheres.2023.100704 4. Data on file. Bausch & Lomb, Inc; 2023. 5. Tauber J, Berdy GJ, Wirta DL, Krösser S, Vittitow JL; GOBI Study Group. NOV03 for dry eye disease associated with meibomian gland dysfunction: results of the randomized phase 3 GOBI study. *Ophthalmology.* 2023;130(5):516-524. doi:10.1016/j.ophtha.2022.12.021 6. Sheppard JD, Kurata F, Epitropoulos AT, Krösser S, Vittitow JL; MOJAVE Study Group. NOV03 for signs and symptoms of dry eye disease associated with meibomian gland dysfunction: the randomized phase 3 MOJAVE study. *Am J Ophthalmol.* 2023;252:265-274. doi:10.1016/j.ajo.2023.03.008

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Learn more at
MIEBO-ECP.COM

IRIS Registry: Wet AMD Patients Are Undertreated

Real-world scenarios are fraught with the obstacles of daily living and rarely align with carefully monitored clinical trial settings, so the true impact of many treatments often varies. Fortunately, large databases such as the IRIS Registry enable powerful real-world analyses of ocular outcomes. “The IRIS Registry represents about 70 percent of all eye care visits in the United States, so it’s quite representative of what’s actually happening in the real world, post approval,” says study co-author Theodore Leng, MD, FACS, of the Byers Eye Institute. “Additionally, real-world patients are often very different from trial patients who are carefully selected based on the trial’s inclusion/exclusion criteria. Patients in the real world might not qualify for a trial because of their visual acuity or lesion size or comorbid medical conditions. It’s vitally important to use these real-world studies to see what’s actually happening with these medications once they’re out in the wild, so to speak.”

Using the IRIS Registry, researchers analyzed anti-VEGF treatment patterns over a six-year period (the longest to date) and the influence of patient demographics on neovascular age-related macular degeneration outcomes. Their findings showed that in the real world, these patients are undertreated and losing vision in the long term.

The retrospective, noninterventional study included a large cohort of 226,767 patients (254,655 eyes;

160,423 with visual acuity data) with a first anti-VEGF injection and at least two years of follow-up.¹ The researchers found that patients experienced a mean visual acuity increase of three ETDRS letters at year one, but this was followed by annual decreases, leading to a net loss from baseline of 4.6 letters after six years. They also reported that patients with longer follow-up had better baseline and follow-up visual acuity.

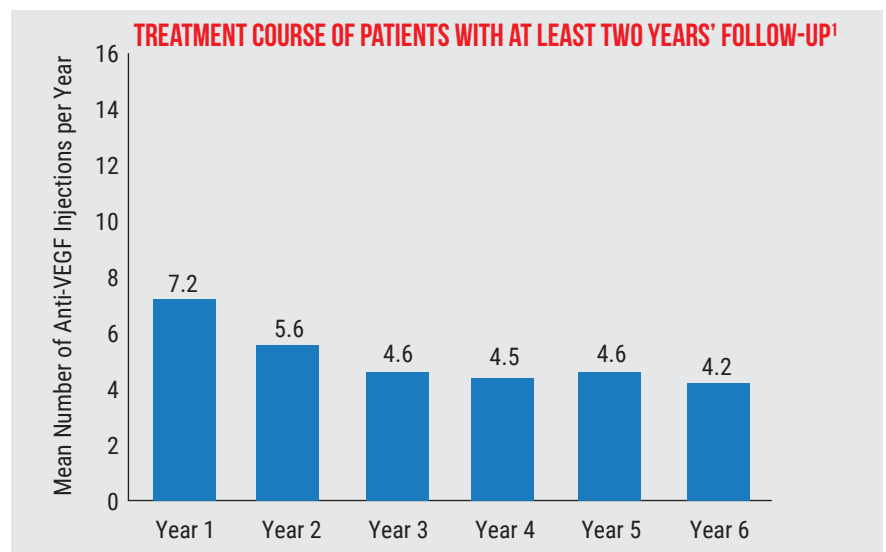
In the long run, patients received fewer injections. The mean number of injections was 7.2 in year one and 5.6 in year two. This leveled off in years three to six, from 4.2 to 4.6 injections, or about one injection every three months.

A total of 38.8 percent of eyes discontinued treatment and 32.3 percent switched treatment. Adjusted data

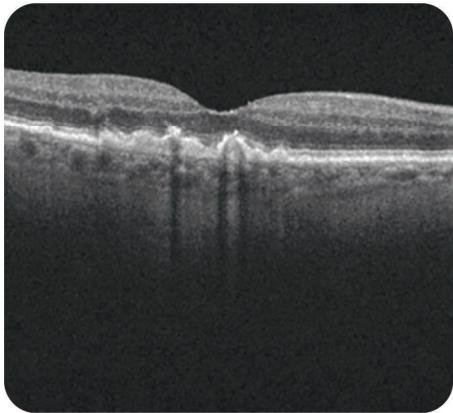
showed that each additional injection led to a 0.68-letter improvement from baseline to year one, leading the researchers to conclude that multiple injections in a year could be clinically meaningful.

The following risk factors were associated with increased risk of vision loss at year one: older age; male sex; Medicaid insurance; and not being treated by a retina specialist. During follow up, 58.5 percent of patients lost 10 or more letters of vision at least once, and 14.5 percent had sustained poor vision after a median of 3.4 years.

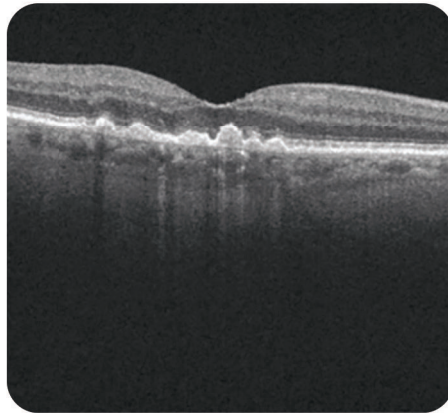
Overall, the study findings indicate that poor adherence to anti-VEGF injections is likely widespread and contributing to vision loss. The researchers pointed out in their paper that new therapies that reduce treatment burden (e.g., via different mechanisms of



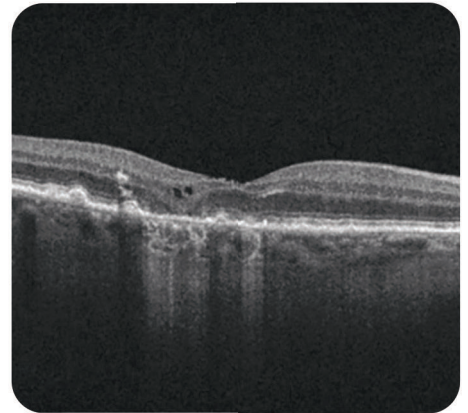
GEOGRAPHIC ATROPHY (GA) CAN PROGRESS FASTER THAN YOU THINK¹



Baseline



Month 3



Month 6

1. Boyer D, Schmidt-Erfurth U, van Lookeren Campagne M, et al. The pathophysiology of geographic atrophy secondary to age-related macular degeneration and the complement pathway as a therapeutic target. *Retina*. 2017;37(5);819-835.

INDICATION

IZERVAY™ (avacincaptad pegol intravitreal solution) is indicated for the treatment of geographic atrophy (GA) secondary to age-related macular degeneration (AMD)

IMPORTANT SAFETY INFORMATION

CONTRAINDICATIONS

IZERVAY is contraindicated in patients with ocular or periocular infections and in patients with active intraocular inflammation.

WARNINGS AND PRECAUTIONS

Endophthalmitis and Retinal Detachments

Intravitreal injections, including those with IZERVAY, may be associated with endophthalmitis and retinal detachments. Proper aseptic injection technique must always be used when administering IZERVAY in order to minimize the risk of endophthalmitis. Patients should be instructed to report any symptoms suggestive of endophthalmitis or retinal detachment without delay and should be managed appropriately.

EVERY MONTH MATTERS WHEN TREATING GA


izervay[™]
(avacincaptad pegol
intravitreal solution) 2 mg



Learn more at
[IZERVAYecp.com](https://www.izervayecp.com)

Neovascular AMD

In clinical trials, use of IZERVAY was associated with increased rates of neovascular (wet) AMD or choroidal neovascularization (7% when administered monthly and 4% in the sham group) by Month 12. Patients receiving IZERVAY should be monitored for signs of neovascular AMD.

Increase in Intraocular Pressure

Transient increases in intraocular pressure (IOP) may occur after any intravitreal injection, including with IZERVAY. Perfusion of the optic nerve head should be monitored following the injection and managed appropriately.

ADVERSE REACTIONS

Most common adverse reactions (incidence $\geq 5\%$) reported in patients receiving IZERVAY were conjunctival hemorrhage, increased IOP, blurred vision, and neovascular age-related macular degeneration.

Please see full Prescribing Information for more information.

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**IVERIC
BIO**
An Astellas Company

IZERVAY™ (avacincaptad pegol intravitreal solution)

Rx only

Brief Summary: This information is not comprehensive. Visit IZERVAYecp.com to obtain the FDA-approved product labeling or call 609-474-6755.

1 INDICATIONS AND USAGE

IZERVAY is indicated for the treatment of geographic atrophy (GA) secondary to age-related macular degeneration (AMD).

2 DOSAGE AND ADMINISTRATION

2.1 General Dosing Information

IZERVAY must be administered by a qualified physician.

2.2 Recommended Dosage

The recommended dose for IZERVAY is 2 mg (0.1 mL of 20 mg/mL solution) administered by intravitreal injection to each affected eye once monthly (approximately every 28 ± 7 days) for up to 12 months.

2.4 Injection Procedure

Only 0.1 mL (2 mg) should be administered to deliver a single dose. Any excess volume should be disposed.

Prior to the intravitreal injection, patients should be monitored for elevated intraocular pressure (IOP) using tonometry. If necessary, ocular hypotensive medication can be given to lower the IOP.

The intravitreal injection procedure must be carried out under controlled aseptic conditions, which includes the use of surgical hand disinfection, sterile gloves, a sterile drape, and a sterile eyelid speculum (or equivalent). Adequate anesthesia and a broad-spectrum topical microbicide should be given prior to the injection.

Inject slowly until the rubber stopper reaches the end of the syringe to deliver the volume of 0.1 mL. Confirm delivery of the full dose by checking that the rubber stopper has reached the end of the syringe barrel.

Immediately following the intravitreal injection, patients should be monitored for elevation in intraocular pressure (IOP). Appropriate monitoring may consist of a check for perfusion of the optic nerve head or tonometry.

Following intravitreal injection, patients should be instructed to report any symptoms suggestive of endophthalmitis (e.g., eye pain, redness of the eye, photophobia, blurring of vision) without delay.

Each vial and syringe should only be used for the treatment of a single eye. If the contralateral eye requires treatment, a new vial and syringe should be used and the sterile field, syringe, gloves, drapes, eyelid speculum, filter needle, and injection needle should be changed before IZERVAY is administered to the other eye. Repeat the same procedure steps as above.

Any unused medicinal product or waste material should be disposed of in accordance with local regulations.

3 DOSAGE FORMS AND STRENGTHS

Intravitreal solution: 20 mg/mL clear to slightly opalescent, colorless to slightly yellow solution in a single-dose vial.

4 CONTRAINDICATIONS

4.1 Ocular or Periocular Infections

IZERVAY is contraindicated in patients with ocular or periocular infections.

4.2 Active Intraocular Inflammation

IZERVAY is contraindicated in patients with active intraocular inflammation.

5 WARNINGS AND PRECAUTIONS

5.1 Endophthalmitis and Retinal Detachments

Intravitreal injections may be associated with endophthalmitis and retinal detachments. Proper aseptic injection techniques must always be used when administering IZERVAY in order to minimize the risk of endophthalmitis. Patients should be instructed to report any symptoms suggestive of endophthalmitis or retinal detachment without delay, to permit prompt and appropriate management.

5.2 Neovascular AMD

In clinical trials, use of IZERVAY was associated with increased rates of neovascular (wet) AMD or choroidal neovascularization (7% when administered monthly and 4% in the sham group) by Month 12. Patients receiving IZERVAY should be monitored for signs of neovascular AMD.

5.3 Increase in Intraocular Pressure

Transient increases in intraocular pressure (IOP) have been observed after an intravitreal injection, including with IZERVAY. Perfusion of the optic nerve head should be monitored following the injection and managed as needed.

6 ADVERSE REACTIONS

The following potentially serious adverse reactions are described elsewhere in the labeling:

- Ocular and periocular infections
- Neovascular AMD
- Active intraocular inflammation
- Increase in intraocular pressure
- Endophthalmitis and retinal detachments

6.1 Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

The safety of avacincaptad pegol was evaluated in 733 patients with AMD in two sham-

controlled studies (GATHER1 and GATHER2). Of these patients, 292 were treated with intravitreal IZERVAY 2 mg (0.1 mL of 20 mg/mL solution). Three hundred thirty-two (332) patients were assigned to sham.

Adverse reactions reported in ≥2% of patients who received treatment with IZERVAY pooled across GATHER1 and GATHER2, are listed below in Table 1.

Table 1: Common Ocular Adverse Reactions (≥2%) and greater than Sham in Study Eye

Adverse Drug Reactions	IZERVAY N = 292	Sham N = 332
Conjunctival hemorrhage	13%	9%
Increased IOP	9%	1%
Choroidal neovascularization	7%	4%
Blurred vision*	8%	5%
Eye pain	4%	3%
Vitreous floaters	2%	<1%
Blepharitis	2%	<1%

* Blurred vision includes visual impairment, vision blurred, visual acuity reduced, visual acuity reduced transiently.

8 USE IN SPECIFIC POPULATIONS

8.1 Pregnancy

Risk Summary

There are no adequate and well-controlled studies of IZERVAY administration in pregnant women. The use of IZERVAY may be considered following an assessment of the risks and benefits.

Administration of avacincaptad pegol to pregnant rats and rabbits throughout the period of organogenesis resulted in no evidence of adverse effects to the fetus or pregnant female at intravenous (IV) doses 5.1 times and 3.2 times the human exposure (based on AUC) at the maximum recommended human dose (MRHD) of 2 mg once monthly, respectively.

In the U.S. general population, the estimated background risks of major birth defects and miscarriage in clinically recognized pregnancies is 2-4% and 15%-20%, respectively.

Animal Data

An embryo fetal developmental toxicity study was conducted with pregnant rats. Pregnant rats received daily intravenous (IV) injections of avacincaptad pegol from day 6 to day 17 of gestation at 0.1, 0.4, 1.2 mg/kg/day. No maternal or embryofetal adverse effects were observed at any dose evaluated. An increase in the incidence of a non-adverse skeletal variation, described as short thoracolumbar (ossification site without distal cartilage) supernumerary ribs, was observed at all doses evaluated. The clinical relevance of this finding is unknown. Plasma exposures at the high dose were 5.1 times the MRHD, based on Area Under the Curve (AUC).

An embryo fetal developmental toxicity study was conducted with pregnant rabbits. Pregnant rabbits received daily IV injections of avacincaptad pegol from day 7 to day 19 of gestation at 0.12, 0.4, 1.2 mg/kg/day. No maternal or embryofetal adverse effects were observed at any dose evaluated. Plasma exposure in pregnant rabbits at the highest dose of 1.2 mg/kg/day was 3.2 times the human exposure at the MRHD, based on AUC.

8.2 Lactation

There is no information regarding the presence of avacincaptad pegol in human milk, the effects of the drug on the breastfed infant or on milk production.

The developmental and health benefits of breastfeeding should be considered along with the mother's clinical need for IZERVAY and any potential adverse effects on the breastfed infant from IZERVAY.

8.4 Pediatric Use

Safety and effectiveness of IZERVAY in pediatric patients have not been established.

8.5 Geriatric Use

Of the total number of patients who received IZERVAY in the two clinical trials, 90% (263/292) were ≥65 years and 61% (178/292) were ≥75 years of age. No significant differences in efficacy or safety of avacincaptad pegol were seen with increasing age in these studies. No dose adjustment is required in patients 65 years and above.

17 PATIENT COUNSELING INFORMATION

Advise patients that following IZERVAY administration, patients are at risk of developing neovascular AMD, endophthalmitis, elevated intraocular pressure and retinal detachments. If the eye becomes red, sensitive to light, painful, or if a patient develops a change in vision, instruct the patient to seek immediate care from an ophthalmologist.

Patients may experience temporary visual disturbances and blurring after an intravitreal injection with IZERVAY and the associated eye examinations. Advise patients not to drive or use machinery until visual function has recovered sufficiently.

Manufactured by:

IVERIC bio, Inc., An Astellas Company. Parsippany, NJ 07054

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action, routes of administration or increased durability) may improve visual outcomes.

Dr. Leng adds that in addition to new treatments, clinicians can take some steps to prepare patients for long-term success. “When we start treating patients with nAMD, it’s a good idea to set expectations not only upfront, covering the next few months, but also long-term. Be sure to tell patients that it’s important to keep coming back because there’s a very good chance that they won’t lose any more vision and that their vision

may actually improve. The emphasis here is on the long term. I tell patients that this is a treatment for a chronic, lifelong condition, kind of like high blood pressure or diabetes. This isn’t like fixing a broken bone. It’s a long-term journey together. Setting up that expectation early is key.”

Dr. Leng also says that having systems in place in your clinic to reduce the number of patients lost to follow-up can also boost adherence. “Things may be going swimmingly for six months, a year or two years, but every now and then something

might happen,” he explains. “A doctor might be out for an emergency, or the patient might be hospitalized or have something else going on their life that forces them to cancel or no-show for their appointment. Sometimes those appointments never get rescheduled, and that’s when patients lose vision. Building some systems into our practice workflows to help prevent that from happening could help.”

1. Wykoff CC, Garmo V, Tabano D, et al. Impact of anti-VEGF treatment and patient characteristics on vision outcomes in nAMD: Up to 6-year analysis of the AAO IRIS Registry. *Ophthalmology Science* 2023. [Epub ahead of print].

Alternative Postop Regimen Similar to Traditional One

After cataract surgery, the typical regimen of topical antibiotics, corticosteroids and a non-steroidal anti-inflammatory, sometimes called “triple-drop therapy,” comes with its own set of limitations, including cost, patient adherence issues and the potential for elderly patients to experience physical difficulty administering drops. Due to these factors, alternatives have emerged. While perioperative intracameral injection is quite popular with cataract surgeons, a group of researchers decided to investigate outcomes with intravitreal administration of an antibiotic and a steroid (abbreviated IVAS) coupled with post-op topical NSAID, a regimen known as IVAS-NSAID for short. The antibiotic agent was moxifloxacin and the steroid was triamcinolone.

The retrospective study compared non-infectious outcomes of this method against topical therapy usage.¹ In total, 2,143 eyes of 2,143 patients—1,079 receiving IVAS-NSAID and 1,064 receiving TDT—

who underwent cataract surgery were included from three diverse study centers in the United States. Best-corrected visual acuity and intraocular pressures were similar between the groups at all time points of one week,



one month and six months post-surgery.

A total of 11.6 percent of TDT eyes developed post-op complications, but the rate was even lower in the IVAS-NSAID group—just 6.5 percent. Interestingly, both patients who underwent femtosecond laser—as-

sisted cataract surgery (FLACS) and those with dark irides experienced a higher incidence of persistent corneal edema after IVAS-NSAID. As well, those with dark irides also saw higher incidence of cystoid macular edema and rebound inflammation.

Expanding on these findings, the study authors explained, in a paper for *American Journal of Ophthalmology*, that “IVAS-NSAID may be considered a safe alternative to topical regimens in non-FLACS and light irides patient populations” while reducing the eye drop burden for most patients.

Similar rates of IOP elevation were seen between both groups, which could be explained for a few reasons. One is that surgeons used a technique of manual wound burping after IVAS injection to confirm acceptable IOP, which was not routinely done in the TDT group. Another likelihood is due to the researchers of this study using lower concentration of triamcinolone (2.25 mg) in the IVAS injection than what is injected for posterior segment inflammation (4 mg), which has been the focus of previous studies that reported higher IOP rates with injection. As well, injection closer to the limbus carries greater propensity

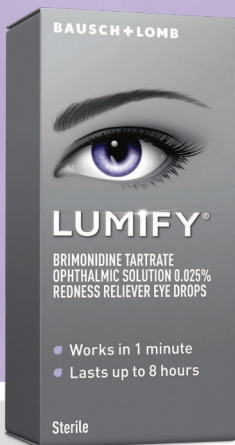
(Continued on p. 12)

CORRECTION

In the November article, “How to Select the Right MIGS for the Job,” the procedure being studied by ViaLase was incorrectly

described as femtosecond laser trabeculotomy. The actual name of the procedure is femtosecond laser image-guided high-precision trabeculotomy.

Review regrets the error.



BRIGHTER LOOKING EYES WITH ONE DROP

The Conversation Eye Care Providers Should Be Having with Patients



Melissa Toyos, MD

Practices at Toyos Clinic located in Tennessee, Mississippi, and New York

Aesthetics are an important patient concern that can affect how they feel about themselves and around other people. Patients commonly use products and services that promise aesthetic enhancement, including lash extensions, eyelash growth treatments, colored contact lenses, eye makeup, eye creams, and serums. Increasingly, patients also seek out redness-relieving eye drops to improve the appearance of their eyes.

Ocular Redness: A Key Patient Concern

Demand is substantial: 4 in 10 sales in the over-the-counter (OTC) eye drop category are for redness relievers.¹ Because ocular redness is often caused by "minor" eye irritations, patients may not recognize it as a valid concern that they can discuss with their eye care provider (ECP) and are, therefore, not always professionally counseled on which redness reliever is best for them. Without their ECP's input, patients can sometimes lean on potentially unreliable sources, such as the store shelf, their peers, commercials, or the internet. Herein lies an opportunity to educate patients and guide them through the enormous ocular redness market while also addressing the root cause of their symptoms.

LUMIFY®: A Clinically Proven Approach to Treating Ocular Redness

LUMIFY® (brimonidine tartrate ophthalmic solution) 0.025% drops are indicated for relieving redness of the eye due to minor eye irritations.² Most redness relievers are α 1- or α 1/ α 2-adrenergic receptor agonists; α 1-adrenergic receptor agonism constricts corneal arterioles, hindering oxygen delivery to the cornea, which causes rebound redness. Brimonidine tartrate, by contrast, is selective for the α 2-adrenergic receptor, primarily constricting ocular surface venules, which

do not affect ocular surface oxygen delivery and therefore is not associated with high levels of rebound redness.³

In 6 clinical studies with over 600 patients, low-dose brimonidine tartrate demonstrated a 1 minute onset of action, which persisted for up to 8 hours.⁴ It had a favorable safety profile and, consistent with its mechanism of action, a low incidence of rebound redness (1.2%).^{4,5,6} Adverse event rates did not significantly differ from control, and the most common adverse events in brimonidine-treated eyes were reduced visual acuity (4.0%) and conjunctival redness (2.6%).⁵

Opportunity for ECPs to Step In

Market research indicates that patients report using of redness relievers an average of 3 days per week.⁷ Ocular redness is a key concern for many patients, but the OTC eye care market contains an often overwhelming array of products. Understanding and communicating the benefits and challenges of available products is key to helping patients narrow down which products—out of everything on the shelf—might work best for them.

LUMIFY® provides safe and effective redness relief for my patients dealing with minor eye irritations

LUMIFY® is a redness reliever drop differentiated in its mechanism of action, rapid effects, and minimal rebound redness. LUMIFY® provides patients with excellent redness relief. In recommending a product as efficacious and reliable as LUMIFY®, ECPs can establish themselves as trusted professionals who can



Incorporating ocular aesthetics into the patient conversation



Ask patients if they are happy with how their eyes look and feel



Ask patients if they use OTC eye care products and if they are satisfied with them



Consider that the aesthetic aspect of eye care may be just as important to a patient as the clinical aspect



Be ready and willing to provide OTC recommendations

address patients' needs—both clinical and aesthetic. This can lead not only to improved patient outcomes and satisfaction but could also enhance trust in their relationship with their ECP.

1. IQVIA Sales Data, Latest 52 weeks ending 6/18/2023
2. LUMIFY® [Drug facts]. Bausch & Lomb Incorporated, Bridgewater, NJ.
3. Corboz MR, Rivelli MA, Varty L, et al. Pharmacological characterization of postjunctional α -adrenoceptors in human nasal mucosa. *Am J Rhinol.* 2005;19(5):495-502.
4. McLaurin E, Cavet ME, Gomes PJ, Ciolino JB. Brimonidine ophthalmic solution 0.025% for reduction of ocular redness: a randomized clinical trial. *Optom Vis Sci.* 2018;95(3):264-271.
5. Ackerman SL, Torkildsen GL, McLaurin E, Vittitow JL. Low-dose brimonidine for relief of ocular redness: integrated analysis of four clinical trials. *Clin Exp Optom.* 2019;102(2):131-139.
6. Torkildsen GL, Sanfilippo CM, DeCory HH, Gomes PJ. Evaluation of efficacy and safety of brimonidine tartrate ophthalmic solution, 0.025% for treatment of ocular redness. *Curr Eye Res.* 2018;43(1):43-51.
7. Data on file. Bausch & Lomb. Rochester, NY

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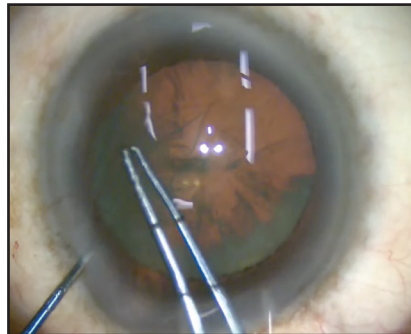
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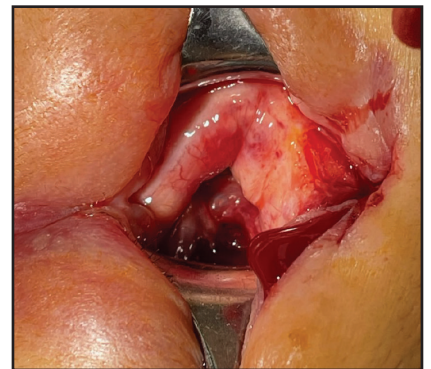
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WILLS EYE RESIDENT CASE SERIES

A car accident brings a 77-year-old woman to Wills Eye.

Bryce Hwang, MD,
Karine Shebacló, MD,
Charlotte Marous, MD, and
Jacqueline Carrasco, MD

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GLAUCOMA MANAGEMENT

Neurostimulation for Vision Restoration

How neurostimulation research in glaucoma is progressing, and why stress management might help.

Christine Yue Leonard
Senior Associate Editor

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References:

1. Zavodni Z, Pan L, Saylor M, Mok K, Cheng H. Enhancing clinic and operating room (OR) connectivity via a cloud-based application to improve practice efficiency for cataract surgery. Study summary presented at: ASCRS Annual Meeting; April 22, 2022; Washington, DC. 2. Alcon Data on File, 2020. 3. Blaylock JF, Hall B. Astigmatic results of a diffractive trifocal toric IOL following intraoperative aberrometry guidance. *Clin Ophthalmol*. 2020;14:4373-4378. 4. Cionni RJ, Dimalanta R, Breen M, Hamilton C. A large retrospective database analysis comparing outcomes of intraoperative aberrometry with conventional preoperative planning. | *Cataract Refract Surg*. 2018;44(10):1230-1235. 5. Van Vliet EJ, Bredenhoff E, Sermeus W, Kop LM, Sol CA, Harten WH. Exploring the relation between process design and efficiency in high-volume cataract pathways from a lean thinking perspective. *Int J Qual Health Care*. 2011;23(1):83-93. 6. Håkansson I, Lundström M, Stenevi U, Ehinger B. Data reliability and structure in the Swedish National Cataract Register. *Acta Ophthalmol Scand*. 2001;79(5):518-523.

(Continued from p. 7)

for IOP elevation.

Postop inflammatory events were similar, with risk factors of particular concern (prior uveitis, diabetic status) not associated with increased inflammatory risks with IVAS-NSAID; this demonstrates a comparable safety profile to TDT without posing additional risks, the researchers said.

Patients who underwent FLACS and received IVAS-NSAID had higher rates of persistent corneal edema, reflecting previous reports citing increased postop inflammation following FLACS. Similarly, those with dark iri-

des have previously been found to have higher rates and degrees of postoperative inflammation, reflecting the greater rates seen in this study of rebound inflammation, persistent corneal edema and cystoid macular edema.

Due to this association, the researchers suggested that “surgeons may consider avoiding IVAS in patients with dark irides or using additional anti-inflammatory medications (e.g., additional injectable, implantable or topical steroids) to supplement IVAS-NSAID.”

Other than these contraindica-

tions, the IVAS-NSAID technique may improve patient compliance and reduce health-care costs while providing a simplified postop medication course, the researchers concluded, stating their belief that “these findings can aid surgeons in developing personalized postoperative regimens for the optimal use of IVAS-NSAID, based on patients’ comorbidities and demographic characteristics.”

1. Mian OT, Asif H, Sandhu U, et al. Non-infectious outcomes of intravitreal antibiotic-steroid injection and topical NSAID vs. triple drop therapy post cataract surgery. *Am J Ophthalmol*. November 7, 2023. [Epub ahead of print].

Body Position’s Impact on Intraocular Pressure

Fluctuations in intraocular pressure, particularly over a 24-hour period, are a known contributor to glaucoma progression. Given that research has also shown that IOP readings can be affected by posture, glaucoma patients may potentially be able to reduce IOP fluctuations by adjusting their posture throughout the day, as demonstrated by a recent observational study. It also offers clinicians guidance on improving the reliability of in-office readings by being mindful of patients’ posture.

A total of 74 patients (148 eyes) with open-angle glaucoma participated.¹ Researchers obtained intraocular pressure measurements from patients while they were in the following positions: supine, left lateral decubitus, right lateral decubitus, head tilted downwards position with immediate head-up (transient head tilted downwards), seated, seated with head tilted downwards, standing and walking. Patients held each position for five minutes before IOP readings were taken.

Overall, IOP seemed to decrease as elevation of body position increased. Compared with the seated position, IOP was significantly higher with the

three sleeping positions—supine, left lateral decubitus, right lateral decubitus—as well as with the patient’s head tilted downwards.

The study authors theorized in their paper that “the decrease in the vertical distance between the eyes and the heart in three different sleeping postures and the head tilted downwards position could lead to an increase in IOP.” They further explained, “The reduction in gravitational potential energy associated with the drainage of aqueous humor into the heart might contribute to the elevation of intraocular pressure.”

The researchers also observed that the lateral sleeping position showed a higher intraocular pressure than the supine position, which they suggest could be attributed to the fact that “the lateral position requires more gravity to overcome when aqueous humor flows out.”

On the other hand, IOP decreased significantly when standing or walking compared with the seated position (with eyes at primary gaze) or any of the sleeping positions. Additionally, walking decreased intraocular pressure levels significantly more than standing.

“The act of standing upright or walking is associated with a temporary reduction in central blood volume, leading to a decrease in cardiac output and mean arterial pressure,” the study authors elaborated in their paper. Further supporting the observed pressure decrease during walking, prior research has also shown that aerobic exercise can reduce IOP.

Based on this data, clinicians may consider recommending their open-angle glaucoma patients to sleep in a lateral position and spend more time standing and walking throughout the day to minimize intraocular pressure fluctuations. Additionally, the researchers suggest that during 24-hour IOP monitoring, accurate nighttime measurements should be obtained while patients are in their sleeping postures rather than seated. Lastly, to improve the reliability of in-office intraocular pressure readings, the researchers advise clinicians to perform the measurement after a patient has maintained a seated-level gaze position for at least five minutes. ◀

1. Sang Q, Xin C, Yang D, Mu D, Wang N. Effect of different postures on intraocular pressure in open-angle glaucoma. *Ophthalmol Ther*. November 4, 2023. [Epub ahead of print].

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To Err is Human

On the homefront, we're currently in the middle of a process many families go through, fraught with anticipation and also anxiety: the college search.

One of the toughest parts of it is you're asking a teenager who's still learning about the world and her place in it to determine what she wants to do for the rest of her life and, at the same time, figure out the best college to pursue the training. On this count, however, I've always felt we were lucky: Ever since she could pick up a crayon, our daughter has shown a very obvious talent for art.

When she was 9, she could draw the characters from her favorite movies remarkably well. Her figures were nearly identical to the actual characters, down to little details like a playful dip of the head or an arched eyebrow. In public, other kids would actually stop to watch her draw. Later on, when she was 12, she began doing portraits on commission for an illustration website, reproducing patrons' favorite characters from fiction.

Now, at 18, she's looking to hone her talent by going to college for graphic design/art/illustration. At a time when a lot of young people aren't sure what they want to study in college (understandably so), it was a relief that she has such a demonstrable talent to key on. So, imagine my disappointment when, at lunch with a respected colleague, he matter-of-factly said if he were entering college right now, he'd avoid art, graphic design or illustration. "AI can create any image you want," he said. As a parent, you want to be able to envision a stable, secure future for your child, where her skills are in demand in the marketplace. Hearing his hot take was disheartening.

I looked into it, and stories of AI's pillaging the world of illustration are increasing. In China, for example, skilled artists who create detailed posters promoting a company's latest video game are paid upwards of \$1,000 per design. In 2022, however, AI image generators wiped out 70 percent of these jobs.¹ These artists had a gift that enabled them to put food on the table and a roof over their heads—and it was all taken away virtually overnight.

Callous observers say, "Just adapt, do something else," as if it's easy to discard something you've got a talent for, and that's become part of your life. And even if you buckle down and re-train, what if AI eliminates that new job, too? Ironically, even the people at the top, the CEOs, who are the final arbiters of displacing workers with AI, aren't safe. In one survey, 49 percent of CEOs say that their job—or most of it—*should* be replaced by AI.² (I'm not sure why they're so excited about it.)

Amid this rush to automate, we're forgetting that most people derive meaning and satisfaction from their work, so replacing them with computers removes meaning from people's lives. AI can be helpful, for sure, but I'd like to see us enter this new era with care.

It's true that we probably make more errors than machines, but to err is human. So, we can remove the errors from a task, but do we have to remove the humans, too?

— *Walter Bethke*
Editor in Chief

1. Zhou V. AI is already taking video game illustrators' jobs in China. <https://restofworld.org/2023/ai-image-china-video-game-layoffs/>. Accessed Nov 25, 2023.

2. edX Survey Summary. <https://press.edx.org/edx-survey-finds-nearly-half-49-of-ceos-believe-most-or-all-of-their-role-should-be-automated-or-replaced-by-ai>. Accessed November 26, 2023.

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► OFFICE DESIGN

A Fresh Look for Exams

If your exam lanes are looking a little rough around the edges, EyeDesigns has launched a new line of exam room decor, called Orvos Exam Environments, that the company says may help make them more appealing.



EyeDesigns says the Orvos exam systems are engineered with angled countertop cutouts that position the doctor within a 90-degree radius of the computer keyboard and other items on the desk, while still maintaining strong patient interaction. The company adds that this design decreases muscle fatigue and neck strain that can occur when moving from the patient to the computer and various instruments, makes use of an articulated computer arm that allows the physician to show the patient the monitor, and gives the physician easy access to the EMR system.

Orvos has designs for high-volume medical school teaching environments, hospitals and solo practices. The company's available Smart Office system is designed to organize daily-use items like drops, tissues and paperwork in an effort to increase exam-lane efficiency.

For more information on the Orvos system, visit orvosexam.com.

► DIAGNOSTICS

Topcon Ups the Tempo

If you're looking for a middle-ground between headset-mounted perimeters and traditional desktop-based devices, Topcon's new Tempo might be worth a look.

The Tempo uses an eyepiece reminiscent of the headset-mounted devices and is suitable for use in ambient light, but in a

desktop device that also employs many familiar testing protocols. The result, Topcon says, will make the process less stressful for patients, techs and eyecare providers—and 39 percent faster than standard automated perimetry.

Topcon highlights that the device is equipped with a binocular feature that can test the right and left eyes separately while it randomly presents the test object to either eye in a non-occlusion manner without the patient being aware of which eye is being tested. The company believes that, because patients don't recognize which eye the stimulus is presented to, it's been reported that this test method may be useful in the evaluation of functional VF loss, such as malingering or psychological disorders.

For more info, go to topconhealthcare.com/products/tempo.

B+L Brings Greater Efficiency and a New IOL

If you're looking to give cataract patients' intermediate vision a boost, Bausch + Lomb says its new enVista Aspire intraocular lens may fill the bill.

The company says the enVista Aspire combines novel optics, which are designed for a broader depth of focus, with the proven benefits of the enVista platform to address patient's vision needs in today's modern, digital world, calling it a "compelling new option for the many patients who use digital devices on a daily basis."

For patients with astigmatism, the enVista Aspire also comes in a toric version. Featuring a low-cylinder design, enVista is the only toric IOL platform available to treat less than 1 D of astigmatism at the corneal plane, Bausch + Lomb says.

For more information, visit bauschsurgical.com.

Bausch + Lomb also recently launched SeeNa, an ophthalmic diagnostic system for refractive cataract patients that's fully integrated with the company's Eyetelligence surgical planning software to "help streamline surgical planning and information flow."

Bausch + Lomb says SeeNa captures nine key measurements necessary for evaluating patients' eyes before cataract surgery, and determining the cataract intraocular lens power calculation in one single step. It also offers a user-friendly interface, the company adds, allowing clinicians and staff to quickly master acquisition and operation and receive results in seconds.

SeeNa's integrated Eyetelligence software connectivity allows for efficient upload of the measurements, enabling a seamless, secure flow of this data from the office to the operating room, Bausch says.

For more information, visit bauschsurgical.com/ataract/seena/. ◀

Global Perspectives on Steroids: Study Designs and Diabetic Macular Edema Management Around the World

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**Real-life Experience with Dexamethasone Intravitreal
Implants in Patients with DME**
By Anat Loewenstein, MD



Laurent Kodjikian

**Rationale for Early-Switch and First-Line Dexamethasone
Implants for DME Management**
By Laurent Kodjikian

Real World Use of Dexamethasone for DME
By Michael Singer, MD



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Fluocinolone Acetonide Intravitreal Implant for DME
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Outcomes after IOL Exchanges

Scientists assessed risk factors for worse visual acuity outcomes after intraocular lens exchange and common post-surgical complications, as part of a retrospective cohort study.

Eyes from patients ages 18 years and older in the American Academy of Ophthalmology's IRIS Registry that underwent intraocular lens exchange in the United States between 2013 and 2019, were included.

Scientists determined VA improvement compared to baseline at one-year postoperatively. A multivariable general estimating equation model adjusting for demographic factors and baseline vision was used to identify factors associated with VA worse than 20/40 at one-year postoperatively.

Main outcome measures included VA outcomes and postoperative complications following lens exchange.

A total of 46,063 procedures (n=41,925 unique patients) were included in the researchers' analysis of the registry. Here are some of the findings:

- Overall VA improved from mean logMAR 0.53 ±0.58 (Snellen 20/70) preoperatively to mean logMAR 0.31 ±0.40 (20/40) at one-year postoperatively.
- Among eyes with VA recorded at baseline and at one-year postoperatively, 60.5 percent achieved VA of 20/40 or better at one year.
- VA of worse than 20/40 at one year was associated with:
 - o greater age (OR: 1.16 per

five-year increase; CI, 1.14 to 1.18);

- o higher logMAR baseline VA (OR: 1.14 per 0.1 increase; CI, 1.14 to 1.15);

- o black vs. white race (OR: 1.96; CI, 1.68 to 2.28);

- o Hispanic ethnicity (OR: 1.82; CI, 1.59 to 2.08); and

- o Asian vs. white race (OR: 1.48; CI, 1.21 to 1.81);

- o Medicaid (OR: 1.78; CI, 1.40 to 2.25) vs. private insurance;

- o smoking (OR: 1.22; CI, 1.11 to 1.35);

- o concurrent anterior vitrectomy (OR: 1.65; CI, 1.51 to 1.81) and posterior vitrectomy (OR: 1.53; CI, 1.41 to 1.66) vs. no vitrectomy.

- Female sex (OR: 0.93; CI, 0.87 to 0.99) was associated with 20/40 or better VA at one year.

- At one year, epiretinal membrane (10.9 percent), mechanical lens complication (9.4 percent) and dislocation of the replacement lens (7.1 percent) were the most common complications.

Scientists found the annual number of intraocular lens exchanges rose steadily over time. Vision improved in more than half of patients, and worse visual outcomes were associated with greater age, worse baseline vision, black race, Hispanic ethnicity, Medicaid insurance, smoking and concurrent vitrectomy. Scientists added that epiretinal membrane was the most common complication.

Ophthalmology 2023; Oct 17. [Epub ahead of print]
Son HS, Chang DF, Li C, et al.

The Effect of 15 Years of CXL On Transplantation

Scientists looked at the long-term effects of corneal collagen cross-linking on the frequency of corneal transplants among patients with keratoconus in the same region.

Before the introduction of cross-linking in 2007, 55 primary corneal transplants had been conducted in patients with keratoconus (2005 and 2006) at the Department of Ophthalmology, Oslo University Hospital, Norway. Scientists collected data from the department's corneal transplant registry for 2021 and 2022. The primary outcome was the number of corneal transplants performed in patients with keratoconus. Age, sex, visual acuity (recorded in logMAR notation), keratoconus stage according to the Amsler-Krumeich classification system and steepest keratometry reading (maximum keratometry by Pentacam HR, Oculus) were recorded. In addition, scientists analyzed the annual number of corneal cross-linking treatments conducted from 2007 to 2022.

Here are some of the findings from the researchers' review:

- A total of 352 corneal transplants were performed between 2021 and 2022.
 - Among the transplants, 11 (3.1 percent) were for patients with keratoconus.
 - All included patients were male; 90.1 percent of patients were graded stage 4, and 9.1 percent were graded stage 3.
 - The mean maximum keratometry was 79 D (range: 61.0 to 109 D).
 - The mean best-corrected visual acuity (logMAR) was 1.3 (range: 0.2 to 3.0).
 - Between 2021 and 2022, 431 CXL treatments were performed.
- Scientists uncovered a significant decrease in the number of corneal

transplants performed in patients with keratoconus 15 years after the introduction of corneal cross-linking. They concluded that the availability of the procedure may considerably reduce the need for keratoplasties in this group of patients.

Cornea 2023; Oct 18. [Epub ahead of print].
Hagem AM, Thorsrud A, Sæthre M, et al.

Less-frequent Recall in Diabetic Patients

In the U.K., the English Diabetic Eye Screening Programme offers people living with diabetes annual screening. Less frequent screening has been advocated among people living with diabetes without diabetic retinopathy, but evidence for individual ethnic groups is limited. Investigators examined the potential effect of biennial vs. annual screening on the detection of sight-threatening DR (and proliferative diabetic retinopathy among people living with diabetes without DR) from a large urban multi-ethnic English Diabetic Eye Screening Programme.

Diabetic patients taking part of the North-East London English Diabetic Eye Screening Programme (January 2012 to December 2021) with no DR with up to eight years of follow-up were examined. The researchers determined what effect delays in identification of sight-threatening DR and proliferative diabetic retinopathy events if two-year screening intervals been used.

Here are some of the findings:

- Among 82,782 people living with diabetes (37 percent white, 36 percent South Asian and 16 percent black), there were 1,788 incident sight-threatening DR cases over mean 4.3 ± 2.4 years (sight-threatening DR rate 0.51; CI, 0.47 to 0.55 per 100-person-years).
- Sight-threatening DR incidence rates per 100-person-years by ethnicity were: 0.55 (CI, 0.48 to 0.62) for South Asian patients, 0.34 (CI, 0.29 to 0.40) for white patients, and 0.77 (CI, 0.65 to 0.90) for black patients.
- Biennial screening would have delayed diagnosis by one year for 56.3 percent (1,007/1,788) with sight-threatening DR and 43.6 percent (45/103) with proliferative diabetic retinopathy.
- Standardized cumulative rates of delayed sight-threatening DR per 100,000 persons for each ethnic group were: 1,904 (CI, 1,683 to 2,154) for black patients, 1,276 (CI, 1,153 to 1,412) for South Asian patients and 844 (CI, 745 to 955) for white patients.

Investigators determined that biennial screening would have delayed detection of some sight-threatening diabetic retinopathy and proliferative diabetic retinopathy by one year, especially among black patients. ◀

Br J Ophthalmol 2023; Oct 24. [Epub ahead of print].
Olvera-Barrios A, Rudnicka AR, Anderson J, et al; ARIAS Research Group.

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REVIEW OF OPHTHALMOLOGY

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It's That Time of Year Again

Musings on life, medicine and the practice of ophthalmology.

MARK H. BLECHER
CHIEF MEDICAL EDITOR

It's that time of year again. How trite it is to say how fast the year went, but it's true. I've now finished my third year in my second career and intend to keep going. A far cry from doing some part-time work to get me out of the house; I'm going 24/7/365 and still with enough goals left to accomplish that I'm actually looking forward to 2024. And pleasantly I'm OK with continuing on. But there's still a sense of conclusion as the end of the year approaches. Typically my column in December is full of cheer and goodwill, and not infrequently includes a homily or a nod to Charles Dickens. However I think I've milked that as much as I can and really am content this year to simply be more content, to have a sense of peace and being grounded that eludes me and perhaps many of you, during the course of the year. The mad dash of

day to day, putting out fires with the knowledge that tomorrow there will be more of them without end. And enjoying the holidays really does work better if you're not chasing something trivial and mundane. It's a concept I've known for years but failed to achieve repeatedly. To grasp it, it requires standing back a bit, taking yourself out of the 'flux.'

Part of achieving this sense of Zen will also require me to stand down from my constant monitoring of the world at large. The realization came to me that I can't really do a lot about all the awful and evil things happening at the moment. I mean I can and should stand up and support truth, justice and our democracy. But on a day-to-day basis, my mental health would be far better served to reflect on what I personally can and have accomplished rather than the chaos that surrounds me. It's a fine line between doom scrolling and checking out completely. It involves

a more considered approach to the challenges and tasks in front of you. You have to sort out what needs to be done, what ought to be done and what can be done. Part of that comes from knowing and appreciating where you've been and where you are now. To do this, you need a moment of contemplation, a pause to consider. I'm so used to reflexively responding to stimuli, to the world around me. It's an impetuosity common in the young, and intemperate in the mature. I'm trying to take a moment, even a split second before responding verbally. To actually hear and see and then think, instead of saying something immediately, or rushing in, I might stop and smile. Acknowledge quietly. It gets an amazing response, perhaps because it's a bit atypical for me. But even better it feeds a feeling of being fully present. And that's where I'm going with all this: Be in the moment, but in the moment with the perspective of your history. This provides not only context but an acceptance that where you are is worth appreciating and not everything is about what's next—a good approach at any time of year and even more resonant at the end of one.

Thanks for reading my columns during the year and wishing you and yours a happy and a healthy. See you in 2024! ◀



WesMD

This article has no commercial sponsorship.

Dr. Blecher is an attending surgeon at Wills Eye Hospital.



EDITED BY THOMAS JOHN, MD

CORNEA/ANTERIOR SEGMENT

Pearls for Combination Surgery

A retina specialist shares pearls and tips for planning and executing successful anterior-posterior combination surgery.

RAJESH C. RAO, MD
ANN ARBOR

Today, combined surgery is performed for a number of indications including epiretinal membrane, macular hole, prior complicated cataract surgery, retinal detachment, pars plana glaucoma drainage device insertion and corneal surgery. However, the logistics of combined surgery, such as sharing an OR with another surgeon and coordinating surgical schedules, can make this a daunting task. Here, I'll share some pearls from a retina standpoint for ensuring both surgical teams are successful.

The Golden Rule

As with any type of relationship, it's important to establish good rapport early on. The first case you do with another surgeon may be followed by many more cases in the future. Your operating room time may correspond with that of a particular retina surgeon, so it's a good idea to get to know them and their preferences, and vice versa. Also consider what the other surgeon's day looks like and how busy it is. Anterior segment surgeons may be quite a bit busier in terms of volume than retina surgeons, so being patient on both of our ends goes a long way. Also be sure to consider the retina

surgeon's level of experience doing combined cases. Have they done many before or is this their first time?

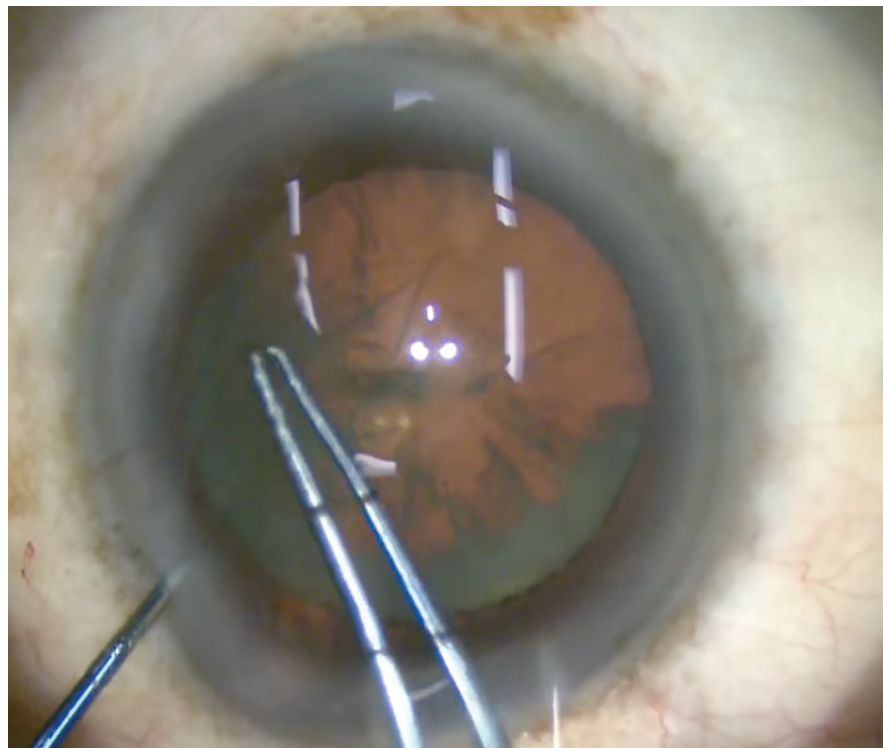
Order of Operations

Communicating clearly about surgical steps and comfort level with varying conditions in combined cases will help ensure that the

procedures go smoothly. Here are three common combined surgery scenarios that benefit from discussion beforehand:

- **Silicone oil removal.** From the retina point of view, there's not always a need to remove the silicone oil. However, relatively few anterior segment surgeons are comfortable with having silicone oil in the eye because of the potential migration of the oil to the anterior segment, which could disrupt visualization. The retina surgeon can remove the oil first to make the anterior segment surgery easier.

On the other hand, some surgeons are comfortable with keeping the silicone oil in while they perform phacoemulsification. If that's the case, be sure to discuss how to



Uday Devgan, MD

Creating a smaller capsulorhexis than usual (≤ 5 mm) will help to ensure that the IOL optic doesn't prolapse during or after the case due to increased posterior pressure from an air or gas bubble.

This article has no commercial sponsorship.

Dr. John is a clinical associate professor at Loyola University at Chicago and is in private practice in Oak Brook, Tinley Park and Oak Lawn, Illinois. He can be reached at 708-429-2223; email: tjconference@gmail.com.

SYFOVRE[®]
(pegcetacoplan injection)
15 mg / 0.1 mL

GA unravels so much

**Save retinal
tissue by slowing
progression**¹⁻³



INDICATION

SYFOVRE[®] (pegcetacoplan injection) is indicated for the treatment of geographic atrophy (GA) secondary to age-related macular degeneration (AMD).

IMPORTANT SAFETY INFORMATION

CONTRAINDICATIONS

- SYFOVRE is contraindicated in patients with ocular or periocular infections, and in patients with active intraocular inflammation

WARNINGS AND PRECAUTIONS

● Endophthalmitis and Retinal Detachments

- Intravitreal injections, including those with SYFOVRE, may be associated with endophthalmitis and retinal detachments. Proper aseptic injection technique must always be used when administering SYFOVRE to minimize the risk of endophthalmitis. Patients should be instructed to report any symptoms suggestive of endophthalmitis or retinal detachment without delay and should be managed appropriately.

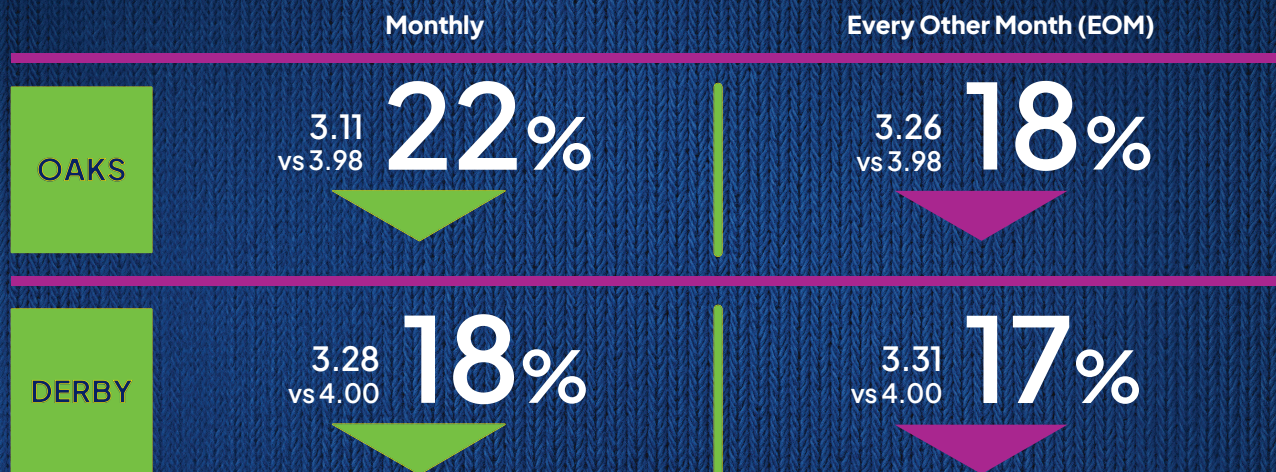
● Neovascular AMD

- In clinical trials, use of SYFOVRE was associated with increased rates of neovascular (wet) AMD or choroidal neovascularization (12% when administered monthly, 7% when administered every other month and 3% in the control group) by Month 24. Patients receiving SYFOVRE should be monitored for signs of neovascular AMD. In case anti-Vascular Endothelial Growth Factor (anti-VEGF) is required, it should be given separately from SYFOVRE administration.

● Intraocular Inflammation

- In clinical trials, use of SYFOVRE was associated with episodes of intraocular inflammation including: vitritis, vitreal cells, iridocyclitis, uveitis, anterior chamber cells, iritis, and anterior chamber flare. After inflammation resolves, patients may resume treatment with SYFOVRE.

SYFOVRE achieved continuous reductions in mean lesion growth rate* (mm²) vs sham pooled from baseline to Month 24¹



SE in trials (monthly, EOM, sham pooled): OAKS: 0.15, 0.13, 0.14; DERBY: 0.13, 0.13, 0.17.

*Slope for baseline to Month 24 is an average of slope of baseline to Month 6, Month 6 to Month 12, Month 12 to Month 18, and Month 18 to Month 24.¹

Based on a mixed effects model for repeated measures assuming a piecewise linear trend in time with knots at Month 6, Month 12, and Month 18.¹

GA=geographic atrophy; SE=standard error.



Explore the long-term data

IMPORTANT SAFETY INFORMATION (CONT'D)

WARNINGS AND PRECAUTIONS (CONT'D)

- **Increased Intraocular Pressure**

- Acute increase in IOP may occur within minutes of any intravitreal injection, including with SYFOVRE. Perfusion of the optic nerve head should be monitored following the injection and managed as needed.

ADVERSE REACTIONS

- Most common adverse reactions (incidence ≥5%) are ocular discomfort, neovascular age-related macular degeneration, vitreous floaters, conjunctival hemorrhage.

Trial Design: SYFOVRE safety and efficacy were assessed in OAKS (N=637) and DERBY (N=621), multi-center, 24-month, Phase 3, randomized, double-masked trials. Patients with GA (atrophic nonexudative age-related macular degeneration), with or without subfoveal involvement, secondary to AMD were randomly assigned (2:2:1:1) to receive 15 mg/0.1 mL intravitreal SYFOVRE monthly, SYFOVRE EOM, sham monthly, or sham EOM for 24 months. Change from baseline in the total area of GA lesions in the study eye (mm²) was measured by fundus autofluorescence (FAF).^{1,4}

References: 1. SYFOVRE (pegcetacoplan injection) [package insert]. Waltham, MA: Apellis Pharmaceuticals, Inc.; 2023. 2. Pfau M, von der Emde L, de Sisternes L, et al. Progression of photoreceptor degeneration in geographic atrophy secondary to age-related macular degeneration. *JAMA Ophthalmol.* 2020;138(10):1026–1034. 3. Bird AC, Phillips RL, Hageman GS. Geographic atrophy: a histopathological assessment. *JAMA Ophthalmol.* 2014;132(3):338–345. 4. Data on file. Apellis Pharmaceuticals, Inc.

Please see Brief Summary of Prescribing Information for SYFOVRE on the adjacent page.

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SYFOVRE® (pegcetacoplan injection), for intravitreal use
BRIEF SUMMARY OF PRESCRIBING INFORMATION
Please see SYFOVRE full Prescribing Information for details.

INDICATIONS AND USAGE

SYFOVRE is indicated for the treatment of geographic atrophy (GA) secondary to age-related macular degeneration (AMD).

CONTRAINDICATIONS

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Active Intraocular Inflammation

SYFOVRE is contraindicated in patients with active intraocular inflammation.

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Neovascular AMD

In clinical trials, use of SYFOVRE was associated with increased rates of neovascular (wet) AMD or choroidal neovascularization (12% when administered monthly, 7% when administered every other month and 3% in the control group) by Month 24. Patients receiving SYFOVRE should be monitored for signs of neovascular AMD. In case anti-Vascular Endothelial Growth Factor (anti-VEGF) is required, it should be given separately from SYFOVRE administration.

Intraocular Inflammation

In clinical trials, use of SYFOVRE was associated with episodes of intraocular inflammation including: vitritis, vitreal cells, iridocyclitis, uveitis, anterior chamber cells, iritis, and anterior chamber flare. After inflammation resolves patients may resume treatment with SYFOVRE.

Increased Intraocular Pressure

Acute increase in IOP may occur within minutes of any intravitreal injection, including with SYFOVRE. Perfusion of the optic nerve head should be monitored following the injection and managed as needed.

ADVERSE REACTIONS

Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

A total of 839 patients with GA in two Phase 3 studies (OAKS and DERBY) were treated with intravitreal SYFOVRE, 15 mg (0.1 mL of 150 mg/mL solution). Four hundred nineteen (419) of these patients were treated in the affected eye monthly and 420 were treated in the affected eye every other month. Four hundred seventeen (417) patients were assigned to sham. The most common adverse reactions ($\geq 5\%$) reported in patients receiving SYFOVRE were ocular discomfort, neovascular age-related macular degeneration, vitreous floaters, and conjunctival hemorrhage.

Table 1: Adverse Reactions in Study Eye Reported in $\geq 2\%$ of Patients Treated with SYFOVRE Through Month 24 in Studies OAKS and DERBY

Adverse Reactions	PM (N = 419) %	PEOM (N = 420) %	Sham Pooled (N = 417) %
Ocular discomfort*	13	10	11
Neovascular age-related macular degeneration*	12	7	3
Vitreous floaters	10	7	1
Conjunctival hemorrhage	8	8	4
Vitreous detachment	4	6	3
Retinal hemorrhage	4	5	3
Punctate keratitis*	5	3	<1
Posterior capsule opacification	4	4	3
Intraocular inflammation*	4	2	<1
Intraocular pressure increased	2	3	<1

PM: SYFOVRE monthly; PEOM: SYFOVRE every other month

*The following reported terms were combined:

Ocular discomfort included: eye pain, eye irritation, foreign body sensation in eyes, ocular discomfort, abnormal sensation in eye

Neovascular age-related macular degeneration included: exudative age-related macular degeneration, choroidal neovascularization

Punctate keratitis included: punctate keratitis, keratitis

Intraocular inflammation included: vitritis, vitreal cells, iridocyclitis, uveitis, anterior chamber cells, iritis, anterior chamber flare

Endophthalmitis, retinal detachment, hyphema and retinal tears were reported in less than 1% of patients. Optic ischemic neuropathy was reported in 1.7% of patients treated monthly, 0.2% of patients treated every other month and 0.0% of patients assigned to sham. Deaths were reported in 6.7% of patients treated monthly, 3.6% of patients treated every other month and 3.8% of patients assigned to sham. The rates and causes of death were consistent with the elderly study population.

USE IN SPECIFIC POPULATIONS

Pregnancy

Risk Summary

There are no adequate and well-controlled studies of SYFOVRE administration in pregnant women to inform a drug-associated risk. The use of SYFOVRE may be considered following an assessment of the risks and benefits.

Systemic exposure of SYFOVRE following ocular administration is low. Subcutaneous administration of pegcetacoplan to pregnant monkeys from the mid gestation period through birth resulted in increased incidences of abortions and stillbirths at systemic exposures 1040-fold higher than that observed in humans at the maximum recommended human ophthalmic dose (MRHOD) of SYFOVRE (based on the area under the curve (AUC) systemically measured levels). No adverse maternal or fetal effects were observed in monkeys at systemic exposures approximately 470-fold higher than that observed in humans at the MRHOD.

In the U.S. general population, the estimated background risk of major birth defects and miscarriage in clinically recognized pregnancies is 2-4% and 15-20%, respectively.

Lactation

Risk Summary

It is not known whether intravitreal administered pegcetacoplan is secreted in human milk or whether there is potential for absorption and harm to the infant. Animal data suggest that the risk of clinically relevant exposure to the infant following maternal intravitreal treatment is minimal. Because many drugs are excreted in human milk, and because the potential for absorption and harm to infant growth and development exists, caution should be exercised when SYFOVRE is administered to a nursing woman.

Females and Males of Reproductive Potential

Contraception

Females: It is recommended that women of childbearing potential use effective contraception methods to prevent pregnancy during treatment with intravitreal pegcetacoplan. Advise female patients of reproductive potential to use effective contraception during treatment with SYFOVRE and for 40 days after the last dose. For women planning to become pregnant, the use of SYFOVRE may be considered following an assessment of the risks and benefits.

Pediatric Use

The safety and effectiveness of SYFOVRE in pediatric patients have not been established.

Geriatric Use

In clinical studies, approximately 97% (813/839) of patients randomized to treatment with SYFOVRE were ≥ 65 years of age and approximately 72% (607/839) were ≥ 75 years of age. No significant differences in efficacy or safety were seen with increasing age in these studies. No dosage regimen adjustment is recommended based on age.

PATIENT COUNSELING INFORMATION

Advise patients that following SYFOVRE administration, patients are at risk of developing neovascular AMD, endophthalmitis, and retinal detachments. If the eye becomes red, sensitive to light, painful, or if a patient develops any change in vision such as flashing lights, blurred vision or metamorphopsia, instruct the patient to seek immediate care from an ophthalmologist.

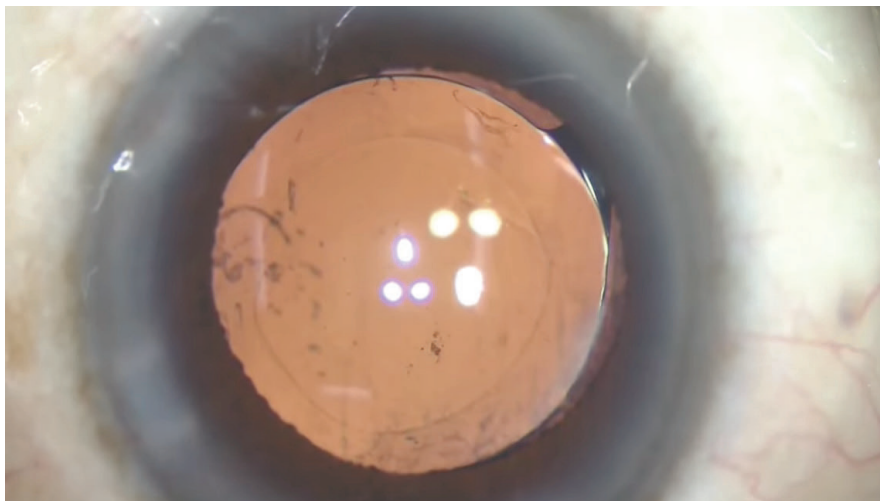
Patients may experience temporary visual disturbances associated either with the intravitreal injection with SYFOVRE or the eye examination. Advise patients not to drive or use machinery until visual function has recovered sufficiently.

Manufactured for:
 Apellis Pharmaceuticals, Inc.
 100 Fifth Avenue
 Waltham, MA 02451

SYF-PI-17Feb2023-1.0

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Uday Devgan, MD

A 4.5-mm capsulorhexis with an acrylic monofocal IOL. Acrylic IOLs are preferable to silicone IOLs in combined surgery cases.

proceed. Oftentimes, irrigation pressure from the anterior hand-piece is increased in these cases to maintain stable fluidics to counter the increased posterior pressure.

• **Trocar placement.** Before surgery, be sure to communicate about preferences on trocar placement, position and infusion status. Do you prefer no trocar, or do you prefer to control the infusion? It's important to note that during combined surgery, the intraocular pressure status isn't apparent, and there are always risks for hypotony and choroidals. I prefer to pre-place an infusion trocar, whether or not a cannula is inserted. The infusion might not be turned on, per the anterior segment surgeon's preference, in order to not apply additional posterior pressure from pars plana infusion.

• **Scleral buckling.** Scleral buckling will raise the posterior pressure. If done first, the anterior segment surgeon will need to keep in mind that the posterior pressure has increased.

Strategic Pearls

Here are some pearls to consider for one of the most common combined procedures, phacovitrectomy:

• **Use what's comfortable.** When performing a combined phacovit-

rectomy procedure, it's often advantageous for the cataract surgeon to perform the procedure using the machine they feel most comfortable with. I've found that this tends to be more efficient. Having this discussion prior to the surgery is key.

• **Adapt the size of the capsulorhexis.** A slightly undersized capsulorhexis (≤ 5 mm) will help to reduce the risk of IOL optic prolapse during or after the case.

• **Avoid stromal hydration.** Combined cases, especially the second part done by the retina surgeon, may take a while, especially for patients with conditions such as tractional retinal detachments. Having plenty of corneal clarity and avoiding stromal hydration during I/A is key.

• **Be aware of PC laxity.** Oftentimes after combined surgery, the bag may be distended. Though uncommon, the retina surgeon may bite the bag during anterior vitrectomy. At the end of the surgery, there may be a small capsulotomy. Usually this isn't an issue provided the rest of the cataract surgery goes well but be aware that the Viscoat or ProVisc may create a laxness of the PC and increase the risk for that.

• **Discuss the preferred type of**

wound closure. Some retina surgeons prefer suture closure of the main wound.

• **Assess IOL position and AC morphology.** At the end of the case, because of the fluidics, the optic may peak out of the pupil a bit or there may be some anterior chamber shallowing. Sometimes the retina surgeon may bring the anterior segment surgeon back in. Or, if the retina surgeon feels comfortable, then they may help by putting more fluid into the anterior chamber, changing the infusion pressure and/or putting in some Miochol to constrict the iris to prevent IOL prolapse anteriorly.

• **Assess the retina.** Be sure to perform scleral indentation and look at the peripheral retina to assess for any retinal breaks.

• **Communicate postoperative positioning.** Early postoperative positioning may be required in cases requiring tamponade for retinal breaks.

• **Hold off on cycloplegia.** Miotics often aren't needed unless there's evidence of significant IOL prolapse. In these cases, try to avoid cycloplegia until postop day one or later.

In summary, when performing combined surgery, it's important to know your partner, conduct a thorough pre-planning discussion and communicate clearly with each other. Phacovitrectomy can be executed safely using single-piece IOLs with appropriate modifications to microsurgical technique: wound construction; small capsulorhexis; and avoiding stromal hydration. ◀

ABOUT THE AUTHOR



Dr. Rao is the Leonard G. Miller Professor of Ophthalmology and Visual Sciences and an associate professor of ophthalmology, pathology and human genetics at the University of Michigan. He has no related financial disclosures.



EDITED BY ARTURO CHAYET, MD

REFRACTIVE/CATARACT RUNDOWN

A Pain in the Neck

Prone to musculoskeletal pain, ophthalmologists seek ergonomic solutions for the sake of their bodies and careers.

LIZ HUNTER
SENIOR EDITOR

Alison Early, MD, a medical and surgical comprehensive ophthalmologist including cataract and refractive surgery at Cincinnati Eye Institute, has been practicing for approximately six years and in that time she's already experienced musculoskeletal discomfort. In fact, she first noticed it as a resident.

"It wasn't something that anybody inquired about or asked me or even talked about at all," Dr. Early recalls. "I remember thinking maybe it's the chair that I'm sitting in or the computer height or something, but I didn't really pursue it any further. I think that there's a culture throughout medical school residency fellowship that it's hard, it's uncomfortable and you're sort of rewarded for pushing through difficult things. And frankly, a lot of our equipment isn't really designed with the user ergonomically in mind."

After observing Michael Snyder, MD, who is an ophthalmology professor at the University of Cincinnati, in the operating room, Dr. Early noticed how he discussed proper ergonomics and positioning during surgery. It was the first time she'd heard someone else mention the issues she was dealing with. However, as her career in private practice began, the tightness in her back, neck and shoulders was noticeable at the end of each day.

"I learned that it was something very commonly encountered by ophthalmologists, and not just us, but lots of people

in similar careers—dentists, head and neck surgeons, and people who spend a lot of time looking through microscopes," continues Dr. Early. "We all assume similar positions and repetitive postures, which lead to what are called cumulative strain injuries. So it's not necessarily a large-scale motion that causes you to throw your back out in a dramatic way, but this repetitive motion over and over and over and over again, all day, every day for weeks, months, years, decades that can actually really affect the longevity of your career and yourself."

This issue of musculoskeletal disorders and chronic pain among ophthalmologists and microsurgeons has been studied, with self-reported rates of 50 percent¹ in a 2005 study of nearly 700 ophthalmologists in the Northeast, and more recently, smaller studies have shown rates of 66 percent² and 81 percent.³ Severity and frequency of pain has led some surgeons to reduce their operating time and clinic hours.²

Some within the field see this as an emerging epidemic that requires awareness and education in order to save the next generation of ophthalmologists. Many accomplished cataract and refractive surgeons are sharing their own personal experiences, as well as the posture and equipment modifications they've made to find relief.

"Sam Masket, MD, has been really at the forefront," says Dr. Early. "I think in his position as a very widely known and well-respected career ophthalmologist, for him to have been as open as he's been about the issues that he's had

(sharing his own spinal MRI images and publishing in journals), it's really eye-opening. For him to sit where he is with his perspective and gravitas and to encourage people to start addressing this early, I think it does carry a lot of weight."

Common Culprits in Ophthalmology

It's evident that the contributing factors to the chronic pain experienced by ophthalmologists is a combination of repeated positions and movements, along with ill-designed equipment.

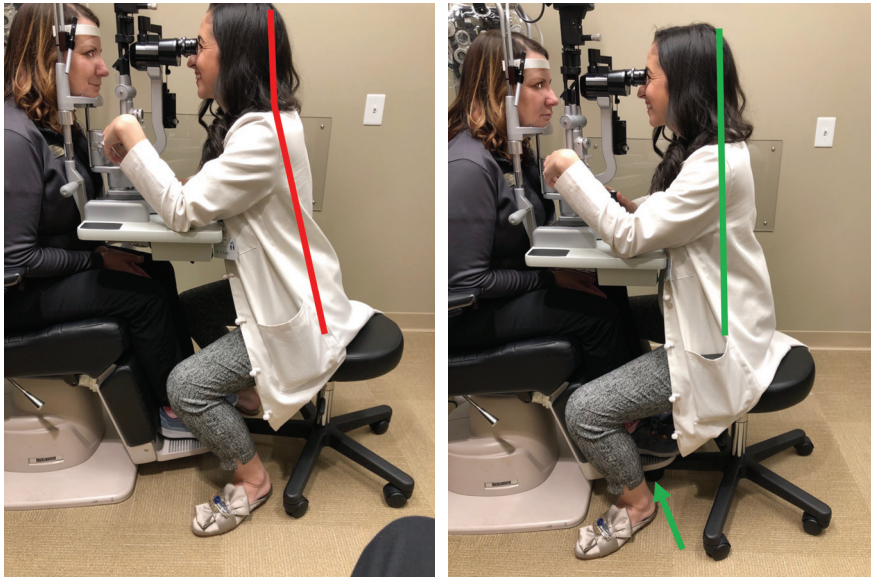
In 2015, Deepinder K. Dhaliwal, MD, LAC, a professor of ophthalmology at the University of Pittsburgh, slipped on water in the operating room. She developed a severe L5, S1 disc herniation and became disabled. She tried everything she could to avoid having surgery, including physical therapy, acupuncture, meditation, as well as pain medication and use of an interferential current stimulator device, which she would use right before operating. Ultimately, she persevered through the pain without surgery, but did a deep literature dive into musculoskeletal disorders in ophthalmology.

One of the most common culprits cited is the slit lamp. "The slit lamp is a huge one," Dr. Dhaliwal says. "What we do is we crane our neck forward to get closer to the patient—we're leaning forward all the time. That's terrible."

Steven G. Safran, MD, who's a comprehensive ophthalmologist in private practice in Lawrenceville, New Jersey, says it was a medical issue of his own that alerted him to the harm the slit lamp was causing to his body. It started with a visit to the chiropractor for an adjustment due to lower back pain. Dr. Safran subsequently broke out with shingles in the area and neck pain that wasn't there previously. Another

This article has no commercial sponsorship.

Dr. Chayet is considered a pioneer in refractive and cataract surgery, and is the medical director of the Codet Vision Institute in Tijuana, Mexico. He is a clinical investigator for RxSight, LensGen and ForSight Vision6.



The slit lamp is one of the main sources of complaints from ophthalmologists who often lean forward at an uncomfortable angle to examine patients. Above, Alison Early, MD, demonstrates the adjustments she made to create a more neutral spine while sitting at the slit lamp, including elevating the patient's chair and moving closer to avoid leaning.

adjustment led to numbness and pain on his left side. An MRI revealed severe disc damage of his C5-6/C6-7. As a solo practitioner, Dr. Safran struggled to keep up with his patients, working through the pain. He eventually underwent surgery in 2016, but healing the nerves took two or three years.

“When this was going on I became acutely aware of the things that were exacerbating the problem, because what you can tolerate when you’re healthy, you can’t tolerate when you’re not healthy,” says Dr. Safran. “It was then that I started to realize that my slit lamp tables and leaning into them for exams was harmful. It’s almost impossible to have good posture and if you have a head-forward position, it puts a lot of strain on your back and upper back muscles, leading to repetitive injury to the disc and vertebrae.”

Dr. Early also noticed how the slit lamp put her body into an awkward position. “As a cataract and refractive surgeon I see usually between 40 and 50 patients per day, and I’m doing fairly thorough examinations on all of them at the slit lamp,” she says. “Slit lamps are wonderful, but their design hasn’t changed much in at least the last half

century. They’re really not ergonomically designed for either the patient or the examiner and the chair that the patient sits in positions them in a slightly reclined position. That sets up the examiner to be leaning more dramatically forward. The issue that I had was when I was in that position, my trapezius and upper spine and neck were very sore at the end of the day because I was essentially in an abnormal neck extension all day to look through the microscope oculars to examine patients. My seat or stool was behind me so my hips were flexed and my neck was extended, which caused a lot of the load bearing to be in my thoracic and cervical spine.”

The indirect ophthalmoscope is another uncomfortable piece of equipment, adds Dr. Dhaliwal. “It’s super heavy and there’s something called ‘text neck.’ Text neck comes from flexing your neck forward to look at your phone, which you should never do. However, that’s becoming an epidemic and truly it can wreck your spine,” she says. “With the indirect, when you think about it, we’re flexing our neck forward with a heavy weight on our head. If the human head typically

weighs 10 to 12 pounds, when you flex it forward about 45 degrees that increases the effective weight of your head close to 50 pounds. If you go 60 degrees, that’s an effective weight of 60 pounds. And then when you add the weight of an indirect it’s very heavy. Even if you don’t have the indirect on your head, just flexing your neck forward changes how much effective weight your cervical spine has to support.”

It’s not just MDs who are noticing occupation-related pain, notes Dr. Early. “I’ve spoken to career ophthalmic technicians who have shoulder issues, which once they become aware of the possibility of cumulative strain injuries, they realize this is probably from moving the phoropter in front of the patient 30 to 40 times a day for decades and their one shoulder will be affected or they’ll have issues with grasp and grip leading to carpal tunnel and radial neuropathy because of all the gripping and twisting and holding lenses and fine finger movements,” she says.

Chairs and sitting posture should be considered, too, says Dr. Dhaliwal. “Sitting is really problematic because when you compare it to lying down, sitting puts 250 times as much pressure on the intervertebral discs as compared to lying down,” she says. “Standing is much better. That puts 100 times as much pressure on your disks, believe it or not. If you’re having back problems, lying down is the best thing in order to relax your spine, but obviously we can’t do that easily at work.”

Dr. Early actually realized that her office attire was somewhat dictating the way she could sit while examining patients. “Prior to the pandemic I was always in business-professional clothing, often in heels, dresses, skirts, which basically forced me to twist my spine to examine patients,” she recalls. “I’d be seated in a side-saddle position, which of course is not a neutral spine. As a result of the confusion and concern about contact spread at the beginning of the pandemic, I started wearing scrubs so that I could change immediately upon arriving home, and it helped in a num-



In the OR, Alison Early, MD, prioritizes positioning herself properly with a neutral spine and relaxed shoulders, as opposed to extending her body to reach the equipment, which can lead to injury.

ber of ways. I've continued to do this and I'm able to focus on positioning myself in a positive ergonomic posture."

Adjustments to Consider

Each of these surgeons we spoke with have made both small- and large-scale modifications that they say contributed to marked improvement in their pain and overall well-being. Here are a few of their suggestions.

- **Slit lamp.** A miniscule change helped Dr. Early. "What I found was that just by essentially removing the barrier of the patient's foot rest, either by elevating the patient's chair maybe a half an inch to an inch, or just folding the foot rests out of the way, that allowed me to move my chair forward closer to the patient so that my body could be closer to the slit lamp, my spine to be in a neutral upright position, and my neck to be in a neutral upright position," she says. "Almost instantaneously making that very minor change, which probably takes two to four seconds for patients, nearly immediately resolved that discomfort that I was having."

"I like to have a straight posture with my ears over my shoulders, my shoulders over my hips and my neck is straight," says Dr. Dhaliwal. "I raise

the patient's chair and I slide my chair under the patient's footrest. I have the patient sit near the forward edge of the chair so they're actually perched much more forward, and then they lean into the slit lamp so I stay straight. Actually, they're much more comfortable, especially women who sometimes have a hard time getting close enough to the slit lamp. I'm never hunched over."

Of course there will be patients who are unable to accommodate these adjustments, but it's still worth doing for the majority of your other cases, notes Dr. Early. "If you're in your proper posture 90 percent of the time, you can meet a patient who has physical limitations the other 10 percent of the time and it'll take a much longer period of time for you to experience issues related to that small fraction of patients," she says.

Dr. Safran's slit lamp modifications were a bit more intricate and actually involved redesigning his whole table. Working with a patient who was a carpenter and cabinet maker, Dr. Safran's new design puts his oculars flush with the edge of the table, enabling him to sit up straight without craning his neck forward. The slit lamp table is also rounded and smooth to support his elbows without being painful.

"The tables really made it possible for me to continue practicing because I don't think I would have been able to continue when I was having this problem in the first year or two after my surgery," he says. "I don't think it would have been possible for me to see patients using my old table."

Since then, Dr. Safran has lent his input to Haag-Streit in their creation of a line of slit lamp tables (without financial interest). One suggestion was to allow headrest straps to be switched out. "Longer straps allow the patient's head to be closer to the doctor, even a half inch or one inch closer makes a difference," he says. "If the headrest strap is shorter then it's going to be tighter and push the patient's head back away from you."

Although Dr. Safran prefers his own table, he and other ophthalmologists are glad to see industry responding to these issues.

"We need industry to really change the way we do things and we need to be able to operate safely and effectively with new tools so that we can decide when we want to retire and we are not forced to retire due to disability," says Dr. Dhaliwal.

- **Indirect ophthalmoscope.** To resolve her issues with this equipment, Dr. Dhaliwal says she now raises the patient's chair up as high as it'll go and then performs a dilated fundus exam while keeping her neck straight. "It's changed my life," she says.

- **Operating room.** "The OR chair is really important," adds Dr. Dhaliwal. "The key is that the chairs should have good lumbar support, allow our legs to be comfortable under the surgical bed and allow us to look through the operating microscope without craning our neck."

Chair and operating tables don't always sync up either, and the microscope is a third element to adjust, says Dr. Early. "I operate with a traditional operating microscope and my goal is to position myself first, use the lumbar support, spinal support, neutral spine position, neutral neck, and then bring the patient into position and into



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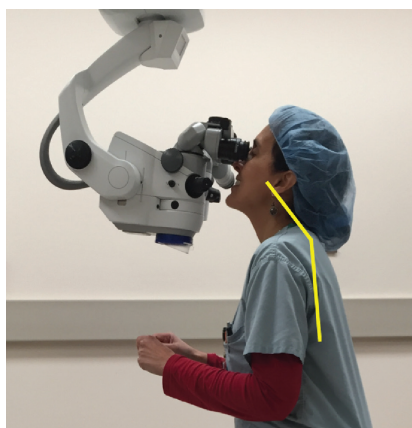
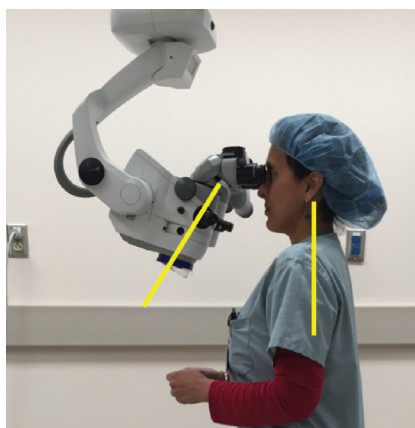
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Poor posture at the microscope (left) can lead to musculoskeletal discomfort and cause severe damage to the spine over time if uncorrected. As Deepinder Dhaliwal, MD, LAc, demonstrates (right), adjusting equipment to your body is a simple modification that can make a big difference.

focus,” she says. “That’s helped me a lot through long operating room days.”

An alternative, which has become quite popular in modern operating rooms, is actually using a 3D Heads Up operating suite, continues Dr. Early. “That can potentially eliminate the positioning with the microscope oculars and gives the surgeon a much more ergonomically friendly position in the OR,” she says. “For those who do have access to that, I think that’s a wonderful investment for a practice to make in their surgeons over the long term.”

Although it’s a step forward, Dr. Dhaliwal believes the 3D Heads Up may still put strain on the neck. “You have to turn your neck to see the screen. It should be straight, so it’s not the best position,” she says.

Dr. Safran says he didn’t modify equipment in the operating room, per se, but he did modify what was going on between his ears. “I modified my awareness of my posture,” he says. “I like to meditate and there are many cultures with chair meditation techniques and certain posture: your ears are positioned over your shoulders, head in line with the spine, shoulders back and lower back curved forward with your knees angled downward slightly. I try to emulate this in the operating room. I straddle a banana seat with my knees lower than my hips and I sit up straight. I don’t use back support.”

An OR setup should be built to

suit each individual surgeon, says Dr. Dhaliwal. “There are challenges for people with shorter torsos and longer legs—like me,” she says. “I have to tilt the scope more in order to be comfortable, not extend my neck and be able to fit my legs underneath the surgical bed. You really have to do a deep dive into making sure your surgical setup is comfortable in order to operate effortlessly and, no matter how many cases you’re doing, not end the day in discomfort.”

She suggests it might even be a good idea to consult physical and occupational therapists. “Truly we should be inviting them into our ORs and offices to assess our posture and make recommendations,” Dr. Dhaliwal says.

• **Core strength.** Knowing how to strengthen your core is very important for every microsurgeon. “The multifidus muscle goes along the spine and that’s really what you want to strengthen,” Dr. Dhaliwal says. “When you do that, you’re able to really support your spine so that you’re less prone to injury.”

Dr. Early agrees. “A lot of people overlook the importance of having a strong core, but as an ophthalmologist, especially a surgical ophthalmologist, when you’re operating you’re using both hands and both feet and your core is really what’s responsible for stabilizing your entire body when all of your limbs are in use,” she says. “Being physically active in your everyday life, focusing on a healthy strong core—your abdomi-

nal muscles and your anterior core as well as your posterior core and spinal muscles—is really critical to just setting yourself up for success in being able to sustain the career longevity that we all want.”

Awareness in Young Ophthalmologists

There’s hope that these lessons can be passed on to ophthalmologists who are just starting out before it’s too late.

“Younger ophthalmologists may just take some of this discomfort as par for the course,” says Dr. Early. “Medical training and residency is difficult. It’s uncomfortable, we’re sleep deprived, it takes a toll on our bodies, but you don’t always feel like you have the license to look out for yourself when you’re a trainee. I think it’s really important for trainees to be aware of it, for residency programs and fellowship programs to be aware of it and try to encourage the residents and fellows and young career doctors to take care of themselves in ways that aren’t just sleep, hygiene and healthy food and things like that, but actually caring for your body as you go about your workday is really critical.”

Dr. Safran says it’s hard for young people to think that far ahead to their later years and how their actions now will affect them. “It’s like someone who smokes when they’re young, and then they get to age 60 and realize it wasn’t such a great idea,” he says. “Young ophthalmologists may not feel the need to be concerned about their neck when they’re young, but if they want to be better surgeons, having good posture will make them better.” ◀

1. Dhimitri KC, McGwin G Jr, McNeal SF, Lee P, Morse PA, Patterson M, Wertz FD, Marx JL. Symptoms of musculoskeletal disorders in ophthalmologists. *Am J Ophthalmol* 2005;139:1:179-81.

2. Schechet SA, DeVience E, DeVience S, Shukla S, Kaleem M. Survey of musculoskeletal disorders among U.S. ophthalmologists. *Digit J Ophthalmol* 2020;31:26:4:36-45.

3. Tan NE, Wortz BT, Rosenberg ED, Radcliffe NM, Gupta PK. Digital survey assessment of factors associated with musculoskeletal complaints among U.S. ophthalmologists. *Clinical Ophthalmology* 2021;15:4865-4874.

DISCLOSURES

Drs. Dhaliwal, Early and Safran report no relevant disclosures.

THE TELEMEDICINE OF TODAY AND TOMORROW

Experts say telemedicine hasn't reached its peak yet, but there's hope for the future.

CHRISTINE YUE LEONARD
SENIOR ASSOCIATE EDITOR

The COVID-19 pandemic catapulted telemedicine into the health-care vanguard when the “lockdown” and social distancing guidelines were in place, but now that the United States has transitioned to its new normal, does telemedicine still have a role in daily ophthalmic practice? We spoke with several subspecialists to find out how they're using telemedicine now and which aspects they feel need improvement.

Telemedical Tales

“During the pandemic, medical specialties that relied more on history-taking or counseling and less on clinical examination or advanced imaging were more readily able to move to virtual visits and telemedicine,” explains Ian C. Han, MD, a retina specialist who practices at the University of Iowa Hospital and Clinics. “Much of ophthalmology practice was considered ‘elective’ for a time early in the pandemic, and visits considered routine were delayed rather than pursued as scheduled.

“Retina visits were much harder to

delay, as we have a higher percentage of urgent/emergent conditions (e.g., retinal detachment), and higher risk of vision loss due to lapses in care (e.g., from pauses in intravitreal anti-VEGF therapy),” he continues. “As a result, our department didn't pursue any robust mechanisms for virtual retina visits.” He says this held true even after many of the pandemic restrictions were lifted, and despite the fact that he practices in “a major academic center in the rural Midwest where patients often drive many hours for clinic visits.”

Retina specialist Sunir Garg, MD, of Wills Eye Hospital and Mid-Atlantic Retina in Philadelphia, agrees, that without the ability to examine the patient's retina, they were fairly limited in what they could offer patients. “We'd get a lot of calls saying, ‘My eye is red after the injection,’ and we could tell if there was a subconjunctival hemorrhage, so that was potentially helpful for patients. But for most patients, when the call was about blurry central vision and trouble seeing, it was hard for us to know what was going on without looking at the retina.

“We did telemedicine for a little while, but eventually it was more

trouble than it was worth,” he continues. “We haven't gone back to it. There are some who set up a sort of OCT scanning center in an office with basically a technician and an OCT machine, where the doctor would read it remotely, but we didn't do that.”

At one point during the pandemic, Dr. Garg's practice tried remote scribing to reduce the number of people in the clinic. “Traditionally, a person with us in the exam room will help enter the verbal dictation into the EMR,” he explains. “We spent time exploring having this dictation picked up by a microphone, and then a technician who wasn't necessarily physically with me would have access to the EMR that I was looking at and would populate that EMR in real time. That actually worked pretty well. For our group, with the way it was set up, that wasn't something we necessarily chose to continue, but I know other groups who have and found it to be successful.”

Like many retina specialists, glaucoma specialist Michael V. Boland, MD, PhD, of Massachusetts Eye and Ear, reports that his practice “was never a huge user [of telemedicine], even during the pandemic. We found

This article has no commercial sponsorship.

Drs. Dockery, Prakash, Han, Garg, Boland, and Schoenberg have no related financial disclosures.

it challenging to get everything done that we wanted to. Patients came in for testing anyway. All of our glaucoma patients are being seen in-person at this point.”

Telemedicine was somewhat more useful in anterior segment subspecialties. Cornea specialist Gaurav Prakash, MD, of Pittsburgh University School of Medicine, says that his practice was pushing virtual care during the pandemic for routine cases, but now it’s dropped down significantly. “Each provider has his or her own comfort levels, but I’m more in favor of clinic visits,” he says. “There’s been a substantial decrease [in our usage of telemedicine] although we still have telephone calls to circle back with the patient regarding things. We used to have testing off site, and then we’d review those results with the patient. We also followed up non-sight-threatening issues such as improving conjunctivitis.”

“When we were shut down for COVID and then ramping back up, I did a decent amount of telemedicine with patients,” says cornea, cataract and refractive specialist Evan Schoenberg, MD, of Georgia Eye Partners in Atlanta. “There was a lot of interest in exploring options and getting the ball rolling. I found virtual visits relatively useful for educating. You could do a lot just by understanding what a patient’s glasses prescription was and talking with them about their potential options based on their refraction and their age. Then patients would come in for the actual consultation pretty ramped up and raring to go in terms of knowing what they thought they wanted and knowing there was a potential option at least.

“In the last year, I’ve done almost no telemedicine though,” he continues. “We’re a very busy in-person clinic and I just don’t have a block of business hours that I want to set aside for seeing patients to do telemedicine myself.”

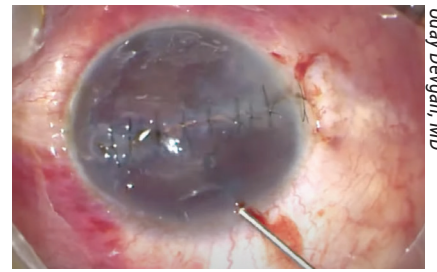
In neuro-ophthalmology, a study of 159 patients found that 65.4 percent were satisfied with their virtual visit, 93.7 percent said they felt comfortable asking questions and 73.9 percent found the instructions given before the

visit easy to understand.¹ More than 87 percent of neuro-ophthalmologists in the survey reported that they were able to perform a virtual examination that provided sufficient information for medical decision-making. Testing range of eye movements, visual acuity, Amsler grids, Ishihara color plates and pupillary exam were reportedly easy to conduct, while other examination components were more challenging, such as saccades, red desaturation, visual fields, convergence, oscillations, ocular alignment and smooth pursuit. Vestibulo-ocular reflex, VOR suppression and optokinetic nystagmus were very difficult to test. As with most subspecialties, the inability to perform a fundus examination was a significant limitation.

Best Tele-Scenarios

Experts say that patients who are likely to benefit from telemedicine are established patients and those who are fairly stable but still need additional follow-up to ensure their conditions aren’t progressing. “For example,” says Philip Dockery, MD, MPH, of the Harvey and Bernice Jones Eye Institute, University of Arkansas for Medical Sciences Little Rock, “it’s beneficial to see a patient with keratoconus in person for the initial evaluation, particularly if they require cross-linking, but subsequent visits after the initial follow-up period could be done by telehealth visits where the patient comes in for imaging to ensure there are no changes in their corneal tomography, and then we review those results with the patient virtually. Similarly, a post-transplant patient with Fuchs’ dystrophy might also come in for imaging to ensure there are no areas of edema or graft detachment, followed by a virtual visit.”

“Anything where it’s purely a discussion could be suited to telemedicine,” Dr. Boland adds. “Perhaps something that’s been discussed before or about changing a medication, or moving on to surgery, where we just need to talk about it without performing an exam for additional information. Those types of visits were easy, and those were things



Ulray Deygan, MD

Telemedicine was employed for emergency department triage and follow-up during the pandemic. Above, a resident surgeon repairs a ruptured globe that presented to the ED.

we could do even now. I think it’s just hard to work in the virtual visits inside of an otherwise in-person clinic.”

One of the more promising areas of ophthalmic telemedicine is emergency department triage² and follow-ups. “One area where I’m doing telemedicine is helping out with our emergency department,” says Dr. Boland. “Patients with non-urgent eye issues who need follow-ups I see in virtual visits. I’m currently following up on corneal abrasions, subconjunctival hemorrhages, dry eye and foreign body removal—things that just need a follow-up to confirm that symptoms have resolved and to make sure there are no other questions from the patient after their initial visit.”

Dr. Boland says red-eye symptoms and pain are among the most common presentations at the emergency department, but “a number of things can cause a red eye. Some are vision-threatening, and others are totally benign. It’s hard to tease those apart. A subconjunctival hemorrhage is usually the one thing you can figure out, but if it’s a bloodshot eye that could have any number of causes.”

Dr. Schoenberg says he’s thought about hiring a refractive counselor or having one of his optometric team do a half-day of refractive telemedicine consults, since the infrastructure is available now. “We might launch that in the future, but I’m not doing it at present,” he says. He envisions these consults as potentially coming from online leads, such as his practice’s website or an online quiz. “People might be able to self-schedule a 15-minute telemedicine

consultation about [refractive] options, and then that would potentially be a lead into scheduling an in-person consultation. It could also be used as a discussion point for patients who are referred from other doctors in the community, but usually those doctors are doing education in their offices before we get to them.”

If you’re expecting a potential treatment may be warranted that day or it’s the patient’s initial visit, an in-person evaluation is the best option, according to Dr. Dockery. He says, “You can get a better view using a slit lamp and do a complete workup, meet the patient, develop better rapport in person, and then do the initial diagnosis and any sort of treatment or management.”

He emphasizes the importance of multimodal imaging, such as slit lamp imaging, anterior segment OCT and corneal tomography, which offer a better picture of what’s going in. “There’s not really a great form of imaging that can replace an in-person slit-lamp exam,” he says. “Even two-dimensional slit-lamp photography is just that—two dimensional. You’re limited in your ability to discern the location or depth of certain lesions or areas of concern.”

Dr. Prakash agrees. “Overall, virtual care depends on the investigative capabilities we have,” he says. “I’d rather see a patient in person who’s mission-critical in terms of losing vision than to see them remotely, because obviously, it’s contingent on the quality of the camera and illumination. Cornea is very visual. Telemedicine may be useful for certain scenarios, but I don’t see it replacing or taking a significant chunk away from cornea, as such.”

Reduced Patient Burden

“Many offices were looking for ways to continue to see patients even when they were trying to keep their in-person workload down to reduce the number of patients in the clinic and allow for social distancing,” says Dr. Dockery. “During that time, I think many providers realized that the telemedicine platform allows for you to see many patients, particularly routine patients, in an effi-

cient way—often remotely, where they don’t need to come into the office.”

He says telemedicine’s role in minimizing the travel burden some patients face can be significant. “Many patients really enjoy it because it limits their travel and they’re able to stay closer to home. They don’t have to go into a large city or navigate a parking deck or fight traffic. They don’t have to wait nearly as long in the clinic. Usually, at remote imaging pods or centers, they’re able to get in and out very quickly, so patients enjoy it and they’re almost able to do it on their own time.”

“I think there’s likely to be an increasing demand from patients for communication on their own timeframes,” says Dr. Schoenberg. “The ‘do it now’/Uber Eats world where you sit at home and things come to you isn’t going to go away anytime soon. I wouldn’t be surprised to find that we end up expanding telemedicine in the future. I know there are practices that have been doing it pretty successfully and seeing good benefits from it. I don’t think that it’s going to be a must for every practice, but I think in some environments and some patient populations, it’ll be a big piece of patient care eventually.”

Studies report that young people, those who would otherwise miss work and those who are familiar with video conferencing and internet use, are more likely to be interested in ophthalmic telemedicine services.³ Experts say that practices looking to increase their telemedicine usage could target these populations.

But while telemedicine can help overcome some patient barriers such as travel, experts caution against telemedicine’s potential to exacerbate existing inequalities. Many living in rural regions are still without access to high-speed Internet. Historically marginalized populations were less likely to receive ophthalmic telemedicine care vs. in-person care during the first year of the pandemic, according to a retrospective, cross-sectional study at Massachusetts Eye and Ear.⁴ The study also found that older patients, men, non-English speakers, those with an

educational level of high school or less and those who identified as black used telemedicine less; and video-based visits were underutilized by older patients and patients who were retired, disabled, unemployed or had a high school education level or less.

Time is Money

While telemedicine seems to save patients time, the same can’t be said for all practices. “I’ve found that virtual visits take longer,” says Dr. Boland. “By the time you get [the camera] set up and the patient sets up theirs, you could have had that conversation more quickly just going room to room in the clinic as opposed to getting everyone’s video cameras working correctly and connected. It’s just proven easier to have these conversations in the clinic, especially given that the patient already has to come in for testing. They might as well talk to me right now about the result. We’ve started scheduling testing on the same day but slightly in advance of my visit, so that helps keep things flowing pretty smoothly.”

Dr. Boland says an interactive messaging back-and-forth without a video component could be useful. In this scenario, the doctor might call the patient to tell them about their test results—“they look the same and we’ll see you in however many months”—and avoid the whole in-person encounter altogether.”

With the current state of telemedicine, time really is money. Though Dr. Garg says reimbursement for virtual care itself during the pandemic wasn’t an issue, “what we found is that, after all the time and effort of setting up the appointment, getting logged on, figuring out technical difficulties, sitting there, asking the patient questions, waiting for them to respond—the number of patients we could reasonably interface with in an hour was comparatively low compared to what we’re used to doing in retina, too low for us to continue to function that way. Our practice is structured around seeing a certain number of patients, given all the equipment costs, large personnel costs, exam

space and other high fixed costs. Unless our primary model were telemedicine, where the practice would have very low staffing and a small-footprint office, it wouldn't be sustainable. We'd have to radically rethink the delivery of care in order for that to work."

Dr. Schoenberg recalls a similar barrier. While his practice was able to bill virtual visits as if they were in-person visits, thanks to the emergency changes in billing during the pandemic, he says, "I didn't feel that it was a large enough volume to move the needle as a whole practice for the time we were doing it, but it definitely was nice not to be sitting at zero when we were at home and not seeing patients."

Remote Monitoring

Dr. Garg says that once at-home OCT devices (e.g., Notal's investigational AI-enabled Home OCT or the Foresee-Home monitoring program) become more widely available to patients that "will be a step closer to an ability to assess the retina, though home OCT will only allow us to look at the central part of the macula, so it's not going to be great for a lot of what we do, though it'll be helpful."

Dr. Boland's practice sets up certain patients with the iCare Home device to monitor pressures outside of clinic hours. He says it's helped confirm some findings and that they've found a number of patients with pressures too high at times they're never in the clinic. "We never would have found those late night and early morning pressure increases, so it's been helpful," he says. "I think making it more cost-effective for patients would be great."

As for home visual field monitoring, while there are several portable perimetry devices from various companies now, "most or all of them don't have any normative data, so we can't really make diagnoses based on the test." Dr. Boland says. "They certainly don't have longitudinal data either, so we can't identify worsening disease over time. I think as those devices mature, the hope would be that more patients can use them at home. Then they wouldn't have

to come in as much for testing with us.

"The challenge with home monitoring is going to be synthesizing all of this data coming in from outside," he continues. "I have all these new pressure values—what do I make of all this? AI and machine learning algorithms might help us digest all this information to make more efficient decisions. It's also not always clear that we can bill for this service. Sometimes we can; sometimes we can't. There needs to be payment models so patients can use these devices at home long-term, but we haven't worked those out yet, as well as workflow models. We also need better ways of getting the data back into the clinic, so better standards for transmitting home visual fields or home eye pressures to the clinician would be really important."

"There was a lot of hope during the pandemic for telemedicine being used more extensively," Dr. Boland adds. "I think we're still up against a lot of the same challenges—not being able to get testing or do a real exam—so there are some concerns about misidentifying and misdiagnosing patients without all that information. But I think there's some hope that newer home-based technologies might be able to do more going forward."

Reducing Unnecessary Referrals

Dr. Han says that in the "post-pandemic" era, there's been a shift of referral patterns in his area, particularly for comprehensive and general ophthalmology practices. "Several experienced retina specialists in our area have retired, and many local practices have started to refer routine retinal problems and procedures (e.g., intravitreal injections) to our subspecialty clinics. This has resulted in a marked rise in volume in our department, including many cases that may not require retinal specialty evaluation (e.g., diabetic retinopathy screening).

"Early on, a common fear with the emergence of telemedicine and AI-based retinal screenings was that these technologies might replace or obviate the need for retina specialists," he

continues. "However, with our current higher patient volume, relative scarcity of resources (e.g., short staffing in the clinic after the pandemic-associated 'great resignation'), and increasing treatment burdens (e.g., from intravitreal injections, including new drugs for geographic atrophy for dry AMD), one key potential advantage of telemedicine is to assist with screening visits (e.g., for diabetic retinopathy) to decrease the overall volume of unnecessary referrals, thus allowing space for those patients who truly need subspecialty care.

"Modern retina care typically requires high-quality imaging to screen for disease or guide treatment decisions," says Dr. Han. "Some barriers to adoption remain the lack of widespread availability of such technology, though innovative researchers, such as our colleague Michael Abramoff, MD, PhD, have made tremendous progress in recent years toward implementing AI-based pathways for screening."

A Cautious Step Forward

"We're still a bit constrained with the adoption of telemedicine," says Dr. Garg, "but over the next few years, I think we'll have more pieces in place that will make telemedicine potentially more useful for more of our patients."

Dr. Prakash emphasizes the need for balanced approaches with telemedicine. "We want to make sure that by doing telemedicine, we're not compromising the quality of care for the patient," he says. ◀

1. Conway J, Krieger P, Hasanaj L, et al. Telemedicine evaluations in neuro-ophthalmology during the COVID-19 pandemic: Patient and physician surveys. *Journal of Neuro-Ophthalmology* 2021;41:3:356.
2. Meshkin RS, Armstrong GW, Hall NE, Rossin EJ, Hymowitz MB, Lorch AC. Effectiveness of a telemedicine program for triage and diagnosis of emergent ophthalmic conditions. *Eye* 2023;37:2:325-331.
3. Shiuhey EJ, Fox Y, Kurnick A, Rachmiel R, Kurtz S, Waisbourd M. Integrating telemedicine services in ophthalmology: Evaluating patient interest and perceived benefits. *Patient Prefer Adherence* 2021;15:2335-2341.
4. Aziz K, Moon JY, Parikh R, et al. Association of patient characteristics with delivery of ophthalmic telemedicine during the COVID-19 pandemic. *JAMA Ophthalmology* 2021;139:11:1174-1182.

IS THE “SHINY AND NEW” RIGHT FOR YOU?

Expert advice and food for thought when considering the purchase of a new, expensive piece of equipment for your practice.

WALTER BETHKE
EDITOR IN CHIEF

Buying a new piece of equipment for your practice can be exciting—but it can also be risky. With interest rates as high as they are, and reimbursements seemingly cut a few percentage points each year, in many cases the onus is on the practice to make sure a new device not only greatly enhances patient care but also doesn't put too much of a financial strain on the business. Here, individuals from both the clinical and the practice management realms share their tips on making capital purchases. Also, ophthalmologists who responded to a technology survey weigh in on the factors that influence their purchasing decisions.

Evaluating the Potential Purchase

Balancing the benefits to patients and staff with the potential financial impact is one of the keys to bringing in new device.

Richard Jahnle, chief financial officer of Jahnle Eye Associates, which has two

Kamal Kishore, MD



When evaluating new diagnostic technology, Peoria, Illinois, retina specialist Kamal Kishore says it's imperative that his staff, who will be using the new device the most, have significant input into the purchasing decision.

offices in suburban Philadelphia, says his practice looks at several factors when deciding on a large tech investment. “The first consideration might be if a device will make the office flow more efficiently, allow us to see more patients or automate things more effectively,” he says. “Another category is it could be a machine that increases our profitability, so if we invest in it, we know we'll make enough to cover the cost of the machine and make a good return on our invest-

ment. The other category is a machine that can help the doctor get better outcomes depending on what exam or procedure he's doing. In some cases, a machine will cover two or three of those factors. You want at least one of those requirements to be met to even consider purchasing it.”

Kamal Kishore, MD, a retina specialist from Peoria, Illinois, who conducted a course at the most recent American Academy of Ophthalmology meeting

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Mr. Jahnle and Dr. Kishore have no financial interest in any of the products mentioned.

Who Do You Rely on Most for Information about New Equipment?

(1=least useful, 5=most useful)



on how practices can run more efficiently and effectively, says pursuing the standard of care often wins out if you're mulling a purchase. "There are two ways you can make sure you need a piece of equipment," he says. "The first situation is when a new technology comes out and you simply need it. For instance, when OCT came on the scene, it was apparent that retina treatment was going to be OCT-guided from then on. It was going to become the standard of care. The second instance is when your existing technology either breaks down or needs updating."

Drilling down to a specific metric, Mr. Jahnle prefers return on investment. "As an example, we bought two digital ultra-widefield retinal imagers—one for each of our offices—to offer patients an alternative to being dilated," he explains. "The charge for the patient who chooses to use it is \$40. One of the devices cost \$80,000, and the other \$90,000. So, we quickly ran formulas to say, first, what percentage of our patients undergo an exam where we could potentially offer this to them. Second, of those, what percentage do we think will choose this digital imaging over a dilating drop and fundus exam, and how many can we do in a year."

The other potential benefit of a new piece of technology isn't just how much you're reimbursed each time you use it, but the "opportunity revenue" of how much time it might free up to allow you to earn reimbursement dollars from other things, like seeing some more patients. Mr. Jahnle refers to this when he discusses the potential benefit of non-mydratric, digital fundus imaging. "It had the advantage of leading to a

faster exam compared to having to put in dilating drops and then waiting 15 minutes before the doctor could do the exam," he says. "So, you can see more patients. This was kind of an added benefit."

Dr. Kishore says that, once you acknowledge you need a new technology, then comes the question of which one to get? "This can be challenging because there are so many vendors," he says. "For example, when it comes to OCT, there are many companies. Usually, we ask our friends what they have, take a look at the reviews, and then have a rep come in to do a demo. You can then talk about the price and so forth.

"For instance, we needed a fundus camera, and said that we need something like an ultra-widefield digital system," Dr. Kishore continues. "We had an ultra-widefield company, the market leader, come in with a demo, followed by a demo of a competitor system. I asked each of my staff members who take the images which they preferred after the demos, and everyone favored the latter. I said, 'Well, if you guys like that one, that's the way it's going to be,' and we haven't regretted it. The staff liked the ease of use, how easily it interfaced with our EHR and the fact that it had a reviewing station so you could view the images without being at the actual device."

Dr. Kishore says it's crucial to let the people who are going to be using the technology the most have a big say in the decision and that, sometimes, the device with all the latest bells and whistles isn't always the one you wind up liking the most when you actually use it. "When we were looking into

getting a new OCT system, we had the field narrowed down to three," he recalls. "We had each company come in for demos, and we all favored the Topcon Triton. Even though the Triton doesn't have OCTA [in the United States], it's swept-source, so it's much faster, and it takes a fundus photo at the same time as the OCT. Also, it will scan the nerve for glaucoma when you're doing a macular scan. So, you get all three functions in one exam. It also doesn't require dilation. It's user friendly, and the staff liked it." However, Dr. Kishore says if the device is for treatment—which he alone delivers—then he'll be making the decision.

In a focus-group survey of our readers, 17 ophthalmologists weighed in on the equipment-buying process. They were asked to rate the importance of various sources of information from 1 (least important) to 5 (most). On average, the most important source for them is "articles in publications" (average score: 3.88), followed by "friends and colleagues" (3.75). (*The rest of the scores appear in the graph above.*)

New vs. Refurbished

Though you can sometimes save thousands by buying a refurbished machine compared to a new one, practices have to keep a couple caveats in mind.

"If you're considering a refurbished device, the most important thing is the brand," says Mr. Jahnle. "If you're buying an imitation-type device from another country, there might be a risk even though the device might be a lot cheaper. We have a contact who works with some of the larger brands so, if, say, our OCT broke and we were looking for one, we could ask him if he knows of a practice that's closed; maybe it's sold the patient base but not the equipment yet. They may have gone to our contact and sold a five-year-old Zeiss OCT that we could take a look at.

"Of course, you have to be wary when buying refurbished, because you don't know what happened to that machine, whereas a new one will have some form of warranty and support. For instance, the contact that we buy most of our new machines from has associates that are

relatively local. So, if something goes wrong, we can text him and they'll come over to make sure it's working properly."

Like buying an UHD TV at Best Buy, when you buy new, there's always the question of whether or not to get the optional service contract. "We usually don't buy the service contract, because they're expensive," avers Mr. Jahnle. And, we've been lucky in that we haven't had a ton of issues with our machines. However, both of the ultra-widefield fundus imagers that we purchased, and I mentioned earlier, have had issues. The device uses multiple lasers, and if a laser breaks—and you haven't bought their extended warranty—the charge for the part is \$15,000. A laser broke once on us, and we didn't have the extended warranty. At that point, we decided to get the extended warranty for both devices, because we figured if the issue happened with one, it could happen with the other. Though the extended coverage plan is expensive—\$300/month for one machine and \$250/month for the other—we figured it was worth it. It's like insurance for something: You weigh whether it's worth it to buy it."

Renting vs. Buying

Since economics plays a large role in the purchase of new equipment, the question of renting vs. buying often comes up. Which route might work for you often depends on your particular situation.

"We've done both," says Dr. Kishore. "If the technology you're looking at is one that's changing rapidly, I'd rather rent. That's what we did with our previous OCT machine before the Topcon. For a technology that's almost fully mature, like a retinal laser, then I'd rather buy it. It also depends on how much money you have and if there's a 179 deduction the year you're looking to buy in."

For those unaware of the IRS 179 deduction, it's a deduction the IRS occasionally implements that allows businesses to deduct the entire value of a large purchase in a single year (Dr. Kishore says the last time it was available, the limit for the deduction was

\$250,000), reducing their tax liability by a large amount, rather than having to splash out the cash all at once and then depreciate the item over several years.

"If there's no 179 that year, and/or the money for the device may not be readily available, it makes more sense to lease the equipment," Dr. Kishore says. "Also, often these lease programs give you the option to buy the device at its residual value after a certain time. Of course, you're paying some money to the leasing company, but that's OK because the lease expense is considered deductible right away as a leasing expense."

Mr. Jahnle adds that the scale of the practice can impact the rent/buy decision. "If you're a smaller practice, such as a solo ophthalmologist, and you only do 90 laser procedures a year, for example, maybe just have a service bring in a laser every six weeks for you to use for a day," he says. "You can schedule a laser day where you'll do 11 laser procedures."

Review's Readers Weigh in

In the focus-group survey on technology purchases, respondents shared their views on buying new equipment.

Two-thirds say they've bought equipment in the past two years. In that time, they say they acquired:

- an Argos biometer;
- RxSight Light-adjustable Lens;
- Widefield photography and OCT;
- Sofwave (for reducing brow and submental wrinkles and performing neck lifting), Acufit body contouring equipment, TriLift (muscle stimulator to combat skin wrinkles) and the Opti-Light Intense Pulsed Light device;
- Diagnostic devices and artificial

intelligence software;

- iTrace; and
- a surgical microscope.

When asked to rate the importance of various factors when buying equipment on a scale from 1 (least important) to 5 (most), they rated "improving patient care outcomes" the highest, with an average score of 4.38. "Ease of use" came next (4.31), followed by "training/tech support from manufacturer" (4.25). (*The rest of the factors and their average ratings appear in the graph below.*)

The physicians also had thoughts on the whole experience of acquiring new technology, both the highs and the lows.

One surgeon from Louisiana doesn't like "the lack of transparency in pricing," when evaluating new equipment. A surgeon from Texas thinks similarly, saying the part he likes least is "negotiating the price."

A surgeon from California says it's not so much the price of new technology that makes the buying process difficult, it's the dwindling resources afforded ophthalmology by payors. "Investing in new technology—even replacing old equipment—becomes ever challenging as reimbursement rates continue to decline," he says. "We need insurance/Medicare payment reform that at least keeps pace with inflation."

New York surgeon Jimmy Hu says that, despite impediments like cost and decreased reimbursement, physicians ultimately find a way to keep pace with technology. "Our clinics are demanding increased patient volumes and throughput," he says. "Our tools must be dependable, easy-to-use and produce useful measurements and outcomes." ◀

What's Important to You When Buying any New Technology?

(1=least important, 5=most important)

	Average
Improving patient care outcomes	4.38
Increasing revenue	3.81
Reputation of the manufacturer	3.69
Ease of use	4.31
Training/tech support from mfg.	4.25

GETTING THE BEST RESULTS WITH PHAKIC LENSES

Refractive surgeons walk through the steps for phakic IOL implantation.

ANDREW BEERS
ASSOCIATE EDITOR

Though LASIK, PRK and SMILE are popular, effective options for many patients, not everyone is a candidate for them. As an alternative, patients and their surgeons can turn to phakic lenses such as the EVO implantable collamer lens and the Artisan phakic intraocular lens, though taking the intraocular surgery route opens up a new level of challenges and possible pitfalls.

If you're looking to start implanting phakic IOLs—or are already involved with their implantation but would like to hear some new tips and tricks—read on to learn expert surgeons' best practices.

First Steps

Consulting with patients prior to the procedure is key, and ensuring the patient is well educated can help ease the process later on. "These patients don't usually have any prior knowledge of phakic IOLs," says Majid Moshirfar, MD, Research Medical Director at Hoopes Vision Research Center, professor of ophthalmology at John A.

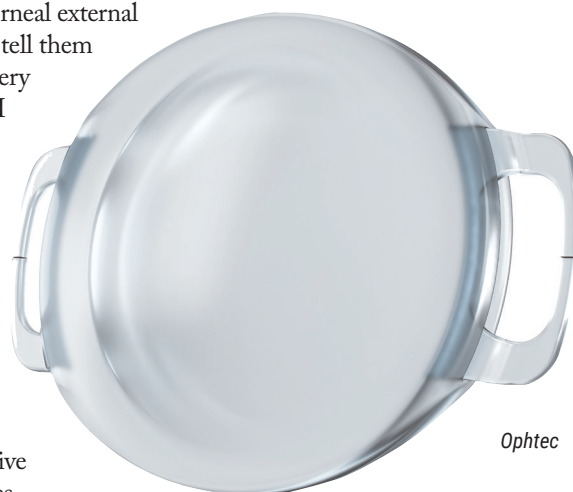
Moran Eye Center at the University of Utah School of Medicine, and medical co-director at Utah Lions Eye Bank.

"They visit my clinic because they all think that they'll be able to get procedures in terms of corneal surgery: PRK; LASIK; SMILE. But, when we realize that they don't have the capability to undergo those surgeries, either because of their baseline refractive error or perhaps they have inherent corneal external disease, we usually have to tell them that corneal refractive surgery isn't a viable option. Then, I tell these patients to look into an alternative, which is more of an additive procedure. That's when we talk about phakic intraocular lenses."

Once the patient understands the procedure and shows an interest, surgeons then go into the possible operative and postoperative outcomes. "You need to talk with a patient prior to the surgery about these things," says Dr. Moshirfar. "I usually give them the informed consent

that's provided by the company itself, but I still have a face-to-face with them and I try to explain all the possible outcomes.

"I think the common complications that we need to share with our patient is perhaps an oversizing or undersizing of the lens, and perhaps



Ophtec

Currently undergoing FDA trials, the Artiflex PIOL uses iridoplastic bridges, similar to the Artisan PIOL, to clip it to the iris. Instead of a rigid design, the Artiflex is foldable, meaning smaller and less invasive incisions.

This article has no commercial sponsorship.

Dr. Dhaliwal is a consultant for Staar Surgical. Drs. Moshirfar and Grayson have no financial interests to disclose.



2ND YEAR OPHTHALMOLOGY RESIDENT

PROGRAMS AND WET LABS

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Course Director

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Jonathan Rubenstein, MD
Course Director

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Dear Resident Program Director and Coordinator,

We would like to invite you to review the upcoming 2nd-Year Ophthalmology Resident Wet Lab Programs for the 2023–2024 Residency Year in Fort Worth. These programs offer a unique educational opportunity for second-year residents. To better familiarize beginning ophthalmologists with cataract surgery, these programs will consist of both didactic lectures and a state-of-the-art, hands-on wet lab experience. Technology and technique will be explained and demonstrated and surgeons will leave better prepared to optimize outcomes and manage complications when they arise. The programs also serve as an opportunity for your residents to network with residents from other programs.

After reviewing the material, it is our hope that you will select and encourage your 2nd Year residents to attend one of these educational activities, which are CME accredited to ensure fair balance.

Best regards,

Derek DelMonte, MD, Kourtney Houser, MD, and Jonathan Rubenstein, MD

Registration Open: www.ReviewEdu.com/CSE2ndYr2023-24

CME courses are restricted to 2nd-year residents enrolled in an ophthalmology residency program at the time of the course. There is no registration fee for this activity. Air, ground transportation in Fort Worth, shared hotel accommodations, and modest meals will be provided through an educational scholarship for qualified participants.



Joint Accreditation Statement

In support of improving patient care, this activity has been planned and implemented by Amedco LLC and Review Education Group. Amedco LLC is jointly accredited by the Accreditation Council for Continuing Medical Education (ACCME), the Accreditation Council for Pharmacy Education (ACPE), and the American Nurses Credentialing Center (ANCC), to provide continuing education for the healthcare team.

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Jointly provided by



Supported by an independent medical education grant from **Alcon**

lack of efficacy in astigmatic correction,” continues Dr. Moshirfar. “Sometimes these lenses rotate slightly, and patients may need to have an enhancement for the residual refractive error. Otherwise, macular edema, iris inflammation, pressure rise, endophthalmitis, retinal detachment and acute vitreous attachment are the rare things that can happen. I think clinicians need to share this information, but I think the common issues that need to be addressed are primarily sizing surprises.”

In regard to the Staar Surgical’s EVO/EVO+ ICL, the design of the lens can cause some issues that patients should be aware of before committing to the procedure. “I tell everybody in advance that they’re going to have a little glint when they look at lights, because the EVO has an opening at the center of the lens,” says Deepinder Dhaliwal, MD, professor of ophthalmology and chief of refractive surgery at the UPMC Vision Institute.

Choosing the Right Lens

In 2005, Staar’s Visian implantable collamer lens was approved by the FDA. This ICL was a minimally invasive foldable lens that corrected myopia ranging from -3 to ≤ -15 D with astigmatism of ≤ 2.5 D.¹ Recently,

Ophitec

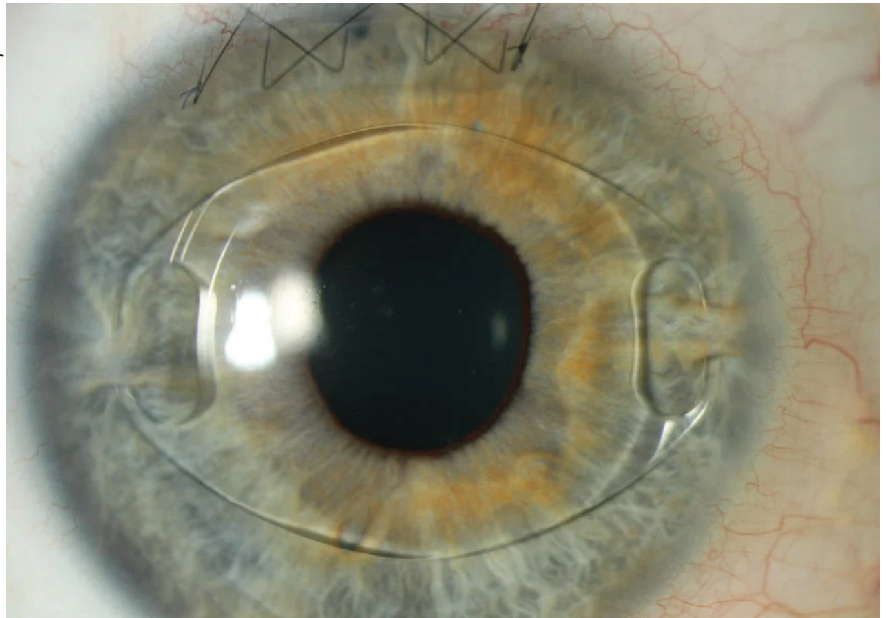


Image of Artisan PIOL implanted into the eye. The lens is positioned in place to allow the “claws” to attach themselves to the iris. Then, the incision is closed with nylon sutures (seen at the top of the image).

Staar reintroduced the Visian on a new platform in 2022. The EVO/EVO+ Visian ICL is the latest advance in phakic lens technology, providing correction in high myopes ranging from -3 to -20 D.² In patients with astigmatism, the EVO/EVO+ ICL can correct 1 to 4 D.² Also, Staar notes on their website that the EVO+ is similar

to EVO, but it’s an expanded optic.

“The reason people embrace the [EVO/EVO+] ICL is the fact that it’s removable technology,” says Dr. Dhaliwal. “It goes in their eye, and they can assess how they like it and if for some reason it’s not jibing with their optical system, or is incompatible for some reason, then they can have it removed.”

Additionally, when the Visian evolved into the EVO/EVO+ platform, they redeveloped the lens to eliminate the need for an iridotomy. “EVO has an opening at the center of the lens, which obviates the need for a peripheral iridotomy,” says Dr. Dhaliwal. “It allows aqueous humor to percolate through the device and bathe the crystalline lens so that the risk of cataract is much less.”

Dr. Dhaliwal summarizes the simplicity of the EVO/EVO+ ICL stating, “I make two paracentesis incisions and the main incision, and then I implant the EVO ICL. Then, I tuck in the little footplates underneath the ICL and remove the viscoelastic.” In a study to understand the applications of the ICL after FDA approval, researchers noted two techniques for incision size. Their standard technique



Staar Surgical

The EVO/EVO+ ICL is indicated for the correction of myopia and astigmatism in patients 21 to 45 years old. Patients with moderate to severe glaucoma, a small anterior chamber angle and a thin endothelial cell layer aren’t candidates for this procedure.

used a 1-mm incision for insertion while their modified technique used a 3-mm incision. While the modified technique provided better results without adversely effecting endothelial cell density and reducing fluctuations in IOP, the standard technique didn't increase surgically induced astigmatism.³

On the other side of the market, Ophtec's Artisan phakic IOL, or Verisyse phakic IOL, was FDA approved in 2006. Ophtec describes this lens as a rigid lens with two iridoplastic bridges, or "claws," that clip into the iris, putting it in the "iris claw lens" category. The lens's maker says that it's offered with a 5-mm curvature with a dioptric range of -5 to -20 D, as well as a 6-mm curvature with a dioptric range of -5 to -15.5 D.

"I still would say on a yearly basis I do close to 80 to 100 ICL cases, but there are situations that, based on the anterior chamber integrity or the iris angle configuration, these patients end up getting the Verisyse lens," says Dr. Moshirfar. Since the IOL material (polymethyl methacrylate) isn't foldable or injectable, a 6-mm wide incision is needed to implant the IOL.⁴

Although all phakic lenses are indicated for myopia, Staar and Ophtec

offer specific lenses for high hyperopic patients. During a study for the Artisan Hyperopic phakic IOL, 26 eyes with a refractive error ranging from 3 to 11 D were observed over a three-year time period. At six months, most patients met the primary endpoint. Researchers noted that 90.9 percent of eyes were around +/- 1 D of intended correction and 81.8 percent were +/-1 D of emmetropia. Some patients experienced posterior synechiae with pigment deposits and one patient had convex irises. Within two years, the lenses implanted in the convex-iris patient were removed.⁵

Staar's EVO/EVO+ ICL isn't approved for hyperopia in the United States, but their Visian lens is still available and approved for hyperopic patients. In a study to examine the effectiveness of the ICL for both myopia and hyperopia, researchers implanted the ICL into 126 eyes between +8.88 and -20.5 D. Since myopia is more prevalent than hyperopia, only 10 hyperopic patients underwent implantation. The average hyperopia treated in these patients was 7.14 D.⁶

Measure, Measure, Measure

Accurate preop measurement of the

patient's eye is crucial for properly sizing the ICL, surgeons say. Refractive surgeons note that there are several ways to get the most accurate results.

"This is a topic in a lot of conversations, and what I do is I use several devices for measurement," says Dr. Dhaliwal. "What we realized is that you only need a manual caliper if you're in between sizes. Basically, you can use any of your devices that you've vetted in your practice. We look at Pentacam, we look at the IOLMASTER and we look at other white-to-white measurements."

Dr. Moshirfar, on the other hand, doesn't attempt to find the white-to-white measurements, but rather measures the sulcus-to-sulcus distance. "The whole concept of measuring the white-to-white along the 100-degree meridian was the historical way that we did for the FDA approval stages of phakic lenses," he says. "We don't do that anymore. I personally have a UBM ultrasound that helps me measure the sulcus-to-sulcus. If somebody implants ICLs on a routine basis, then they should be looking at the parameters that they can obtain from the posterior chamber from the sulcus-to-sulcus." Since the ICL is implanted into the ciliary sulcus, measuring the sulcus-to-sulcus is very important for predicting

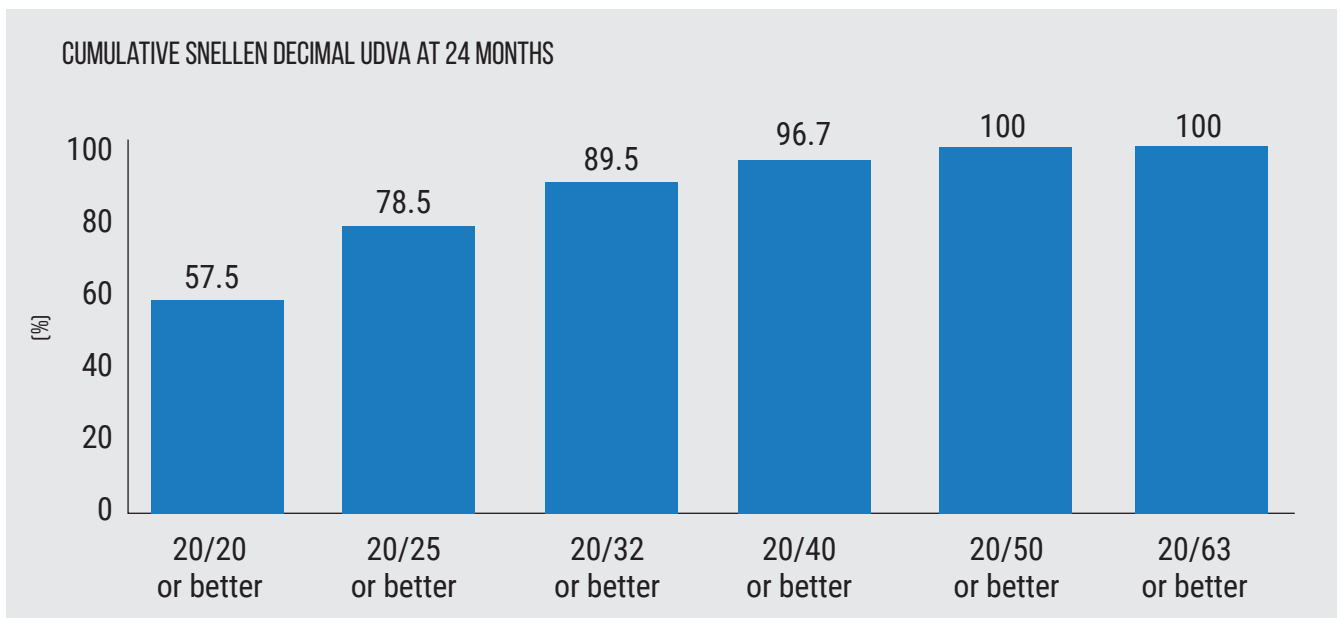
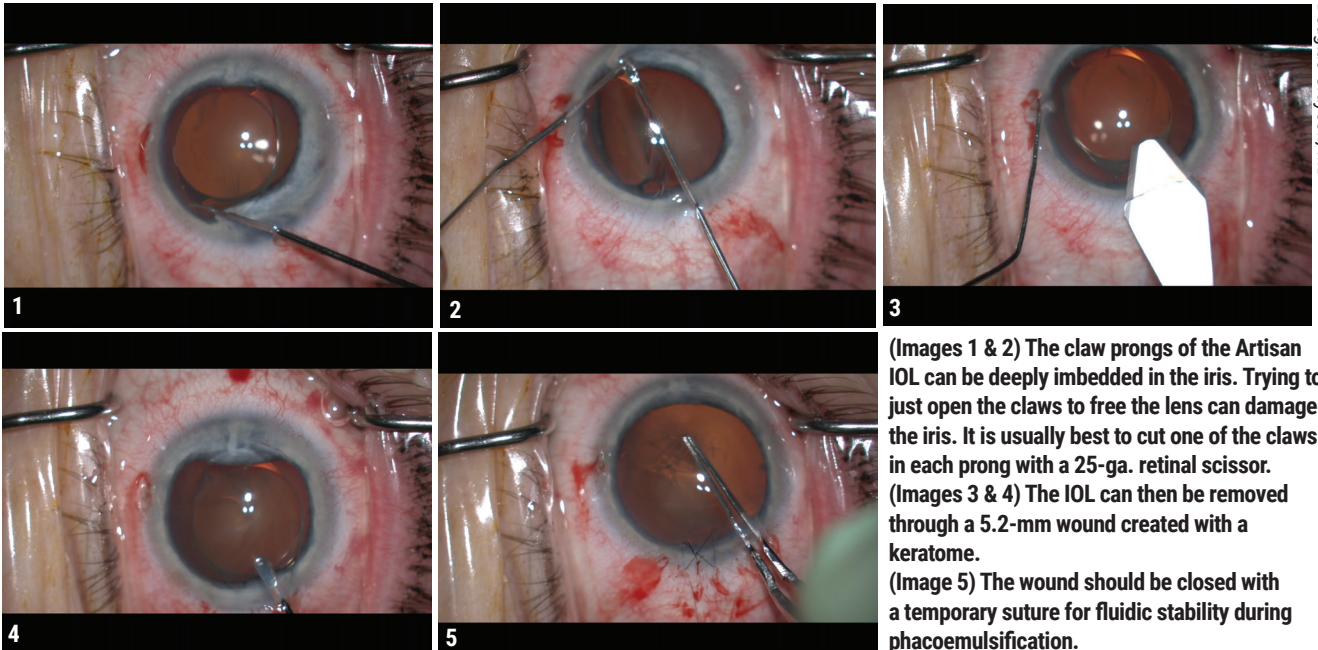


Figure 1. The cumulative proportion of eyes having a given UDVA value at 24 months following implantation of an ICL with a central hole. Before surgery, all eyes had an UDVA worse than 20/63.



(Images 1 & 2) The claw prongs of the Artisan IOL can be deeply imbedded in the iris. Trying to just open the claws to free the lens can damage the iris. It is usually best to cut one of the claws in each prong with a 25-ga. retinal scissor. (Images 3 & 4) The IOL can then be removed through a 5.2-mm wound created with a keratome. (Image 5) The wound should be closed with a temporary suture for fluidic stability during phacoemulsification.

the size of the lens, surgeons say.⁷

Dr. Dhaliwal also determines the sulcus-to-sulcus measurement before operations, but she has a professional assist her. “[At UPMC], we have an imaging technician who records consistent results for our refractive surgery patients,” she says. “She’s doing ultrasound to get the sulcus-to-sulcus measurement.”

Handling Patients Postoperatively

After surgery, refractive surgeons follow up with their patients several times postoperatively. “We usually see our patients on day one, and then between days five and seven, and then we again see them around week four,” says Dr. Moshirfar. “Then, we see them on month three, and then we see them again on months six and 12. After that, we still tell them to come back and see us yearly.”

Dr. Dhaliwal follows a similar routine with her patients, but she goes on to add, “I always check their pressure before they leave the ambulatory surgery center where I operate. I do a one-to-two-hour check of their ICL position and the pressure.”

Besides checking the pressure and the position of the phakic lens, there

are other postoperative measures that surgeons check with their patients. “We also evaluate the vault,” says Dr. Moshirfar. “Postoperatively, these patients are still getting diagnostic images using anterior segment OCT so that we can look at the level of vault, which is basically the space between the ICL and the natural crystalline lens. As the years go by, that vault or separation space gradually gets smaller and narrower.”

Also, we like to look at the lens to make sure these patients aren’t developing pigmentary inflammation in their eyes,” continues Dr. Moshirfar. “We also want to make sure they’re not developing premature cataracts. This group of patients is also at a higher risk of retinal detachment and inherently they’re at a higher risk for glaucoma being high myopes.”

There are unique cases that will need close monitoring. “I did have a nystagmus patient where the ICL rotated a little bit,” says Dr. Dhaliwal. “Due to this, it was really hard to implant and readjust the lens, but I didn’t think that was a big deal. As long as you have the right size ICL, that rotation becomes less of an issue. You just need to follow up with them preoperatively.”

In most cataract cases, the ICL will need to be removed. “Anything in contact with the anterior lens capsule causes cataract formation,” says Douglas Grayson, MD, medical director and chief cataract and glaucoma at Omni Eye Services. “With the foldable ICLs, you cut the lens, you rotate it out, and do your phaco, and you can do everything through a 2.4-millimeter self-sealing wound.”

Artisan phakic IOLs aren’t easily removed before cataract surgery. Dr. Grayson explains how an Artisan lens could be explanted: “The rigid Artisan phakic lenses are tricky to remove because it’s very difficult to unclip the haptic from the iris,” he says. “Once you do that, you need a really large wound to take the lens out, because it’s rigid and it’s five millimeters. Then, after the lens is removed, you have to close that wound partially in order to perform phaco. So, you’ve got to suture the wound for phaco, then take that suture out and then go back in with sutures to close the wound after cataract surgery.”

Interestingly, for the EVO/EVO+ lens, Dr. Grayson has adopted a technique in order to perform femtosecond laser cataract surgery without removing the lens. “Femtosecond laser assisted cataract

PAASS

3RD YEAR RESIDENT

PROGRAM ON ADVANCED ANTERIOR SEGMENT SURGERY PROGRAM & WET LAB

PROGRAM DATES

JANUARY 19–20, 2024
(FRIDAY & SATURDAY)

Didactic sessions

Pleasanton Marriott
11950 Dublin Canyon Road
Pleasanton, California 94588

Wet Labs

Zeiss Innovation Center
5300 Central Pkwy
Dublin, California 94568

Yousuf Khalifa, MD
Madeline Yung, MD

Course Co-Directors

Program Highlights Include

- Intimate meeting (limited to the first 28 residents registered)
- Hands-on wet lab
- Refractive Surgery (LASIK, PRK (refract lenticule extraction)
- MIGs
- Yamane technique
- Capsular Tension Segments
- Complex/dense cataract mgmt

Dear Resident Program Director and Coordinator,

We are excited to announce the upcoming CME Accredited Resident Wet Lab Program on Advanced Anterior Segment Surgery (PAASS). PAASS is an intimate meeting (limited to the first 28 residents registered maximum) designed to help prepare third-year ophthalmology residents to transition successfully into a private practice setting in ophthalmology or their chosen fellowship program, or into an educational environment. The 3rd Year PAASS & Wet Lab will be approved for AMA PRA Category 1 Credits™ and will have an emphasis on successful outcomes by concentrating on building diagnostic, medical and advanced surgical skills in the wet lab (including Yamane, Capsular Tension Segments, MIGs, etc). The course directors and the faculty create a “safe” environment, so the third-year residents feel comfortable discussing questions, new technology, and complications in an atmosphere that strongly encourages interactive participation. **We are capping the number of residents to 28 so that the residents are fully immersed in the learning environment along with a one-to-one (faculty-to-resident) ratio in the wet lab to maximize learning curve with the advanced surgical skills wet lab.**

Ophthalmology residencies in the United States strive to introduce their residents to advanced surgical techniques and technologies in an environment characterized by rapid innovation. Due to continuously evolving technological developments, best practices are constantly changing. As such, there are too few opportunities to gain hands-on training. This meeting will concentrate on advanced techniques and technologies geared towards residents approaching the end of their 3rd Year (PGY4) residency. The meeting will cover topics specifically in the areas of refractive surgery, minimally invasive glaucoma surgery, management of aphakia, new technologies for dense cataract management, intraocular lens selection technologies, heads-up displays, and progression tracking software.

This 2-day course will include one day of didactic and one day of hands-on wet lab experience. The meeting will be led by a faculty comprised of renowned key opinion leaders and specialized surgeons with a background in resident education. The wet lab will feature nationally recognized leaders with one-on-one wet lab mentorship.

We believe this program offers a unique opportunity for residents to gain hands-on experience on advanced anterior segment surgery techniques. We hope that you will select and encourage your 3rd-year residents (PGY-4) to attend this CME accredited program.

Sincerely,

Yousuf M. Khalifa, MD, and Madeline Yung, MD

REGISTRATION IS OPEN NOW at www.ReviewEdu.com/PAASS2024



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Douglas Grayson, MD

Femtosecond laser-assisted cataract surgery can be used in patients with ICLs.
(Top) Initial scan shows a differentiation of the ICL and the anterior lens capsule.
(Middle) ICL lying above the anterior capsule with green delimiting marker line synchronized with the anterior capsule. Manual readjustment of the anterior capsule delimiting line may be required.
(Bottom) Successful femtosecond laser procedure including astigmatic cuts, capsulotomy, and lens softening.

surgery is always a more advantageous way of performing cataract surgery, so just because an ICL is implanted, we didn't want to deprive our patients of doing the femto." To explain further, in a 2016 case report of two cases of cataract with phakic IOLs implanted, the surgeons concluded that the femtosecond laser can be used to create a capsulotomy and nuclear fragmentation through both anterior and posterior chamber PIOLs. Entrapment of cavitation bubbles beneath the ICL was noted in one case. The other case saw a successful femtosecond laser cataract surgery with

an Artisan lens implanted. The surgeons explained the phakic IOL at the end of the surgery by enlarging the temporal incision.⁸

Future of Phakic Lenses

In other countries, Ophtec offers their Artiflex phakic IOL, a foldable lens for the treatment of myopia, which also comes in a toric platform. Currently undergoing FDA trials, Artiflex has been performing safely and effectively around the world for several years. In a 2012 study to evaluate the safety, efficacy and potential risks of the lens, researchers observed 78 eyes after a

two-year period. After the time period, UCVA was 20/40 or better in 84 percent of the eyes. Adverse reactions such as pigmented and non-pigmented precipitates were observed in 17 eyes, which were treated with topical corticosteroids.⁹

According to Ophtec, the Artiflex requires a 3.2-mm incision. This product is mean to be "one-size-fits-all," but Ophtec also notes that this treatment is reversible, therefore patients don't have to commit to the lens. If the Artiflex were to make it to the United States in the future, the phakic lens market would have more unique treatments to treat high myopes.

Surgeons say perhaps the best practice is to thoroughly inform patients about the benefits and the risks of the surgery preoperatively. Says Dr. Dhaliwal, "I think the critical thing is preoperative management of these patients, so that you manage the expectations, because happiness equals postop reality minus preop expectations." ◀

1. STAAR Surgical's VISIAN ICL(TM) receives FDA approval. STAAR Surgical 2005. <https://www.staar.com/news/2005/staar-surgicals-vision-icltm-receives-fda-approval>. (Accessed on 14 Nov. 2023)
2. STAAR Surgical announces U.S. FDA approval of EVO Visian implantable collamer lenses. STAAR Surgical 2022. <https://investors.staar.com/press-releases/press-release-details/2022/STAAR-Surgical-Announces-U.S.-FDA-Approval-of-EVO-Visian-Implantable-Collamer-Lenses/default.aspx>. (Accessed on 14 Nov. 2023)
3. Wang Y, Yang R, Huang Y, Zhang C, Liu H, Jia Z, Zhao S. Clinical observations of EVO-ICL implantation and changes in corneal astigmatism using a modified technique. BMC Ophthalmol. 2022 Sep 23;22:1:381.
4. 1792: Verisyse phakic IOL removal. Cataract Coach 2023. [https://cataractcoach.com/2023/04/03/1792-verisyse-phakic-iol-removal/#:~:text=The%20first%20step%20is%20to,the%20eye%20\(Figure%201\)](https://cataractcoach.com/2023/04/03/1792-verisyse-phakic-iol-removal/#:~:text=The%20first%20step%20is%20to,the%20eye%20(Figure%201)). (Accessed on 13 Nov. 2023)
5. Saxena R, Landesz M, Noordzij B, Luyten GP. Three-year follow-up of the Artisan phakic intraocular lens for hypermetropia. Ophthalmology 2003;110:7:1391-5.
6. Rayner SA, Bhikoo R, Gray T. Spherical implantable collamer lenses for myopia and hyperopia: 126 eyes with 1-year follow up. Clin Exp Ophthalmol. 2010;38:1:21-6.
7. Zhu, QJ., Zhu, WJ., Chen, WJ. et al. A prediction model for sulcus-to-sulcus diameter in myopic eyes: A 1466-sample retrospective study. BMC Ophthalmol 2022;22:307.
8. Kaur M, Sahu S, Sharma N, Titiyal JS. Femtosecond laser-assisted cataract surgery in phakic intraocular lens with cataract. Journal of Refractive Surgery 2016;32:2.
9. Ozertürk Y, Kubaloglu A, Sari ES, Koçtak A, Capkin M, Akçay L, Evcil PS. Foldable iris-fixated phakic intraocular lens implantation for the correction of myopia: two years of follow-up. Indian J Ophthalmology. 2012;60:1:23-8.

THE INS AND OUTS OF CUSTOMIZED LASIK

Topography-guided and topography-integrated/wavefront-guided treatments can produce excellent results, if surgeons can balance the art and science of the technology.

LIZ HUNTER
SENIOR EDITOR

Over the past decade or so, advancements in customized LASIK with guidance from topography or wavefront optimization/topography integrations have achieved outcomes that were previously rare. Surgeons who have mastered the techniques involved in both procedures are getting excellent results. Despite this, only a fraction of refractive surgeons have fully embraced the technology. We spoke with a few surgeons who swear by this segment of LASIK and asked about their experiences and what their peers should know before diving in.

What's Available

It's important to note the variations of customized LASIK treatments that are on the market today and how their outcomes stack up.

- **Contoura Vision, Alcon.** FDA approved in 2015, Contoura is a topography-guided LASIK treatment for patients with myopia and myopia with astigmatism.¹ Contoura

uses Alcon's WaveLight Allegretto Wave Eye-Q or WaveLight EX500 Excimer Laser Systems in concert with the WaveLight Topolyzer Vario Diagnostic Device. In the FDA trials, 68.8 percent of patients achieved 20/16 or better UCVA at three months postop, and 31.6 percent achieved 20/12.5 or better.²

- **iDesign 2.0 Refractive Studio, Johnson & Johnson Vision.** Approved by the FDA in 2018, iDesign integrates topography with its wavefront-guided technology and is approved for myopia, hyperopia and mixed astigmatism.³ In one study, 74.1 percent of eyes undergoing wavefront-guided LASIK in conjunction with the iDesign aberrometer achieved UDVA of 20/16 at three months.⁴

- **EC-5000 Advanced Vision Excimer laser system (NAVEX), Nidek.** This system comprises the Quest M2/EC-5000CX, OPD-Scan III and Final Fit custom ablation software and was FDA approved for the correction of myopia, hyperopia and astigmatism in 2013. In the FDA trials, 48.8 percent of eyes treated for myopic astigmatism had a UCVA of

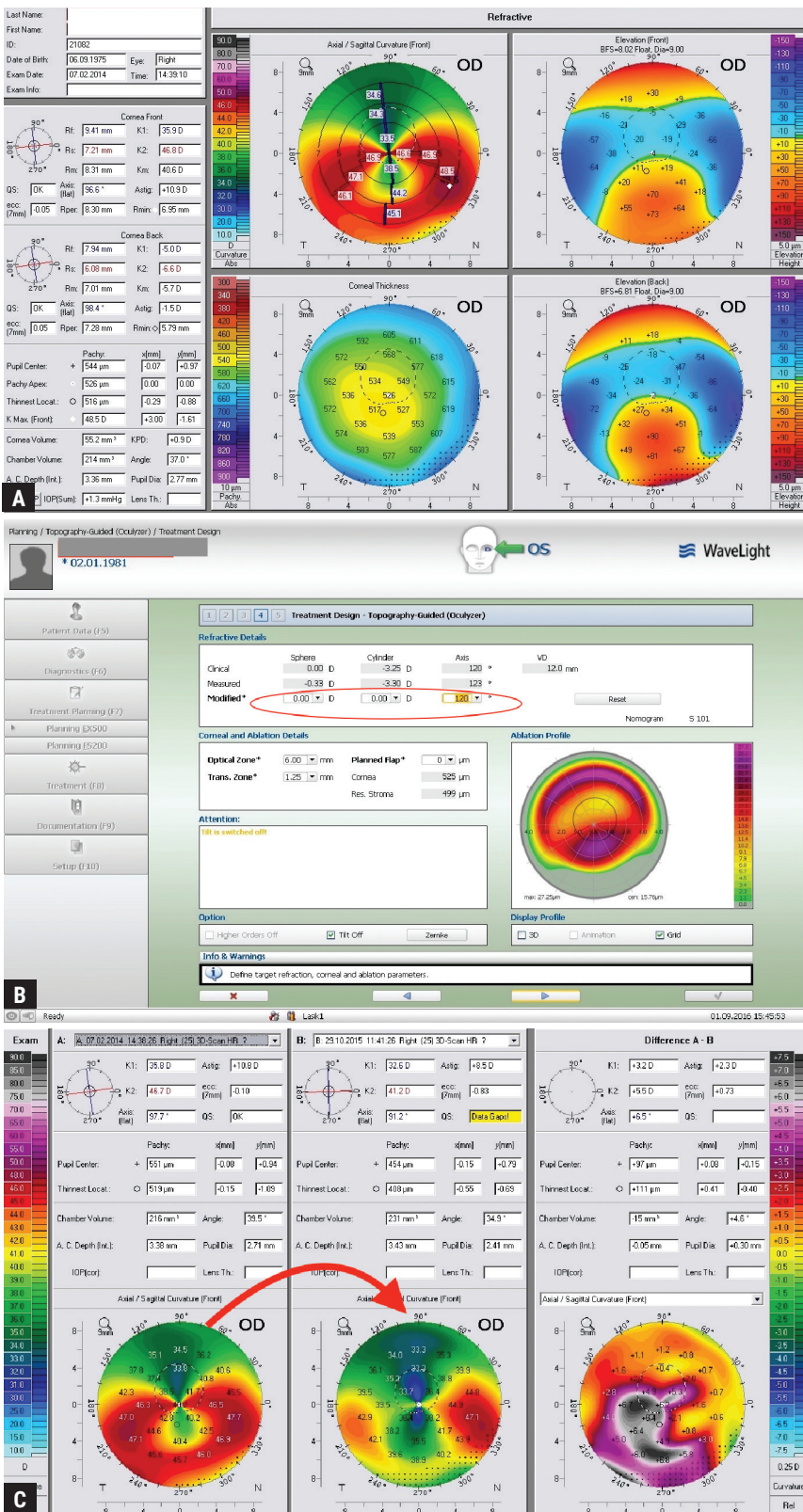
20/16 or better at three months.⁵

When it comes to evaluating topography-guided LASIK vs. other methods, there are some differences that may sway a surgeon to choose one over the other. In a meta-analysis⁶ comparing topo-guided LASIK with wavefront-optimized LASIK, there were no significant differences in the ratio of UDVA of 20/20 or better, or 20/16 or better; however, topo-guided had a higher proportion of postop manifest refractive spherical equivalent within ± 0.5 D of target and fewer surgically induced higher order aberrations, spherical aberrations and coma when compared to wavefront. On the other hand, topo-guided LASIK requires a bit of additional chair time to work the patient up, which some practices see as a disadvantage.

Either method chosen will result in better outcomes than older, non-wavefront-optimized LASIK, says Robert Maloney, MD, a cataract and refractive surgeon in Los Angeles. "What matters is giving our patients the best possible uncorrected vision we can give," Dr. Maloney says. "We know from work done by

This article has no commercial sponsorship.

Dr. Lobanoff is a consultant for Alcon and the CEO and owner of Phorclides. Dr. Kanellopoulos is a consultant for Alcon. Dr. Maloney is a consultant for Johnson & Johnson Vision and holds equity in RXSight. Dr. Waring is a consultant for Johnson & Johnson Vision.



All Images: A. John Kanellopoulos, MD

Steve Schallhorn, MD, in which he looked at the correlation between patient satisfaction and uncorrected vision. He found that for each line of uncorrected vision, patient dissatisfaction doubles. So patients who are 20/15 uncorrected tend to be extremely happy. Patients who are 20/20 tend to be very happy, 20/25 pretty happy, 20/30 not so happy, 20/40 not happy. So we know that it's really important to give people the maximum uncorrected vision and it's very clear that the way we get there is by customizing the treatment to the patient."

Early Adopters' Experiences

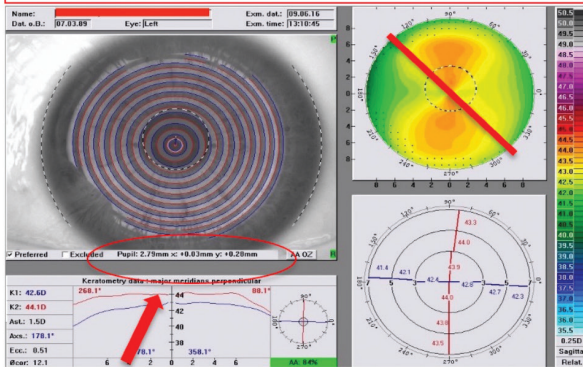
While surgeons in the United States may still be mulling over whether they should invest in topography-guided LASIK, refractive surgeons in Europe have been using it for 20 years, though mainly for irregular corneas, which many surgeons think topography-guided is uniquely suited for. A. John Kanellopoulos, MD, who practices in Greece and is a professor of ophthalmology at NYU Medical School, says topo-guided LASIK was introduced to the European Union as a means to treat irregular corneas.

"We evolved the use of this technology as an enhancement in LASIK cases with outstanding results in visual function improvement for patients who were contact lens-intolerant," says Dr. Kanellopoulos. "We applied it to irregular eyes such as keratoconus, keratoconus and post-refractive ectasia, and we were the first team to combine cross-linking with topo-guided treatments in what is now known as the Athens protocol.

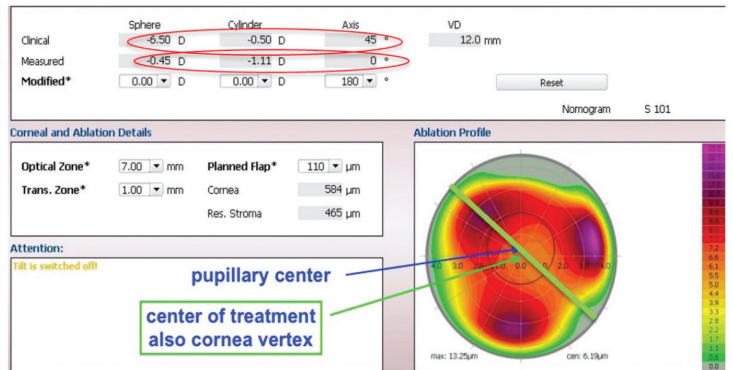
"It was soon after that we realized the advantages of topo-guided treatments for naive myopic and hyperopic eyes as our data showed, for normal conical eyes, topo-guided offers the advantage of reshaping the cornea to become symmetric to the visual axis," he continues.

This case from A. John Kanellopoulos, MD, is a 39-year-old with oblique keratoconus (and not pellucid as shown on the pre-Athens Protocol CXL Pentacam) (A). Shown is the EX500 excimer treatment plan for topography-guided surface ablation (B), followed by the difference preop (left) and postop (middle), and the combined topo-guided ablation with CXL (right) (C).

Manifest cylinder at 135 degrees vs. topographic at 80!!



Angle kappa makes this regular cyl, act as a prism



The topo-software will reshape the cornea to center the vertex, by correcting vertical comma

Understanding TMR (topography-modified refraction):

This is an example case where the refractive cylinder of -0.50 @ 45 degrees does not agree with the topography suggested cylinder of -1.11 @ 180 (O) degrees! Because angle kappa reveals this regular cylinder acts as a prism and creates vertical coma. If no topo-guided is chosen, then the manifest refraction may stand correct, but if the topo-guided reshapes and normalizes the cornea coma in respect to the cornea vertex, the topography-suggested and real cylinder maybe more precise!



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An explanation of how angle kappa in a naive myopic astigmatic eye can be addressed with topo-guided LASIK that will normalize the otherwise-considered normal corneal astigmatism in regard to the cornea vertex (visual axis).

“Although most normal corneas function well, even that slight correction is able to offer gains in lines of vision, along with the correction of the refractive error.”

Mark Lobanoff, MD, a private practice refractive surgeon in Minneapolis, admits he always felt a bit jealous that surgeons in Europe had access to this technology. “Topo-guided LASIK was a repair procedure for patients who had off-center ablations or, in the case of some of the early excimer lasers which had very small optical zones and led to a lot of glare at night, or patients who had scars or irregular corneal topography,” says Dr. Lobanoff. “They could fix the patients who were struggling after LASIK but we couldn’t.”

Alcon initially wanted to conduct an FDA study on irregular eyes, says Dr. Lobanoff, but the FDA insisted it be first proven safe on virgin, healthy eyes. “To Alcon’s amazement, they had some of the best results ever seen after LASIK surgery,” he

says. “An incredibly high percentage could see 20/20 or better. And so Alcon said, ‘We never thought about using this technology for standard, regular treatments.’ And so they branded it Contoura and released it in the United States. Immediately there were problems.”

Dr. Lobanoff was one of the first to introduce topo-guided LASIK in the United States and although some patients did well, a lot of them were ending up 20/25 or 20/30—a big difference from the 20/16 or better noted in the FDA results.

“I called up my mentor R. Doyle Stulting, MD, from Emory University (who ran the FDA study) and asked why my results weren’t as good as the study’s,” recalls Dr. Lobanoff. “And he said, ‘Mark, you have to understand the FDA study was a safety study, so no fewer than three cornea experts looked at every patient’s corneal topography before they were let into the study, and only corneas that were absolutely perfect were allowed in.’ In the FDA study,

they treat off the patient’s manifest refraction. In the real world, patients have topographic irregularities in their cornea and if you treat on the manifest refraction, you get results that aren’t as good. A lot of doctors tried to come up with ways to treat it that made more sense—they all failed. And so after three or four attempts, Alcon was about to give up on the technology.”

Dr. Lobanoff developed a software platform—Phorcides—which is modeled off of geographic imaging software used by cartographers. The software creates vectors for any raised topographic feature, as well as for anterior and posterior corneal astigmatism and internal lenticular astigmatism, and an algorithm presents the best treatment. A retrospective analysis⁷ (which Dr. Lobanoff co-authored), compared outcomes of eyes treated using the manifest refraction vs. those treated with an ablation profile suggested by Phorcides. In the latter group, significantly more eyes had 20/16 or

better UDVA (62.5 percent compared to 41.3 percent). Alcon now recommends using Phorcides (which is free to surgeons) on its Contoura platform.

Some surgeons may have been left with a bad taste in their mouth after the initial Contoura rollout, continues Dr. Lobanoff. "I'd tell them to take a second look. Have an open mind," he says. "Just like technology improves every year, this has improved dramatically since the early days. And it's faster, easier and far more accurate than when they may have tried it the first time."

Dr. Maloney says much has advanced in wavefront technology, too, since he began using it in the clinical trials over 20 years ago. "We first had the WaveScan system and the iDesign 1, and now we're on the iDesign 2 system, which is a really superb wavefront analyzer," he says. "It measures more than 1,000 points. It's very easy to capture and much of the planning is done automatically, so it makes wavefront treatments easy to do. We've seen huge improvements there."

On- and Off-label Candidate Screening Tips

There are certain criteria to keep in mind for customized LASIK treatments, say experts. Both topo-guided and wavefront-guided/topo-integrated are approved for normal corneas; however, they can also be used off-label to treat certain irregular corneas.

"Wavefront is approved for treating low, moderate and high degrees of myopia and astigmatism," says George O. Waring IV, MD, FACS, who practices in South Carolina and uses the iDesign. "The laser also performs very well for mixed astigmatism and select cases of hyperopia and hyperopic astigmatism or compound hyperopic astigmatism, however, more and more we're treating hyperopia with intraocular lens-based solutions."

He agrees this technology can

be very powerful in an abnormal cornea, to an extent. "There are varying philosophies on this," says Dr. Waring. "Some have had excellent experience using this technology in abnormal corneas. An advantage of the high-definition wavefront is that it allows you to more reliably capture irregular corneas. In our experience we tend to defer the treatment to the manifest in the irregular cornea and often are focused more on treating the lower-order aberration if it can improve their uncorrected visual acuity. That's our typical practice pattern, even with the standard treatment focused on the lower-order aberrations in the irregular cornea. We do feel that although there's emerging work that's very promising in therapeutic topography-guided treatments for highly aberrated corneas, there's also promising work using the wavefront-guided system for these as well. These are difficult cases that are often multi-step and require careful informed consent and multiple visits."



It's really important to give people the maximum uncorrected vision, and it's very clear that the way we get there is by customizing the treatment to the patient.

— Robert Maloney, MD



Dr. Lobanoff says image capture is important before proceeding. "You have to capture a quality topography image (on Contoura) with the Vario Topolyzer, a device from Alcon," he says. "Some patients have really high brows or sometimes patients have really deep-set eyes or something prevents you from getting a good topography image. Well, if you don't have a good topography image, you can't treat topographically. The

Contoura is only FDA approved for myopia and myopia with astigmatism, so patients who are hyperopic or have really high myopia above a -9, you can't use Contoura. Otherwise, I feel every patient benefits from this. Every patient in our clinic who's a potential candidate gets this."

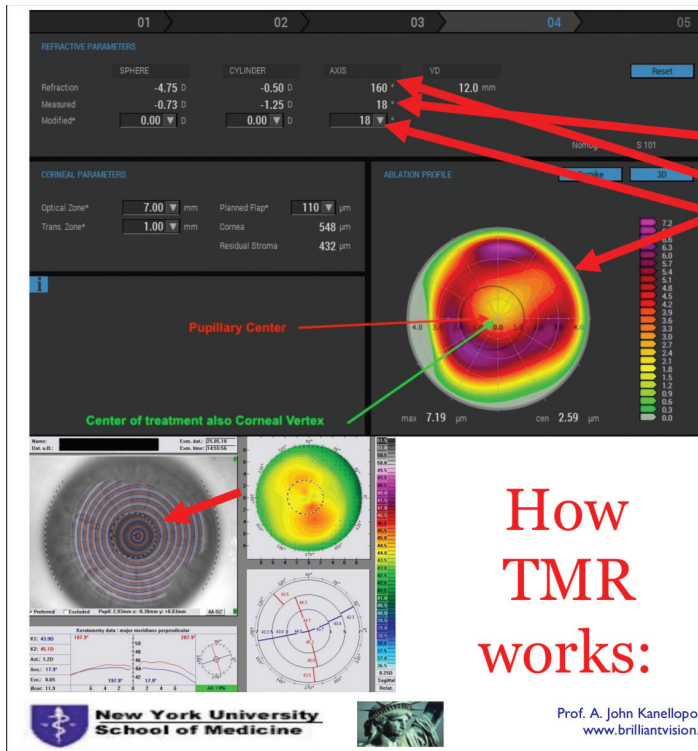
But going back to its roots, continues Dr. Lobanoff, Contoura was first used in Europe for repair procedures. "This is off-label here because in the FDA study they only treated perfect eyes," he says. "But it's really powerful for treating patients who maybe had LASIK in the early days where tracking systems weren't available or microkeratomes left scars or small ablation zones. We can fix a lot of these patients who had complaints from the early days of LASIK and can make them better."

The biggest tip is to start with normal, regular virgin eyes. "First, understand the technology, get used to the results and how you work patients up and then, once you gain confidence with it, start tackling more challenging cases," Dr. Lobanoff says.

"The iDesign 2.0 has a full-gradient topographer that captures over 1,200 x and y slopes, as well as a wavefront aberrometer, so the individual patient's topographic data is used to vertex wavefront-guided data from the pupil to the corneal plane; it also takes into account cosine compensation," says Dr. Waring. "This is high-definition wavefront-guided—not topographically guided—but it's topographically registering the high-definition wavefront, so that gives an extraordinary amount of precision for whole-eye optics that it accounts for, which can treat subtle irregularities, such as coma, in ways that can be difficult to do or can't be done with other technologies."

Pearls for Using the Technology

These experts shared their pearls and caveats for these customized procedures.



How TMR works:

This is another example of a case with significant angle kappa in the x-axis (300μm).

The topography software “reads” -1.25D of cylinder (measured line) at 18 degrees. The clinical refraction (clinical line) is -0.50D of cylinder at 60 degrees!!!

The ‘all o’refraction chosen shows the software ‘attempt’ to normalize the cornea in regard to the cornea vertex, in a pattern that reminds horizontal coma. We theorize here again that the patient himself “accounts and corrects” this coma, within the clinical refraction, as cylinder of axis that actually reduces and ‘shifts’ the axis of the real topographic cylinder. Thus, the clinical chosen by the pt is: -0.5D @ 160 degrees while the topo-measured is -1.25 D @ 18 degrees. The TMR here will be changing the cylinder amount from -0.5 to -1.25 and the axis from 160 to 18 degrees. The sphere will then be reduced from -4.75D to -4.38D in order to maintain the same spherical equivalent.

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Research conducted by A. John Kanellopoulos, MD, suggests using topography-modified refraction as opposed to the subjective manifest refraction to achieve best outcomes.

• **Accounting for accommodation.** Dr. Waring most often hears instances of surgeons with early over-corrections due to not accounting for accommodation. “The technology has internal mechanisms and accommodative fixation targets that account for this, but even then the technicians need to make sure that the ocular surface is pristine and well-lubricated,” Dr. Waring notes. “Number two, that they have the appropriate pupil size and correct registration landmarks, and number three, that the patient understands how to look through the fixation targets to account for accommodation. They can also minimize accommodation by having patients count backwards from 100 in their head, as well as minimize the use of accommodative effort around the time of perioperative planning, for example, minimizing cell phone use in the waiting room, and also minimizing wait-time altogether. We are meticulous about our wavefront captures.”

He continues, “The iDesign 2.0 also generates qualitative metrics in terms of the validity of the scans, and makes recommendations on the highest fidelity of captures as well. All of these matter in your screening process and it’s all part of our training with our technicians.”

• **Nomograms.** For this reason above, a good nomogram is necessary. “It’s important with the wavefront-guided system to use a nomogram because the current system tends to overcorrect slightly so you need a nomogram to reduce the overcorrection,” says Dr. Maloney.

“For a wavefront-guided myopic astigmatism [with the iDesign] for example, we cut back on our spherical ablation a set amount, which is a normal process in a physician adjustment that’s derived from your outcomes,” says Dr. Waring. “This is important when you onboard any laser but it’s particularly important with the iDesign to account not only for the differences in each laser, but

also to account for mild overtreatments that are multifactorial in etiology, including accommodation during the wavefront capture and also the ablative characteristics of a custom wavefront-guided excimer treatment.”

• **Topography-modified refraction.** Manifest refraction has long been the norm for laser vision correction, but the introduction of topo-guided technology has demonstrated the ways in which measured refraction can influence outcomes for the better. As published by Dr. Kanellopoulos, topography-modified refraction⁸ is an adjustment of the amount and axis of astigmatism treated, suggesting that it preemptively bypasses the lenticular astigmatism bias in young myopic eyes and may compensate for some amount of corneal astigmatism and corneal coma generated by angle kappa, therefore leading to superior outcomes in topo-guided myopic LASIK, as stated in the study.

• **Cyclorotation.** “The EX500

excimer laser, which is a descendent of the original 400 IQ excimer laser, has shown the ability of adjusting for the inevitable cyclorotation of all eyes," Dr. Kanellopoulos says. "When the patient goes from standing to supine, the eyes rotate towards the nose, so the right eye rotates clockwise the left eye rotates counter-clockwise for a miniscule number of degrees, but sometimes it could be as high as 9 degrees. Thus, correcting astigmatism, especially in topo-guided treatments, becomes very essential to be adjusted for that eventual cyclorotation."

• **Epithelial mapping.** Dr. Kanellopoulos says he has long argued the values of documenting the naive state of the virgin cornea for any customized treatment. "For close to 15 years now, as a prerequisite, we've used epithelial mapping to establish that," he says. "If epithelial mapping shows irregularity, we'd avoid using customized data that rely on cornea imaging because this would transfer the noise of the measurement on to the customized treatment. Also, if there's a significant deviation of the manifest refraction cylinder amount and axis from that suggested by the topography, confirmation from tomography needs to take place because the perceived curvature of the cornea may not actually be an average of -6 and may interfere with what the refraction topography is measuring. Thus, in any case where the surgeon decides to employ our popularized topo-modified refraction (mentioned above) in their topo-guided treatments, confirmation of the amount of and axis cylinder by tomography needs to take place."

What the Future Holds

Even with the excellent outcomes published across multiple studies, customized LASIK with topo-guided technology hasn't seen the uptake one would expect. Dr. Lobanoff avers that some surgeons might just be comfortable with the results they're already getting with normal wave-

front-guided excimer lasers, which have seen advancements of their own. "When you've got something that's giving you good results, and you've done it for 20 years and you feel comfortable with it, it's hard to get out of your comfort zone," he says.

“**Therapeutic laser refractive surgery is an art and a science that not only requires the right technology but also the right approach.**

— **George O. Waring, IV, MD, FACS**

"I think the real benefit of the technology is the power of the diagnostic and the outcomes that can be realized," says Dr. Waring. "There's been a positive adoption rate for topography-guided treatments, however, many users don't routinely use the topographic treatment aspects of the technology, largely due to the requirement for the additional time and effort for diagnostic workup for both the patients and the staff. However, the outcomes are excellent. All have their nuances and considerations and therapeutic laser refractive surgery is an art and a science that not only requires the right technology, but also the right approach and still represents a very relatively small amount of the market of refractive surgery in the United States. This is an emerging area of interest and research to help many patients in need."

Competition in the refractive surgery arena is only going to get tighter as newer technologies are introduced. Dr. Kanellopoulos believes ray-tracing will be the next frontier in customized LASIK, but says it remains to be seen if it will be adopted globally.

Dr. Maloney is excited about the possibilities. "I think LASIK will continue to improve incrementally with the new laser systems, and I expect we'll get a better version of SMILE," he says. "We'll have new IOL designs coming that will make refractive lens exchange even better. So, I think, while refractive volume is down lately because of the presumed recession, I'm extraordinarily optimistic about the future. My vision is that someday I'll be in a museum with my grandchild and he'll tug on my pant leg and point to an object, 'What's that, Grandpa?' And I'll say, 'Those are eyeglasses.'" ◀

1. Alcon introduces Contoura Vision as first personalized LASIK procedure at American Academy of Ophthalmology Annual Meeting. Nov. 16, 2015. <https://www.alcon.com/media-release/alcon-introduces-contoura-vision-first-personalized-lasik-procedure-american-academy>. Accessed Nov. 20, 2023.
2. FDA Clinical Trials. Allegretto Wave Eye-Q Addendum Procedure Manual T-CAT Topography-Guided Treatments. http://www.accessdata.fda.gov/cdrh_docs/pdf2/P020050S012d.pdf. Accessed Nov. 20, 2023.
3. Johnson & Johnson Vision Launches Next Generation of Personalized LASIK Treatment, iDESIGN Refractive Studio Now Available. Sept., 6, 2018. <https://www.jjvision.com/press-release/johnson-johnson-vision-launches-next-generation-personalized-lasik-treatment-idesign>. Accessed Nov. 20, 2023.
4. Shetty R, Matalia H, Nandini C, et al. Wavefront-guided LASIK has comparable ocular and corneal aberrometric outcomes but better visual acuity outcomes than SMILE in myopic eyes. *J Refract Surg* 2018;34:8:527-532.
5. FDA Clinical Trials. Topography-Assisted Lasik Treatment For Nearsightedness (Myopia) With Astigmatism, Nidek EC-5000 Excimer Laser System. https://www.accessdata.fda.gov/cdrh_docs/pdf/P970053S011d.pdf. Accessed Nov. 20, 2023.
6. Cheng SM, Tu RX, Li X, Zhang JS, Tian Z, Zha ZW, Ruan KW, Yu AY. Topography-guided versus wavefront-optimized LASIK for myopia with and without astigmatism: A meta-analysis. *J Refract Surg* 2021;37:10:707-714.
7. Lobanoff M, Stonecipher K, Tooma T, Wexler S, Potvin R. Clinical outcomes after topography-guided LASIK: Comparing results based on a new topography analysis algorithm with those based on manifest refraction. *J Cataract Refract Surg* 2020;46:6:814-819.
8. Kanellopoulos AJ. Topography-modified refraction (TMR): Adjustment of treated cylinder amount and axis to the topography versus standard clinical refraction in myopic topography-guided LASIK. *Clin Ophthalmol* 2016;3:10:2213-2221.



EDITED BY CARL REGILLO, MD,
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RETINAL INSIDER

An Update on Toxoplasmosis

A review of the diagnosis and management of the most common cause of infectious posterior uveitis.

DAVID FELL, MD BOSTON
DANNY A. MAMMO, MD CLEVELAND

Toxoplasmosis is the most common cause of infectious posterior uveitis worldwide, caused by an infection by the protozoan parasite *Toxoplasma gondii*. It's found both in the United States and across the globe, and is an important consideration to rule out when evaluating any new posterior or panuveitis patient, especially when considering systemic or local (periocular or intraocular) steroid therapy.^{1,2,3} Here, we'll review the finer points of diagnosis and treatment of the condition.

Background and Epidemiology

The high prevalence of *T. gondii* is made possible by its uniquely elaborate and elusive life cycle. In order to replicate, *T. gondii* cysts must be ingested by a felid (domestic or wild cat) and undergo sexual reproduction in their gastrointestinal tract with the help of specific digestive enzymes. Oocysts containing sporozoites are then excreted and once again ingested by a variety of hosts, where they undergo asexual reproduction into tachyzoites and finally bradyzoites, a low virulence form which can persist for long periods of time within tissues cysts until they are

released and cause inflammation to adjacent tissues.³

Worldwide prevalence of toxoplasmosis infection is estimated to be 25 to 30 percent on average, but it varies heavily based on location and climate; national rates can range from ~10 to 20 percent in low-prevalence areas like North America, Southeast Asia and Northern Europe and as high as 80 percent in tropical environments like South America and tropical African countries.^{2,4}

Toxoplasmosis can be acquired at any point of life through ingestion of oocysts or congenitally when a pregnant

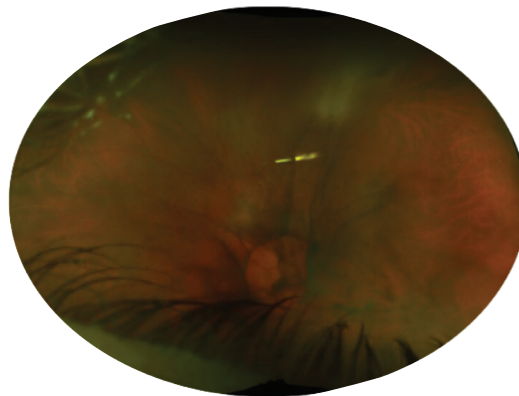


Figure 1. Ultra-widefield fundus imaging of the left eye of a 69-year-old patient with white retinitis seen superiorly through vitreous haze—the “headlight in the fog” appearance. This patient was treated topically for anterior uveitis alone for two years prior to presentation, with progressively worsening vitritis and deterioration in visual acuity.

woman becomes infected and the parasites are passed through the placenta to the fetus.⁵ The latter is far less common and presents earlier in life with different patterns of chorioretinal scarring and inflammation that are discussed below.

Clinical Presentation

Toxoplasmosis was first described as a congenital infection in 1923 and gained wider acknowledgement as a major cause of infectious posterior and panuveitis over the subsequent two decades.^{6,7} While there was initial skepticism over the role the parasite played in inflammatory eye disease, studies examining cadaver eyes as well as experimental non-human models helped to elaborate the role that the organism plays in causing retinochoroiditis in both immunocompetent and immunocompromised subjects.^{8,9,10}

We now know that ocular toxoplasmosis can present with a variety of patterns and degrees of inflammation. Classically, patients will demonstrate an area of retinitis at the border of an inactive chorioretinal scar with some degree of vitritis and/or anterior inflammation.⁹ This has led to the typical description of a “headlight in the fog,” describing the appearance of the bright white, focal retinitis seen through vitreous haze (*Figures 1 and 6*).^{11,12} Vasculitis is often present adjacent to areas of retinitis and can show characteristic “Kyrieleis plaques” (*Figure 2*), which are segmental yellow-white lesions within retinal arteries. These plaques are also now referred to as segmental retinal arteritis due to unacceptable ideological beliefs of Werner Kyrieleis.¹³ Some studies have suggested a sex difference in patients, with female patients more likely to have multiple chorioretinal

This article has no commercial sponsorship.

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lesions as well as recurrent disease.¹⁴

Atypical presentations may occur, especially in patients that are elderly or immunocompromised.¹⁵ In these patients, a high degree of suspicion must be maintained for all patients from isolated optic nerve edema, diffuse retinitis, retinal vasculitis and even scleritis. In these patients, it's especially important to rule out or treat for infectious causes like toxoplasmosis, as they can have severe worsening with local or systemic steroid therapy without antimicrobial coverage.^{16,17,18} One atypical presentation includes atypical toxoplasmosis chorioretinitis mimicking acute retinal necrosis. Including toxoplasmosis PCR testing in initial aqueous taps can lead to timely diagnosis and avoid unnecessary antiviral local and systemic therapy.¹⁹

Choroidal neovascularization may rarely occur at or near previous sites of chorioretinal scarring and require intravitreal anti-VEGF treatment. This doesn't usually present at the time of active inflammation. Similarly, late tractional and rhegmatogenous retinal detachments may occur from vitreous traction that develops as the inflammation improves. Surgical intervention may be needed to prevent permanent vision loss.

Congenital Toxoplasmosis

While patients with congenital toxoplasmosis and ocular involvement may not have any visual complications if scars are extramacular and they have no episodes of inflammation/retinitis, case series examining newborn babies screened for toxoplasmosis due to known maternal infection have shown high rates of ocular involvement at infancy.⁵ In one case series from Brazil, of 187 babies born to mothers with positive toxoplasma IgM, 29 were found to have congenital infections. Within this cohort,¹⁹ (65.5 percent) were found to have ocular involvement.²⁰

Punctate outer retinal toxoplasmosis (PORT) is a unique clinical phenotype that presents more commonly in those with congenital toxoplasmosis and usually within the first two decades of life. These patients typically pres-



Figure 2. Immunocompromised patient on systemic methotrexate who underwent posterior subtenon's triamcinolone injection for initially presumed non-infectious uveitis. The vitreous was positive for toxoplasma with PCR testing. Color fundus photo demonstrating a large area of the macula affected by retinitis. Nasal collateralization is seen as well as Kyrieleis plaques, or segmental retinal arteritis, along the superior and inferior arcades.

ent with small, deep, hypopigmented retinal lesions that persist once the acute inflammatory phase has resolved. Vitreous inflammation is usually minimal in these patients, but retinitis is often accompanied by optic nerve involvement. Presentation can be similar to common non-infectious posterior uveitis, but can be differentiated using multimodal imaging and a high degree of suspicion.^{21,22,23}

Patients with congenital toxoplasmosis are more likely to have bilateral involvement and more aggressive retinitis. They're more likely to have

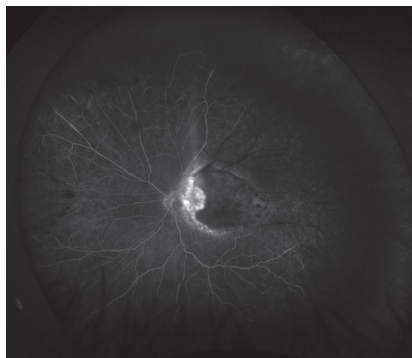


Figure 3. Ultra-widefield fluorescein angiography of the patient in Figure 2 demonstrating early blockage of the active macular lesion as well as occlusion of superotemporal vessels.

recurrent episodes of inflammation and require long-term suppressive therapy, as discussed below.⁵

Multimodal Imaging and Laboratory Testing

Ocular toxoplasmosis is a diagnosis made primarily based on clinical presentation. However, adjunctive testing can be useful to solidify the diagnosis and monitor for improvement.

Ultra-widefield color fundus imaging can provide objective yardsticks by which improvement in vitritis and retinitis can be observed. Fluorescein angiography can help differentiate active (leaking) and quiescent (staining without leaking) lesions as well as highlight areas of retinal vessel occlusion due to lesions (Figure 3).

Optical coherence tomography of the macula can assist in ruling-out the presence of cystoid macular edema and assist with the grading of vitreous cells. Raster scans through lesions can confirm the presence of retinitis and determine the depth of the lesion by looking for full-thickness hyper-reflectivity (Figure 4).¹⁰

Laboratory testing can be useful when the diagnosis of toxoplasmosis is unclear based on clinical presentation and imaging. PCR testing of aqueous or vitreous samples may be used with similarly high efficacy, though some studies have demonstrated relatively higher sensitivity in vitreous samples.^{24,25,26} Serological testing for *T. gondii* IgG and IgM may be used to evaluate prior or recent systemic infections and is mostly helpful for ruling out toxoplasmosis when IgG is negative.²⁷

Management

In general, treatment is indicated for cases where vision is affected or threatened. This may be due to macula-involving retinitis, severe vitritis, optic neuropathy or cystoid macular edema. Inactive-appearing chorioretinal scarring attributed to prior infections can usually be monitored without treatment.²⁸

Most cases of toxoplasmosis can be effectively managed with systemic

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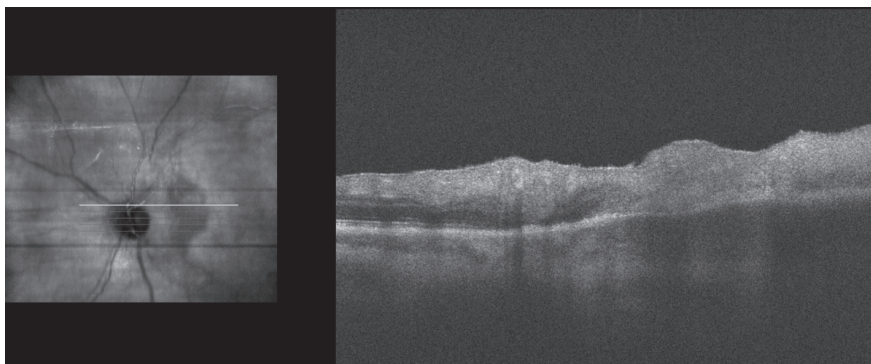


Figure 4. Optical coherence tomography demonstrating full-thickness retinal hyper-reflectivity with loss of retinal laminations temporally, suggestive of retinitis. The choroid also appears to be thicker beneath this area although there's signal blockage due to the overlying retinitis.

medications that target the causative parasite and the accompanying inflammatory reaction. Prior to 2015, the gold standard for this treatment was “triple therapy” composed of pyrimethamine (100 mg for 2 days, then 25 mg daily), sulfadiazine (2 g) and folinic acid (5 mg). Pyrimethamine’s effectiveness in this disease was originally described in 1956²⁸ and has been elaborated upon in the decades that followed.

Since then, regimens evaluating the utility of additional antimicrobials, specifically azithromycin, clindamycin, and trimethoprim-sulfamethoxazole (TMP-S), have been evaluated both in combination with pyrimethamine and as single-therapy agents. While all of these medications have demonstrated effectiveness across multiple studies, there have been scant prospective, randomized studies comparing one to another.^{31,32} In one study, Yanxia Zhang, MD, of China’s Sun Yat-sen University and co-authors used network meta-

analysis to compare outcomes with systemic pyrimethamine-sulfadiazine, clindamycin, azithromycin and TMP-S and found that clindamycin was associated with the greatest improvements in visual acuity and resolution of vitreous inflammation. The same study found that TMP-S was associated with lower rates of recurrence as well as side effects.³³ We tend to use TMP-S as first-line treatment when no contraindications exist.

Dosages for treatment of active ocular toxoplasmosis are:

- pyrimethamine 75 to 100 mg loading dose, followed by 50 mg + sulfadiazine 1 to 4 g daily + folinic acid 5 mg;
- azithromycin 250 to 500 mg daily;
- clindamycin 300 mg four times daily; and
- trimethoprim-sulfamethoxazole 800-60 mg (Bactrim DS) twice daily

Importantly, pyrimethamine is a folic acid inhibitor and is associated with the highest risk of complications, including thrombocytopenia, leukopenia and fevers. Patients receiving pyrimethamine should also take folic acid supplementation and be monitored weekly with bloodwork. Patients receiving TMP-S should be screened and periodically monitored for kidney function testing.^{29,32}

Intravitreal clindamycin (1 mg/0.1 ml) may be considered when there are contraindications to systemic therapy, such as in the first trimester of pregnan-

cy, as well as for macular lesions where a faster response is desired. This may be used alone or in conjunction with systemic and/or intravitreal steroids.^{35,36}

The role of systemic steroids is generally to control robust inflammatory reactions associated with toxoplasma infections, usually severe vitritis. Oral prednisone may be started up to 1 mg/kg depending on the degree of inflammation and titrated slowly over weeks-to-months until the vitritis is resolved and retinitis appears inactive. Figures 1 and 4 show the same patient who demonstrates an impressive response after five months of systemic TMP-S and prednisone. The prednisone was slowly tapered on a monthly basis as the patient’s vitritis improved. Intravitreal dexamethasone has also demonstrated good effectiveness when used in combination with intravitreal clindamycin.^{37,38} Topical steroids and cycloplegics may be used adjunctively when anterior inflammation is present.

Prophylaxis

Recurrence of ocular inflammation isn’t uncommon and has been estimated to occur in 5 to 15 percent of patients within two years of initial treatment and increases with years of follow-up. In many patients, once the active disease process has been controlled, consideration must be given as to whether patients should receive lower-dose prophylactic treatment with systemic

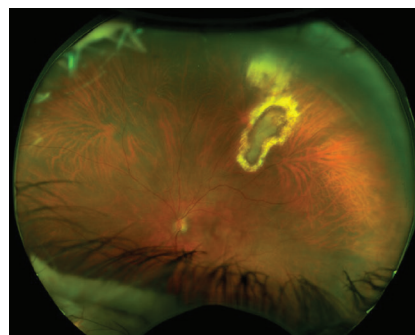
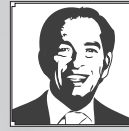


Figure 5. The same patient in Figure 1 after five months of treatment with TMP-S and prednisone, which was slowly tapered. Visual acuity improved from 20/50 to 20/20 with resolution of vitritis. Active-appearing central retinitis and atrophic borders still remained.

Fun fact: Pyrimethamine, brand named Daraprim, was the source of public controversy when in 2015, Turing Pharmaceuticals and its founder Martin Shkreli infamously bought the rights to the medication and increased its market price from \$13.50 to \$750/pill. This forced clinicians to change their practice patterns when treating ocular toxoplasmosis, as well as other conditions, and increased the need for data comparing the effectiveness of alternative therapies to the “gold standard.”³⁴



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ABOUT RICK

Rick Bay served as the publisher of *The Review Group* for more than 20 years. To those who worked for him, he was a leader whose essence was based in a fierce and boundless loyalty. To those in the industry and the professions he served, he will be remembered for his unique array of skills and for his dedication to exceeding the expectations of his customers, making many of them fast friends.



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Figure 6. Ultra-widefield fundus imaging of a 63-year-old woman who presented with floaters and blurry vision, whose exam demonstrated vitreous haze with a white macular retinitis lesion, a nice example of the classic “headlight in the fog” appearance (A). She was treated with oral TMP-S, prednisone, and intravitreal clindamycin with a resolution of the vitritis, pigmentation of the lesion, and a best-corrected visual acuity of 20/20 (B).

therapy for a year or more. This is aimed at preventing recurrence in high-risk patients and preventing systemic spread in immunocompromised patients. A randomized control study compared a year of treatment with TMP-S three times a week to placebo and found a dramatically lower probability of recurrence in the TMP-S group (1.39 percent) compared to the placebo group (27.34 percent) after six years of follow-up.³¹ The pros and cons of continued TMP-S treatment after the active

infection is healed versus observation should be discussed with the patient. Given the strong data on the reduced risk of recurrence with continued use for at least one year after treatment, we encourage its use, especially in recurrent cases. However, the patient’s decision after understanding the risks and benefits is of course the final determining factor.

In conclusion, toxoplasmosis retinochoroiditis is the most common cause of infectious posterior uveitis worldwide and can lead to varying degrees of vi-

sion loss due to macular or optic nerve involvement, vitritis and cystoid macular edema. Treatment includes systemic and/or intravitreal antimicrobials targeting the underlying organism *T. gondii*, as well as steroids in some cases to control the accompanying inflammatory reaction, and should be titrated over weeks-to-months until resolution of all active inflammation is observed. Multimodal imaging techniques and laboratory testing of serum as well as ocular fluids can assist with diagnosis when the picture is unclear, and prophylactic antimicrobials can be considered for patients at high risk for recurrence. ◀

For a version of the article with the endnote references, please visit reviewofophthalmology.com.

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EDITED BY MICHAEL COLVARD, MD
AND STEVE CHARLES, MD

TECHNOLOGY UPDATE

Tips for Securing Patient Data

Health care data breaches happen regularly and there are many ways to prevent the possibility of a cyberattack.

ANDREW BEERS
ASSOCIATE EDITOR

As computer technology advances, so do data breaches. Breaches happen all over the country to various government entities, organizations and business. Over the past three years, health care data breaches have doubled, and the average cost to repair damages and recover from a breach in the health-care industry has grown from \$9.23 million in 2021 to \$10.1 million in 2022.¹ The health-care sector is the most targeted by these attacks, with reports citing 76.59 percent of data breaches in the United States between 2015 and 2019 involved various health care service providers.² With a growing trend in data breaches, how can ophthalmology practices prevent future cyberattacks?

Why Worry?

“Unfortunately, the number-one reason why health information is stolen is for some financial gain,” says Kesa Bond, PhD, an associate professor for the Health Services Administration and Policy at Temple University. “Bad actors can take the data that they gain, and they can either sell it on various black markets, they can commit medical identity theft, or they can commit fraud and abuse. For example, they may use the information that they gain in order to submit it for various claims and reimbursement, and it often takes a long time for insurance companies

to catch up with the error. By the time they perform their audit and realize what has happened, those bad actors are already long gone with the money they’ve made, and they’ve done the damage that they wanted to do.”

What Dr. Bond is alluding to are ransomware attacks, or data breaches with an expected ransom for the stolen data. Ransomware attacks are prevalent for larger health-care organizations. In a 2022 cohort study examining the trends of ransomware attacks on U.S. hospitals and clinics, researchers noted 374 ransomware attacks between 2016 and 2021, which exposed the personal health information of nearly 42 million patients.³ Almost half of these attacks disrupted the delivery of health care (44.4 percent), with electronic system downtime being the leading issue caused by these breaches.³

The Department of Health and Human Services Office of Civil Rights reports most health care data breaches, with the exception of smaller, independent practices. According to their website, all breaches of unsecured protected health information affecting 500 or more individuals will be reported to their database. Due to this limitation, the aforementioned cohort study couldn’t provide statistics for ransomware attacks on smaller practices. Although smaller practices aren’t as closely investigated and publicized like larger practices, hackers and scammers are still incentivized to attack.

“For the larger practice, of course, bad actors are going to get a bigger bang for

their buck, but they also have a greater potential of bumping up against a lot of barriers which are going to stop them, at least that’s what I’d like to believe,” says Dr. Bond. “Whereas the smaller facility likely doesn’t have the budget or capabilities necessary to hold up their front end and keep those bad actors out. So, it’s really a game with these cyber adversaries of going for the low hanging fruit, no matter where that low hanging fruit is. For example, it was a myth that no one could break into an Apple computer. People believed the security system was so robust that it couldn’t happen. It’s not that it doesn’t happen, it’s that there’s so many layers, barriers and obstacles that the bad actors have to go through that they would rather go for the easier target rather than the harder target.”

The ways in which these bad actors infiltrate a system are simple, and it’s really easy to fall victim to their attacks. “The number one way that these actors are getting into our systems is through phishing,” says Dr. Bond. “Phishing is one of the direct paths into the system and in order to get into the system, you need an individual to complete an action. So, a phishing attack is coming by way of email, but in the phishing email, once the individual has clicked on the link or has given their information to the actor who has ‘socially engineered’ them—which is using information that they know in order to manipulate or trick the individual into thinking that the actor is who they say they are—then that’s when that attack is successful.

“Other ways that bad actors can get into the system is by penetrating the system itself. If a health-care organization isn’t implementing strong security practices—firewalls or encryption—this leads to wide open information,” continued Dr. Bond. “And then a smaller method is through either lost or stolen devices. I personally don’t see bad actors going out of their way to steal a laptop, but they will.

This article has no commercial sponsorship.

Dr. Bond has no financial interests to disclose.

Just like any other crime—crimes of opportunity—if the information's there, then they're going to use it for their own good.”

On a larger scale in eye care, there have been major cyberattacks on electronic health records and insurance companies. In December 2021, Eye Care Leaders, a provider of electronic health records and patient management software solutions for eye-care practices, was attacked by hackers. They stole information from Eye Care Leader's myCare Integrity EMR as well as deleted databases and files. A report from November 2022 noted that 3.6 million patients had their information exposed and 41 eye-care providers were affected.⁴

Another incident in eye care also occurred in 2021, involving the 20/20 Eye Care Network, a health-plan provider. Now, in 2023, 20/20 Eye Care Network has reached a \$3 million settlement to resolve claims from individuals affected by its data breach. Although the scale of the attack couldn't be determined, the company notified 3,253,822 individuals who were potentially affected by the attack. The attack was linked to the network's Amazon Web Service cloud storage, where hackers were able to download protected health information including names, Social Security numbers, health insurance information and more. The lawsuit filed against 20/20 Eye Care Network alleged that this was a failure to comply to HIPAA guidelines and adhere to cybersecurity standards.⁵

Preventing Data Breaches

It's good to be prepared for potential data breaches, and it comes down to how willing the practice is to invest in their security system. “It takes a significant amount of money to implement security tools, train individuals on the tools and hire IT professionals who have the skill set and the knowledge to continuously monitor this,” says Dr. Bond. “The organization should take the time to investigate what software would be best for them, and it's important to note that this isn't prescriptive, meaning there's no such thing as a one size fits all. The organization has

to invest in IT professionals who would be able to propose the best systems based on their unique situation.” She goes on to mention that not all IT professionals understand HIPAA guidelines, so it's best to hire someone who is knowledgeable about health-care privacy and safety.

Phishing emails, as explained before, pose a major threat to personal health information, but there are ways to mitigate this. “An important tactic that some clinics have found success with is simulated emails,” says Dr. Bond. “A simulated email is when an employer intentionally sends a phishing email to one of their employees, and it's a test to see if they follow through with it, if they report it, if they ignore, and what they click on. It's OK for them to fail. We want them to fail on this safe environment, but we don't want them to fail when it's real.”

Retraining to train employees on the proper response to phishing emails can be an issue for some clinics since training can be costly. “Organizations aren't willing to give their employees paid time to do this training and they're also not willing to fund the training period,” says Dr. Bond. “We must conduct routine training. If we don't train our employees, then we're just waiting for the breach to happen.” Training doesn't need to be a financial issue as the Cybersecurity and Infrastructure Security Agency (CISA) offers free tools and extensive guidelines on how to train employees to avoid phishing emails.

“Every clinic should have a baseline security risk assessment,” continues Dr. Bond. “In the assessment, you're making an accounting, almost like an inventory, of every place within your workflow that protected data exists.” Other tactics that can be implemented are cyber incident response plans.

CISA has laid out basic steps to prevent ransomware attacks. One of those steps is to establish a basic cyber incident response plan. According to CISA, this plan is a written document approved by senior leaders of an organization that provides detailed steps for before, during and after a confirmed or suspected security incident.⁶

To avoid a breach and then having to use a cyber incident response plan, CISA recommends mitigating vulnerabilities

by employing best practices for Remote Desktop Protocol (RDP) and other remote desktop services. Also, conducting regularly scheduled vulnerability scans and software updates can help reduce exploits and future attacks. Additionally, disabling or blocking the inbound or outbound Server Message Block (SMB) protocol, a client-server communication protocol used for sharing files and other resources on a network, and ensuring all security features are enabled can further mitigate attacks.⁷

If a data breach occurs, then the cyber incident response plan should be enacted. Dr. Bond explains the basic protocol necessary if an incident occurs: “Any time an organization has 500 or more incidences from a data breach, then they must firstly notify the Office of Civil Rights who will begin an investigation. In addition to that, they must notify the media within 60 days. And, of course, you have to notify the patient that their information either was compromised or potentially compromised. The quicker you respond, the better off you'll be.”

There are tons of tactics that can be implemented to strengthen cybersecurity, but as Dr. Bond mentioned earlier, there's no such thing as one size fits all. “We must establish a budget for cybersecurity, we must hire skilled IT professionals and we must conduct routine training,” she explains. “It's very cliché, but we're only as strong as our weakest link.” ◀

1. 2022 Healthcare cybersecurity year in review, and a 2023 look-ahead. OIS, HC3 2023. <https://www.hhs.gov/sites/default/files/2022-retrospective-and-2023-look-ahead.pdf>.

2. Seh AH, Zarour M, Alenezi M, Sarkar AK, Agrawal A, Kumar R, Khan RA. Healthcare data breaches: Insights and implications. *Healthcare (Basel)* 2020;8:2:133.

3. Neprash HT, McGlave CC, Cross DA, et al. Trends in ransomware attacks on US hospitals, clinics, and other health care delivery organizations, 2016-2021. *JAMA Health Forum* 2022;3:12:e224873.

4. Alder S. Eye Care Leaders hack impacts millions of patients. *The HIPAA Journal* 2022. <https://www.hipaajournal.com/eye-care-leaders-impacts-millions-of-patients/>.

5. Alder S. \$3 million settlement proposed to resolve 20/20 Eye Care Network data breach lawsuit 2023. <https://www.hipaajournal.com/3-million-settlement-proposed-to-resolve-20-20-eye-care-network-data-breach-lawsuit/>.

6. Incident response plan (IRP) basics. CISA 2023. https://www.cisa.gov/sites/default/files/publications/Incident-Response-Plan-Basics_508c.pdf.

7. Protecting sensitive and personal information from ransomware-caused data breaches. CISA 2021. https://www.cisa.gov/sites/default/files/publications/CISA_Fact_Sheet_Protecting_Sensitive_and_Personal_Information_from_Ransomware-Caused_Data_Breaches-508c.pdf.



EDITED BY COLLIN ROZANSKI, MD

WILLS EYE RESIDENT CASE REPORT

A 77-year-old woman presents for evaluation of an empty left orbit after a motor vehicle accident.

BRYCE HWANG, MD, KARINE SHEBACLO, MD, CHARLOTTE MAROUS, MD, AND JACQUELINE CARRASCO, MD
PHILADELPHIA

Presentation

A 77-year-old Asian female presented for evaluation of an empty left orbit after a motor vehicle accident. She was the restrained driver in a one-vehicle crash, traveling at 75 miles per hour, during which the airbag deployed. Immediately after the accident, she reported a loss of vision in the left eye. At an outside hospital, she was noted to have a left-sided inferior and medial wall orbital fracture with herniation of the globe into the maxillary sinus. She had no other systemic trauma and no intracranial trauma.

History

Past ocular history included cataract surgery with posterior chamber intraocular lens placement in both eyes. Past medical history disclosed osteoporosis, gastroesophageal reflux disease and leukocytoclastic vasculitis. Family history was unremarkable. In terms of social history, the patient lived alone and had never smoked. She didn't have known drug allergies. Current medications included omeprazole and alendronate.

Examination

The patient's vital signs were within normal limits. There was no evidence of acute or chronic injury to the chest, abdomen, pelvis, extremities or neck. Ocular examination demonstrated best-corrected visual acuity of 20/20 in the right eye and no light perception in the left eye, which was noted to be displaced inferiorly into the maxillary sinus. Multiple attempts were unsuccessfully made to establish potential light perception in the left eye, including transillumination into the region of the herniated globe. Ishihara color plates were 8/8 on the right eye. The pupil was round and reactive on the right. Intraocular pressure was 16 mmHg in the right eye. Confrontational visual field was full in the right eye. Extraocular motility was full for the right eye. The anterior segment examination was remarkable for a well-positioned PCIOL in the right eye. Dilated fundus examination was notable for a cup-to-disc ratio of 0.55 in the right eye. The left upper lid and left lower lid were notable for multiple lid lacerations. No globe was visible on careful examination of the left orbit with Desmarres retractors. No examination of the eye itself could be performed for the left eye.



Figure 1. CT scan of the orbits demonstrates herniation of the left globe into the left maxillary sinus with possible impingement of the lateral orbital floor on the globe.

What's your diagnosis? What management would you pursue? The case continues on the next page.



Figure 2. Preoperative photograph demonstrating herniation of the globe into the maxillary sinus.

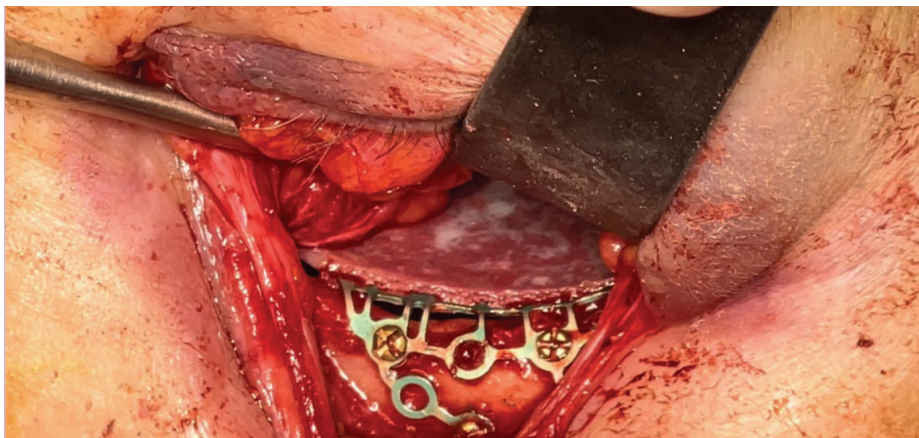


Figure 3. Intraoperative photograph demonstrating placement of a porous, polyethylene-coated titanium implant for orbital floor repair.

Work-up, Diagnosis and Treatment

CT brain and orbits with and without contrast demonstrated a comminuted left-sided orbital floor fracture with herniation of the left globe into the left maxillary sinus (*Figure 1*). Although the left globe appeared symmetric in volume compared to the right globe, the lateral aspect of the orbital floor appeared to exert mass effect on the globe. Extensive orbital hematoma, as well as transection and retraction of all left-sided extraocular muscles were also noted. These findings confirmed that the patient had a traumatic globe dislocation into the maxillary sinus.

Subsequently, the patient was promptly taken to the operating room on the same day for surgical repair. Examination during the procedure confirmed that the globe and orbital contents had subluxed into the maxillary sinus, with nearly complete incarceration of the globe beneath the fractured left orbital floor (*Figure 2*). A transconjunctival approach was employed to access the orbital floor. Malleable retractors were used in a hand-over-hand fashion to carefully elevate the globe and orbital contents back into their proper position within the orbit. To repair the orbital fracture, a porous polyethylene-coated 3-D titan surgical implant was sized appropriately and securely attached to the inferior orbital rim with screws (*Figure 3*). Additional procedures included a left upper medial canthoplasty, repair of the left upper and lower eyelid lacerations, and a left lateral canthoplasty.

The initial examination of the left eye in the operating room revealed an IOP of 6 mmHg, a fixed and dilated pupil, a well-formed anterior chamber, a grossly normal optic nerve, and no apparent retinal lesions (*Figure 4*).

On the first postoperative day, the patient was noted to have hand motion vision on the left. By postoperative week three, the patient's vision had improved to count fingers in the left eye. Examination in the clinic also disclosed a globe with minimal motility, a temporally subluxed posterior chamber intraocular lens capsular bag complex, and a fundus examination without signs of retinal detachment. At the two-month postoperative mark, the patient continued to have count fingers vision, as well as ptosis and motility deficits. This enophthalmos continued to progress during the three- and five-month postoperative visits, with 8 mm of enophthalmos observed at the final examination in our clinic (*Figure 5*). The patient was subsequently evaluated at an outside hospital and underwent a left orbital floor and medial wall fracture overlay using a custom implant. After this procedure, the patient was noted to have 20/40 vision, but still experienced complete left-sided movement deficits and no improvement in the residual enophthalmos.

Discussion

Traumatic globe dislocation into the paranasal sinuses is rare, with only 24 published cases in the English-language literature between 1971 and 2015.¹ The primary causes of such dislocations are traffic accidents, accounting for 42 percent of cases, with other forms of blunt trauma being the second most common cause at 33 percent.¹ Most of these dislocations occur into the maxillary sinus (87.5 percent), with a smaller proportion into the ethmoid sinus (12.5 percent).¹

The mechanisms of such dislocations are thought to involve a combination of



Figure 4. Postoperative photograph demonstrating replacement of the globe into anatomical position.

hydraulic and buckling mechanisms. The hydraulic mechanism theory states that blunt trauma initially occludes the orbital aperture, leading to an increase in intraorbital pressure. This, in turn, causes the orbital bones to fracture at their weakest point, typically along the posterior medial section of the orbital floor. Increased pressure can also lead to more extensive damage in other vulnerable areas of the orbit, such as the medial wall and the remaining inferior floor. On the other hand, the buckling mechanism theory proposes

that direct pressure results in the deformation of the inferior orbital floor, ultimately leading to a blowout fracture of both the orbital floor and the medial wall.^{2,3} Of note, the globe is normally secured within the orbit by an intricate network of soft tissue support structures, including the Lockwood ligament, lateral and medial check ligaments, and orbital fat. Only in cases of severe trauma that disrupt both the soft tissue and bony anatomy can the globe experience herniation or subluxation.⁴

A review of 31 cases in the literature found that 45 percent of them had vision at the level of counting fingers or better, while 39 percent had light perception or worse vision, and 16 percent didn't report any visual outcomes.⁵ Additionally, this review showed that same-day repair was linked to better visual outcomes, with eight out of 14 patients who underwent same-day repair achieving a vision of 20/40 or better, whereas none of the seven patients who had delayed repair beyond the first day reached such visual acuity.⁵

Most authors agree that immediate globe repositioning is crucial. Delayed treatment can lead to increased edema and pressure on the optic nerve and central retinal artery, raising the risk of irreversible vision loss.^{2,6,7} Like our patient, other cases in the literature have demonstrated that individuals initially presenting as having no light perception ultimately achieved 20/40 vision or better. However, it should be noted that outcomes related to eye motility were generally unfavorable, with only three out of 31 cases reporting minimal impairment in extraocular movement. Late enophthalmos is another complication in these cases and is due to displacement of orbital soft tissue into the enlarged bony orbit, fat atrophy, scar contracture and fibrosis of extraocular muscles.⁸

In terms of surgical techniques, there are two primary approaches described for repositioning the dislocated globe: direct traction with the aid of an instrument^{3,9,10} and manual repositioning of the globe through a trans-maxillary approach.^{1,6} For this patient, direct traction of the globe was

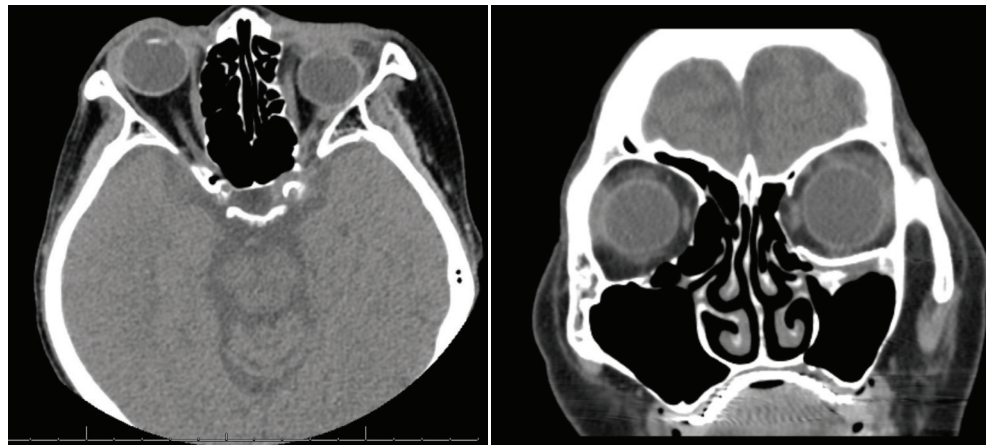


Figure 5. CT scans of the orbit at postoperative month five demonstrate good position of the globe in the superior/inferior axis and marked enophthalmos of the left eye.

able to successfully reposition the globe. Various materials have been used in these procedures, including titanium mesh, silicon sheets, autogenous bone and porous polyethylene. Titanium mesh was chosen for this patient as it had several advantages including biocompatibility, cost-effectiveness and the ability to be appropriately contoured to fit a large wall deficit.^{1,6}

In conclusion, traumatic globe subluxation is relatively uncommon. Same-day repair increases the probability of improved visual outcome. Surgical techniques include direct traction to reposition the globe to an anatomical location. Repair of the fracture is crucial to prevent re-subluxation of the globe. Persistent ocular motility restrictions and late enophthalmos are complications, even in the cases with good visual outcomes. ◀

1. Amaral MB, Nery AC. Traumatic globe dislocation into the paranasal sinuses: Literature review and treatment guidelines. *J Craniomaxillofac Surg* 2016;44:5:642-647.
2. Noman SA, Shindy MI. Immediate surgical management of traumatic dislocation of the eye globe into the maxillary sinus: Report of a rare case and literature review. *Craniomaxillofac Trauma Reconstr* 2017;10:2:151-158.
3. Kreiner B, Amer R, Sharfi G, Solomon A, Ilisar M. Traumatic displacement of the globe into the paranasal sinuses: Case report and guidelines for treatment. *J Oral Maxillofac Surg* 2008;66:4:826-830.
4. Alam MS, Noronha OV, Mukherjee B. Timing of surgery in traumatic globe dislocation. *Indian J Ophthalmol* 2017;65:8:767-770.
5. Lajoie J, Marous C, Wladis E. A case of traumatic globe subluxation into the paranasal sinuses. Abstract presented at: American Society of Ophthalmic Trauma, Paper Session III. June 4, 2022.
6. Haggerty CJ, Roman P. Repositioning of a traumatically displaced globe with maxillary antrostomy: Review of the literature and treatment recommendations. *J Oral Maxillofac Surg* 2013;71:11:1915-1922.
7. Ramstead C, McCabe J, Alkahtani M, Leong-Sit J, Morhart M. Traumatic dislocation of the globe into the maxillary sinus. *Can J Ophthalmol* 2008;43:3:364-366.
8. Hazani R, Yaremchuk MJ. Correction of posttraumatic enophthalmos. *Arch Plast Surg* 2012;39:1:11-17.
9. Xu B, Xu XL, Yan J. Treatment of traumatic globe dislocated completely into the maxillary sinus. *Int J Ophthalmol* 2013;6:1:106-107.
10. Abrishami M, Aletaha M, Bagheri A, Salour SH, Yazdani S. Traumatic subluxation of the globe into the maxillary sinus. *Ophthalmic Plast Reconstr Surg* 2007;23:2:156-158.



EDITED BY KULDEV SINGH, MD, MPH,
AND PETER A. NETLAND, MD, PhD

GLAUCOMA MANAGEMENT

Neurostimulation for Vision Restoration

How neurostimulation research in glaucoma is progressing, and why stress management might help.

CHRISTINE YUE LEONARD
SENIOR ASSOCIATE EDITOR

The retina and optic nerve receive the lion's share of attention when it comes to glaucoma, but an increasing amount of evidence suggests that brain function may have some role to play as well. One potential vision therapy, known as repetitive transorbital alternating current stimulation or rtACS, delivers electrical impulses to the brain, aiming to modulate damaged brain networks and improve low vision. Early studies show promising results. Here, experts explain how this technology works, what it means for glaucoma treatment, and how reducing stress may lead to better outcomes.

Residual Vision

“The concept behind rtACS is that there are nerves—ganglion cells—that are dead in glaucoma, but then there's a penumbra of surrounding ganglion cells that may be injured but not dead,” says Joel Schuman, MD, of Wills Eye Hospital in Philadelphia. “Neurostimulation enhances the function of those injured retinal ganglion cells.”

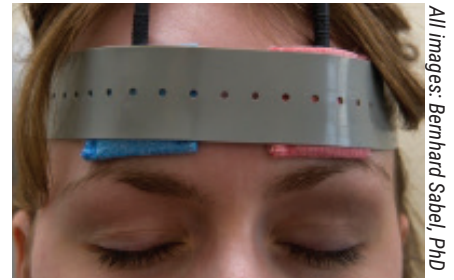
“We refer to these as ‘silent neurons,’” says Bernhard Sabel, PhD, of Otto-von-Guericke University of Magdeburg in Germany, who first proposed the idea of residual vision activation in 2011¹ and back in 1998 demonstrated that computer-based visual training could

improve visual field defects resulting from brain injury.² “Neurons can fall into an inactive state due to damage from long-term or sudden vasoconstriction. Reactivating these silent neurons to improve vision can be achieved by electrical stimulation, which mimics the brain's electrical impulses, helping the brain's functional networks to reorganize themselves in a more normal structure.”

The human brain is remarkably adaptable. “The brain has billions of nerve cells and they're all connected to each other functionally,” explains Dr. Sabel. “Neural signals can travel from anywhere in the brain to any other place in the brain by just four or five synaptic connections. A hundred billion nerve cells with 10,000 synapses make for a lot of options when forming functional connections. Of course, these only travel along the anatomical connections in the brain.

“A functional connection is the path that one nerve signal travels to reach its target,” he continues. “It could take a direct route—a one-to-one anatomical line from point A to point B—but it typically doesn't. Usually, neural signals jump across several synapses to reach their target. When you have damage—dead or injured neurons—it creates a hole in the network and forces the information to travel on a different route. The damage produces desynchronization, or a disturbance of the brain network.”

In studying functional brain connectivity features in partially blind



All images: Bernhard Sabel, PhD

The repetitive transorbital alternating current stimulation device on a glaucoma patient. Therapy is administered for 10 days.

patients with peripheral optic nerve lesions treated using rtACS,³ Dr. Sabel and his colleagues found that visual field improvements were associated with resynchronization of alpha band coherence, an electroencephalogram rhythm that regulates the functional connectivity between brain regions.

This reorganization of brain networks, also called neuromodulation, was also noted in optic neuropathy patients who underwent rtACS therapy.⁴ The multicenter, prospective, randomized, double-blind study included 45 rtACS-treated patients and 37 sham-stimulation patients. Each underwent daily treatment or sham treatment for 50 minutes over a 10-day period. At two months, the rtACS-treated group showed a mean visual field improvement of 24 percent, compared with a 2.5-percent improvement in the sham-stimulation patients. Near-threshold visual fields in the central five degrees also improved, along with thresholds in static perimetry and reaction times after treatment. No visual acuity changes were noted in the treatment vs. sham group. The researchers noted that visual field improvements from rtACS were associated with electroencephalogram power-spectra and coherence alterations in visual cortical networks, which are considered signs of neuromodulation. They concluded that the treatment was safe and effective

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Dr. Singh is a professor of ophthalmology and chief of the Glaucoma Division at Stanford University School of Medicine. He is a consultant to Alcon, Allergan, Santen, Sight Sciences, Glaukos and Ivantis. **Dr. Netland** is Vernah Scott Moyston Professor and Chair at the University of Virginia in Charlottesville.

for partial vision restoration after optic nerve damage and worked presumably by modulating brain plasticity.

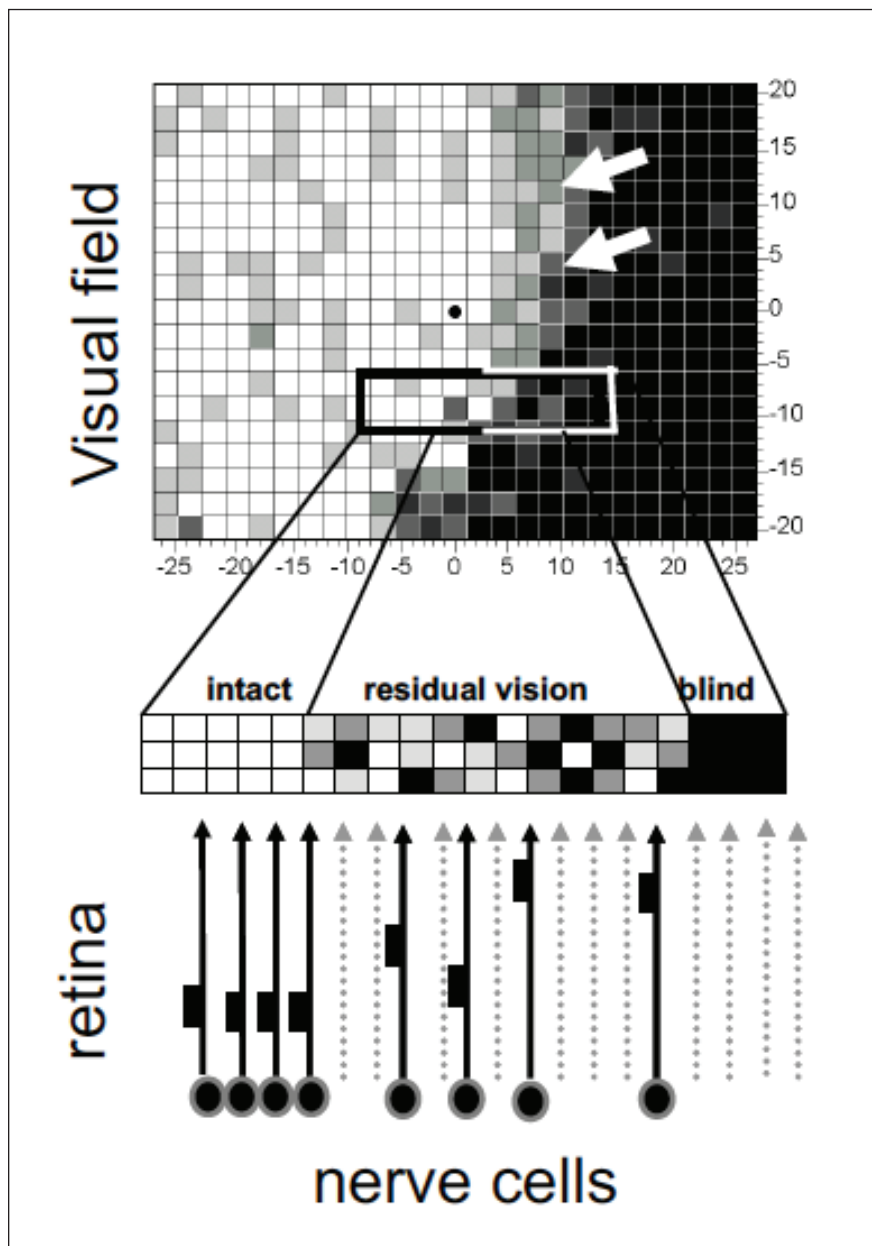
The rtACS therapy was also reported to improve visual and cognitive deficits in two patients suffering from long-COVID.⁵ An analysis of retinal vessels showed reduced vascular dysregulation after treatment, in addition to partial reversal of visual field loss and improved cognitive subfunctions. Since SARS-CoV-2 infection has been shown to cause reduced capacity for blood flow,⁶ the researchers propose that recovery was linked to restoration of vascular autoregulation and subsequent reoxygenation of neurons, though further research is needed.

Dr. Sabel says that improving vascular regulation is an important component of rtACS therapy. He points out that “restoration of the injured neurons requires the return of sufficient blood supply, which is achieved in part by muscle relaxation and subsequent vasodilation from electrical stimulation and by stress reduction.”

Repetitive Transorbital Alternating Current Stimulation (rtACS)

The rtACS device produces a mild electrical current that’s transmitted to the body through the orbit. “There are little pads that are in contact with the skin above the orbit,” Dr. Schuman explains. “That electrical stimulation is believed to stimulate the retina, optic nerve and anterior brain to improve their function. The device was developed by Bernhard Sabel, PhD, in Germany and we’re collaborating with him on our studies. We had two different studies at NYU. One was a randomized controlled clinical trial with 15 subjects.”⁷

The subjects were randomized to either a treatment group or a sham group whose subjects thought they were receiving treatment but were not. (This was achieved by tuning the device as if subjects were going to receive treatment, to a level that yielded phosphenes, and then turning the device down to a level at which subjects wouldn’t feel anything, Dr. Schuman explains.)

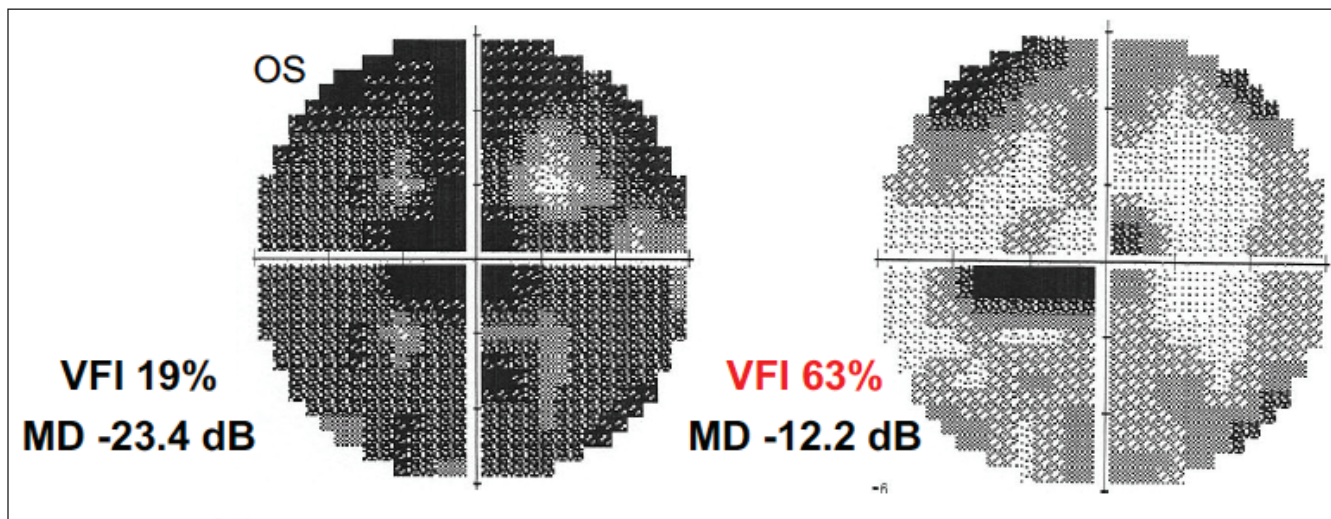


Neurostimulation research has shown that it’s not necessarily an all-or-nothing situation with neurons. Some may be damaged rather than dead. These “silent” neurons (areas of residual vision) are the target of rtACS treatment.

The treatment consisted of 10 approximately 45-minute sessions over a two-week period, where subjects would come into the office every weekday to receive treatment. “What we found was a trend, but not a statistically significant finding, for improvement in visual field,” Dr. Schuman says. “There was a statistically significant finding for improvement in quality of life in the treatment group vs. sham. I’d say this is encouraging. We measured several different quality-of-

life parameters, using a comprehensive combination of those parameters.”

Dr. Schuman’s group also ran an expanded access or compassionate use study, where all subjects knew they were receiving the treatment. “These were patients who didn’t qualify for the pilot study,” Dr. Schuman explains. “We treated around 70 people. What we found was that both in the pilot study and in the expanded access study, there were certain people who responded with



Visual field improvement in a 52-year-old female patient with primary open-angle glaucoma after a 10-day course of daily 20- to 40-minute rtACS sessions at <2 mAmp, 5-25 Hz.

an improvement in visual fields.

“This improvement had a characteristic pattern, where there would be a steep improvement in mean deviation over several tests and then a slowing of that improvement and stabilization,” he continues. “After a certain amount of time—which could be months or years—most of these patients who saw improvement experienced a decline of that improvement back to baseline. If they were retreated at that point, these patients sustained a similar improvement to that of the initial treatment.”

He says it’s unclear why these patients in particular improved. “We haven’t done that analysis yet, but it would certainly be good to know so that we could predict who would have a significant benefit from the treatment,” he says.

Of the patients who noticed an effect of the treatment, Dr. Schuman says they would describe an improvement in the area of “glaucoma fog,” that the fog had cleared in a certain area. “Now, these were patients who had knowledge that they were actually receiving treatment,” he notes. “I have to wonder if there’s bias because of that expectation of improvement. The randomized controlled pilot study is much more convincing in terms of the potential benefit of this treatment. But the expanded access study allowed us to look at more people, and there were spontaneous expressions of what the subject was experiencing. I thought that

was an interesting description of their subjective experience following treatment.”

He adds that some subjects noticed an improvement in their perception of colors and said things looked brighter. “I would say those were fewer—it was mostly the glaucoma fog,” he says. “If subjects noticed an improvement, it was usually described in that way.”

What does neurostimulation research add to our understanding of glaucoma pathogenesis? “I think it helps us understand that not all neurons that aren’t functioning properly are dead,” Dr. Schuman says. “There may be some small fraction of the damaged neurons that we’re able to recover.” He emphasizes that this form of neuro-enhancement shouldn’t be confused with neuro-regeneration. “I think that’s an important distinction. We aren’t actually bringing any neurons back to life.”

Dr. Schuman says it’s important to point out that there’s currently no well-established treatment that improves vision in people with glaucoma. “While we only saw a trend in our small pilot study toward visual field improvement, we did have individuals in whom we noticed this type of improvement that I described. And nothing does that. I think that’s very encouraging, and it’s grounds for further larger studies of this technology. There’s a home version of this technology that’s currently being

tested. NYU set up a study to look into it with Stanford, and Wills will soon join that collaborative study.

“I think that if it turns out that our preliminary findings and the findings that Dr. Sabel reports are reproduced, or they’re expanded, this could easily find its way toward clinical treatment,” he says. “It’s basically a risk-free treatment, and it may enhance glaucoma patients’ vision. It seems to statistically significantly improve their quality of life, so I would be optimistic about it becoming a clinical tool.”

In Early Clinical Trials

An at-home rtACS device is currently in clinical trials. Study investigator Jeffrey L. Goldberg, MD, of Stanford University, writes in an emailed comment, “Dr. Sabel has shown efficacy over the years using a two-week (10-day) course of electrical stimulation to improve patients’ vision or visual fields. This multicenter trial is designed to test whether a two-month course of self-treatment at home would work similarly, or even work better than these prior approaches.”

The clinical trial at Stanford and NYU is currently recruiting study participants to test the safety and efficacy of long-term rtACS therapy with an at-home device in patients with open-angle glaucoma (NCT05626491). A study for optic neuropathies (NCT05626426)

is also recruiting at Stanford. The randomized, double-masked glaucoma study involves active or sham treatment with the device every other day over eight weeks. Estimated enrollment is 45 patients. Primary outcome measures include six-month change from baseline in visual field assessed by Humphrey Visual Field Index. Secondary outcome measures include six-month changes from baseline in visual field assessed by Humphrey mean deviation, by Pelli-Robson contrast sensitivity and by Snel-len visual acuity.

The Stress Factor

Dr. Sabel has treated more than 2,000 patients over the last decade with this neurostimulation therapy at the Savir-Center in Magdeburg, Germany. He says that improvement asymptotes and reaches a ceiling, so in general patients with moderate or severe disease will gain more benefit than a patient with minimal vision loss. However, response to treatment varies considerably.

“A regular question I get from patients is ‘how much will it improve my vision?’ We don’t make those predictions,” he says. “Even a very small change could be subjectively meaningful to the patient. We’ve found that the patient’s response and how much they improve depends not only on the electrical stimulation they receive but also on mental attitude.”

According to Dr. Sabel, of the patients treated for a 10-day course at the Savir-Center, about 85 percent show visual function improvement and about 15 percent benefit very little or not at all. He attributes these outcomes to variations in mental stress.

How does stress influence the amount of residual vision a patient has or gains back? “Most patients always have some residual vision, but stress can reduce the amount,” claims Dr. Sabel. “The influence of stress is two-fold. The sympathetic nervous system activates the body’s fight-or-flight response, and the body undergoes a typical stress response: muscle tension; increased attention; increased blood pressure; and adrenaline release. The parasympathetic nervous

system reduces activity. When this system dominates, the body is calmer with less muscle tension, normalized vessel constriction and activated gland activity. Meditation and breathing exercises can bring the two systems back into balance. Remaining in an overstressed state is unhealthy, and I believe it contributes to glaucoma. Vascular dysregulation is a key feature of glaucoma in addition to neuronal health. Vasoconstriction results in decreased blood flow and oxygen availability to nerve cells, often causing the nerve cells to go into a quiet, inactive state.”



“It’s a massive mental relief to patients when you reassure them that they won’t go blind. Barring very severe cases, delivering this optimistic message will do more good than harm.”

— **Bernhard Sabel, PhD**



In a prospective trial of 90 POAG patients (180 eyes) randomized to a daily meditation group for 21 days or a waitlist group, mindfulness-based stress reduction was found to significantly lower IOP, improve quality of life (WHO QOL questionnaire) and normalize typical stress biomarkers, including cortisol, IL-6, TNF-*alpha*, reactive oxygen species, beta-endorphins, brain-derived neurotrophic factor and total antioxidant capacity (all $p < 0.001$). Additionally, positive parallel changes in gene expression were also observed, leading the researchers to conclude that mindfulness meditation is a useful adjunctive therapy in glaucoma.⁸

Dr. Schuman notes that further study is needed to determine the role stress plays on glaucoma. “We don’t know much about the effect emotional stress has on glaucoma or the perception of people who have glaucoma,” Dr. Schuman says. “I don’t negate it, but we

need more information.”

Relaxation Techniques

Dr. Sabel is currently involved in a controlled trial (NCT04037384) to compare what he calls eye yoga, which includes eye movement exercises and meditation, for four weeks vs. active control (passive reading). Estimated enrollment is 40 participants, randomized to treatment or control arms. Primary outcome measures include visual field change, evaluated by static perimetry and high-resolution perimetry and changes in deviation of eye movements when visual targets are followed, using a computerized test. Secondary outcome measures include changes in the diameter of ocular blood vessels measured using vessel analysis and changes in alpha power using EEG recording (128 channels).

“We adopted meditation techniques and offer them to our patients now in conjunction with electrical stimulation therapy, which is the double-punch to increase blood vessel diameter and get the neurons firing again,” he continues. “Yoga is a way of life, not just a series of asanas or poses, and I call this eye yoga—the combination of eye exercises plus meditation. Along with psychological consulting aimed at improving stress resilience, we support patients to live a more relaxed life overall.”

He explains that the eye exercises involve moving the eye right, left, up, down and in circles. He also recommends palming (covering both eyes and then removing the palm to induce pupillary contraction), gentle massage around the eye, and massaging the neck. “The neck’s very important,” he says. “Tension in the neck and head region can lead to headaches and can be bad for vision.

“As you might imagine, these relaxation techniques only work if the patient isn’t afraid,” Dr. Sabel points out. “Patients who constantly dwell on the idea of going blind, losing vision if they don’t do x, y and z, or just on the fact that they have a progressive sight-threatening disease, will find it more difficult to relax and release stress.”

For this reason, he says it’s important that clinicians focus on positivity

during patient interactions. “Glaucoma is well-known as a sight-threatening condition, and treatment is aimed at slowing its progression,” he says. “Patients take their drops in order to avoid losing more vision, but to patients, this often translates as ‘to avoid going blind.’ Therefore, communicating with the patient in a manner that emphasizes the positive is important to alleviate fear and reduce patient stress.”

While it’s very rare for individuals to have zero light perception, this is often what patients associate with blindness. “Usually, ‘blind’ for a patient means black-blind in both eyes and no vision whatsoever,” Dr. Sabel says. “Tell patients, ‘You will not go blind.’ Even if a doctor doesn’t explicitly tell a patient they could or will go blind, patients often have this intense fear. What you say isn’t always what the patient hears, and what the patient hears, they don’t necessarily understand or even agree with. When patients are afraid and have a negative outlook, they’re more likely to have anxiety about their condition. They may stay home more often and become socially isolated. All of this creates stress. It’s a massive mental relief to patients when you reassure them that they won’t go blind. Barring very severe cases, delivering this optimistic message will do more good than harm.

“Ophthalmologists don’t have a lot of time to talk with their patients,” he acknowledges. “They may see 100 patients in a day, and don’t have psychologists in their office who can talk about vision loss, stress or quality of life issues with patients. This, we may not be able to change. But ophthalmologists can try to allay fears by approaching patients with confident, positive attitudes. In a nutshell, my recommendation would be: Tell patients that the future outlook is optimistic. Say, ‘Here’s the treatment plan to preserve the vision you have. Take your drops, drink enough water, try to relax and not get yourself stressed out.’”

- Sabel BA, Henrich-Noack P, Fedorov A, Gall C. Vision restoration after brain and retina damage: The “residual vision activation theory”. In: Andrea M. Green, C. Elaine Chapman, John F. Kalaska, and Franco Lepore, eds. *Progress in Brain Research* vol. 192—Enhancing performance for action and perception: Multisensory integration, neuroplasticity and neuroprosthetics, Part II. New York: Elsevier, 2011:199-262.
- Kasten E, Wüst S, Behrens-Baumann W, Sabel BA. Computer-based training for the treatment of partial blindness. *Nature Medicine* 1998;4:1083-1087.
- Bola M, Gall C, Moewes C, et al. Brain functional connectivity network breakdown and restoration in blindness. *Neurology* 2014;83:542-551.
- Gall C, Schmidt S, Schittkowski MP, et al. Alternating current stimulation for vision restoration after optic nerve damage: A randomized clinical trial. *PLoS One* 2016;11:6:e0156134.
- Sabel BA, Zhou W, Huber F, et al. Non-invasive brain microcurrent stimulation therapy of long-COVID-19 reduces vascular dysregulation and improves visual and cognitive impairment. *Restorative Neurology and Neuroscience* 2021;39:6:393-408.
- Ahmed AI, Saad JM, Han Y, et al. Coronary microvascular health in patients with prior COVID-19 infection. *JACC Cardiovasc Imaging* 2022;5:12:2153-2155.
- Sohn A, Cadena M, Lee T, et al. Effect of repetitive transorbital alternating current stimulation (rtACS) on vision-related quality of life (QoL) in subjects with glaucoma. *Invest Ophthalmol Vis Sci* 2023;64:4351.
- Dada T, Mittal D, Mohanty K, et al. Mindfulness meditation reduces intraocular pressure, lowers stress biomarkers and modulates gene expression in glaucoma: A randomized controlled trial. *J Glaucoma* 2018;27:1061-1067.

DISCLOSURES

Dr. Sabel is the creator of the rtACS device in clinical trials and the founder of the Savir-Center in Magdeburg, Germany. **Dr. Goldberg** and **Dr. Schuman** have no related financial disclosures.

XDEMYV™ (lotilaner ophthalmic solution) 0.25%, for topical ophthalmic use

BRIEF SUMMARY OF PRESCRIBING INFORMATION
Please see the XDEMYV™ package insert for full Prescribing Information.

INDICATIONS AND USAGE
XDEMYV is indicated for the treatment of Demodex blepharitis.

CONTRAINDICATIONS
None.

WARNINGS AND PRECAUTIONS
Risk of Contamination Do not allow the tip of the dispensing container to contact the eye, surrounding structures, fingers, or any other surface in order to minimize contamination of the solution. Serious damage to the eye and subsequent loss of vision may result from using contaminated solutions.

Use with Contact Lenses Contact lenses should be removed prior to instillation of XDEMYV and may be reinserted 15 minutes following its administration.

ADVERSE REACTIONS
Because clinical studies are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

XDEMYV was evaluated in 833 patients with Demodex blepharitis in two randomized, double-masked, vehicle-controlled studies (Saturn-1 and Saturn-2) with 42 days of treatment. The most common ocular adverse reaction observed in controlled clinical studies with XDEMYV was instillation site stinging and burning which was reported in 10% of patients. Other ocular adverse reactions reported in less than 2% of patients were chalazion/hordeolum and punctate keratitis.

USE IN SPECIFIC POPULATIONS
Pregnancy: Risk Summary There are no available data on XDEMYV use in pregnant women to inform any drug associated risk; however, systemic exposure to lotilaner from ocular administration is low. In animal reproduction studies, lotilaner did not produce malformations at clinically relevant doses.

Data Animal Data In an oral embryofetal developmental study in pregnant rats dosed during organogenesis from gestation days 6-19, increased post-implantation loss, reduced fetal pup weight, and incomplete skeletal ossification were observed at 50 mg/kg/day (approximately 1390 times the recommended human ophthalmic dose (RHOD) on a body surface area basis) in the presence of maternal toxicity (i.e., decreased body weight and food consumption). A rare malformation of situs inversus of the thoracic and abdominal viscera occurred in 1 fetus from a pregnant rat receiving 50 mg/kg/day; whether this finding was treatment-related could not be excluded. No maternal or embryofetal toxicity was observed at 18 mg/kg/day (approximately 501 times the RHOD on a body surface area basis). In an oral embryofetal development study in pregnant rabbits dosed during organogenesis from gestation days 7-19, no embryofetal toxicity or teratogenic findings were observed at 20 mg/kg/day (approximately 580-times the RHOD on an AUC basis), even in the presence of maternal toxicity (i.e., decreased food consumption and body weight).

In an oral two-generation reproductive toxicity study, F0 male and female rats were administered lotilaner at doses up to 40 mg/kg/day for 10 weeks before pairing and during the 2-week pairing period (3 weeks for males). Dosing for F0 females continued through lactation day 22. F1 male and female rats were administered lotilaner at 1 and 5 mg/kg/day post-weaning from day 23 for 10 weeks before pairing and during the 2-week pairing period (3 weeks for males). Dosing for F1 parenteral females continued through lactation day 22. There were no clear adverse effects on the F1 generation, and a slightly lower mean body weight during lactation was noted for F2 pups at 5 mg/kg/day. The no observed adverse effect level (NOAEL) was determined to be 5 mg/kg/day

(approximately 139 times the RHOD on a body surface area basis).

Lactation: Risk Summary There are no data on the presence of XDEMYV in human milk, the effects on the breastfed infant, or the effects on milk production. However, systemic exposure to lotilaner following 6 weeks of topical ocular administration is low and is >99% plasma protein bound, thus it is not known whether measurable levels of lotilaner would be present in maternal milk following topical ocular administration. The developmental and health benefits of breastfeeding should be considered along with the mother’s clinical need for XDEMYV and any potential adverse effects on the breast-fed child from XDEMYV.

Pediatric Use: Safety and effectiveness in pediatric patients below the age of 18 years have not been established.

Geriatric Use: No overall differences in safety or effectiveness have been observed between elderly and other adult patients.

NONCLINICAL TOXICOLOGY
Carcinogenesis, Mutagenesis, Impairment of Fertility
Carcinogenesis Long-term studies in animals have not been performed to evaluate the carcinogenic potential of lotilaner.

Mutagenesis Lotilaner was not genotoxic in the following assays: Ames assay for bacterial gene mutation, *in vitro* chromosomal aberration assay in cultured human peripheral blood lymphocytes, and *in vivo* rat micronucleus test.

Impairment of fertility In a two-generation study of reproductive performance in rats, F0 male and female rats were administered lotilaner at oral doses of 40 mg/kg/day for 80 days reduced to 20 mg/kg/day for 47-50 supplementary days. Reduced pregnancy rates and decreased implantation rates were observed in F0 females at doses 20 mg/kg/day (approximately 556 times the RHOD on a body surface area basis), which were also associated with maternal toxicity (i.e., decreased body weight and food consumption). No effects on fertility were observed in F0 females at the dose of 5 mg/kg/day (approximately 139 times the MRHOD on a body surface area basis). No effects on fertility were observed in F1 males at the oral dose of 20 mg/kg/day (approximately 556 times the RHOD on a body surface area basis), and no effects on fertility were observed in F1 males and females at the oral dose of 5 mg/kg/day (approximately 139 times the RHOD on a body surface area basis).

PATIENT COUNSELING INFORMATION
Handling the Container Instruct patients to avoid allowing the tip of the dispensing container to contact the eye, surrounding structures, fingers, or any other surface in order to minimize contamination of the solution. Serious damage to the eye and subsequent loss of vision may result from using contaminated solutions.

When to Seek Physician Advice
Advise patients that if they develop an intercurrent ocular condition (e.g., trauma or infection), have ocular surgery, or develop any ocular reactions, particularly conjunctivitis and eyelid reactions, they should immediately seek their physician’s advice concerning the continued use of XDEMYV.

Use with Contact Lenses Advise patients that XDEMYV contains potassium sorbate, which may discolor soft contact lenses. Contact lenses should be removed prior to instillation of XDEMYV and may be reinserted 15 minutes following its administration.

Use with Other Ophthalmic Drugs Advise patients that if more than one topical ophthalmic drug is being used, the drugs should be administered at least 5 minutes between applications.

Missed Dose Advise patients that if one dose is missed, treatment should continue with the next dose.

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during patient interactions. “Glaucoma is well-known as a sight-threatening condition, and treatment is aimed at slowing its progression,” he says. “Patients take their drops in order to avoid losing more vision, but to patients, this often translates as ‘to avoid going blind.’ Therefore, communicating with the patient in a manner that emphasizes the positive is important to alleviate fear and reduce patient stress.”

While it's very rare for individuals to have zero light perception, this is often what patients associate with blindness. “Usually, ‘blind’ for a patient means black-blind in both eyes and no vision whatsoever,” Dr. Sabel says. “Tell patients, ‘You will not go blind.’ Even if a doctor doesn't explicitly tell a patient they could or will go blind, patients often have this intense fear. What you say isn't always what the patient hears, and what the patient hears, they don't necessarily understand or even agree with. When patients are afraid and have a negative outlook, they're more likely to have anxiety about their condition. They may stay home more often and become socially isolated. All of this creates stress. It's a massive mental relief to patients when you reassure them that they won't go blind. Barring very severe cases, delivering this optimistic message will do more good than harm.

“Ophthalmologists don't have a lot of time to talk with their patients,” he acknowledges. “They may see 100 patients in a day, and don't have psychologists in their office who can talk about vision loss, stress or quality of life issues with patients. This, we may not be able to change. But ophthalmologists can try to allay fears by approaching patients with confident, positive attitudes. In a nutshell, my recommendation would be: Tell patients that the future outlook is optimistic. Say, ‘Here's the treatment plan to preserve the vision you have. Take your drops, drink enough water, try to relax and not get yourself stressed out.’”

1. Sabel BA, Henrich-Noack P, Fedorov A, Gall C. Vision restoration after brain and retina damage: The “residual vision activation theory”. In: Andrea M. Green, C. Elaine Chapman, John F. Kalaska, and Franco Lepore, eds. *Progress in Brain Research* vol. 192—Enhancing performance for action and perception: Multisensory integration, neuroplasticity and neuroprosthetics, Part II. New York: Elsevier, 2011:199-262.
2. Kasten E, Wüst S, Behrens-Baumann W, Sabel BA. Computer-based training for the treatment of partial blindness. *Nature Medicine* 1998;4:1083-1087.
3. Bola M, Gall C, Moewes C, et al. Brain functional connectivity network breakdown and restoration in blindness. *Neurology* 2014;83:542-551.
4. Gall C, Schmidt S, Schittkowski MP, et al. Alternating current stimulation for vision restoration after optic nerve damage: A randomized clinical trial. *PLoS One* 2016;11:6:e0156134.
5. Sabel BA, Zhou W, Huber F, et al. Non-invasive brain microcurrent stimulation therapy of long-COVID-19 reduces vascular dysregulation and improves visual and cognitive impairment. *Restorative Neurology and Neuroscience* 2021;39:6:393-408.
6. Ahmed AI, Saad JM, Han Y, et al. Coronary microvascular health in patients with prior COVID-19 infection. *JACC Cardiovasc Imaging* 2022;5:12:2153-2155.
7. Sohn A, Cadena M, Lee T, et al. Effect of repetitive transorbital alternating current stimulation (rtACS) on vision-related quality of life (QoL) in subjects with glaucoma. *Invest Ophthalmol Vis Sci* 2023;64:4351.
8. Dada T, Mittal D, Mohanty K, et al. Mindfulness meditation reduces intraocular pressure, lowers stress biomarkers and modulates gene expression in glaucoma: A randomized controlled trial. *J Glaucoma* 2018;27:1061-1067.

DISCLOSURES

Dr. Sabel is the creator of the rtACS device in clinical trials and the founder of the Savir-Center in Magdeburg, Germany. **Dr. Goldberg** and **Dr. Schuman** have no related financial disclosures.

XDEMZY™ (lotilaner ophthalmic solution) 0.25%, for topical ophthalmic use

BRIEF SUMMARY OF PRESCRIBING INFORMATION

Please see the XDEMZY™ package insert for full Prescribing Information.

INDICATIONS AND USAGE

XDEMZY is indicated for the treatment of Demodex blepharitis.

CONTRAINDICATIONS

None.

WARNINGS AND PRECAUTIONS

Risk of Contamination Do not allow the tip of the dispensing container to contact the eye, surrounding structures, fingers, or any other surface in order to minimize contamination of the solution. Serious damage to the eye and subsequent loss of vision may result from using contaminated solutions.

Use with Contact Lenses Contact lenses should be removed prior to instillation of XDEMZY and may be reinserted 15 minutes following its administration.

ADVERSE REACTIONS

Because clinical studies are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

XDEMZY was evaluated in 833 patients with Demodex blepharitis in two randomized, double-masked, vehicle-controlled studies (Saturn-1 and Saturn-2) with 42 days of treatment. The most common ocular adverse reaction observed in controlled clinical studies with XDEMZY was instillation site stinging and burning which was reported in 10% of patients. Other ocular adverse reactions reported in less than 2% of patients were chalazion/hordeolum and punctate keratitis.

USE IN SPECIFIC POPULATIONS

Pregnancy: Risk Summary There are no available data on XDEMZY use in pregnant women to inform any drug associated risk; however, systemic exposure to lotilaner from ocular administration is low. In animal reproduction studies, lotilaner did not produce malformations at clinically relevant doses.

Data Animal Data In an oral embryofetal developmental study in pregnant rats dosed during organogenesis from gestation days 6-19, increased post-implantation loss, reduced fetal pup weight, and incomplete skeletal ossification were observed at 50 mg/kg/day (approximately 1390 times the recommended human ophthalmic dose (RHOD) on a body surface area basis) in the presence of maternal toxicity (i.e., decreased body weight and food consumption). A rare malformation of situs inversus of the thoracic and abdominal viscera occurred in 1 fetus from a pregnant rat receiving 50 mg/kg/day; whether this finding was treatment-related could not be excluded. No maternal or embryofetal toxicity was observed at 18 mg/kg/day (approximately 501 times the RHOD on a body surface area basis). In an oral embryofetal development study in pregnant rabbits dosed during organogenesis from gestation days 7-19, no embryofetal toxicity or teratogenic findings were observed at 20 mg/kg/day (approximately 580-times the RHOD on an AUC basis), even in the presence of maternal toxicity (i.e., decreased food consumption and body weight).

In an oral two-generation reproductive toxicity study, F0 male and female rats were administered lotilaner at doses up to 40 mg/kg/day for 10 weeks before pairing and during the 2-week pairing period (3 weeks for males). Dosing for F0 females continued through lactation day 22. F1 male and female rats were administered lotilaner at 1 and 5 mg/kg/day post-weaning from day 23 for 10 weeks before pairing and during the 2-week pairing period (3 weeks for males). Dosing for F1 parenteral females continued through lactation day 22. There were no clear adverse effects on the F1 generation, and a slightly lower mean body weight during lactation was noted for F2 pups at 5 mg/kg/day. The no observed adverse effect level (NOAEL) was determined to be 5 mg/kg/day

(approximately 139 times the RHOD on a body surface area basis).

Lactation: Risk Summary There are no data on the presence of XDEMZY in human milk, the effects on the breastfed infant, or the effects on milk production. However, systemic exposure to lotilaner following 6 weeks of topical ocular administration is low and is >99% plasma protein bound, thus it is not known whether measurable levels of lotilaner would be present in maternal milk following topical ocular administration. The developmental and health benefits of breastfeeding should be considered along with the mother's clinical need for XDEMZY and any potential adverse effects on the breast-fed child from XDEMZY.

Pediatric Use: Safety and effectiveness in pediatric patients below the age of 18 years have not been established.

Geriatric Use: No overall differences in safety or effectiveness have been observed between elderly and other adult patients.

NONCLINICAL TOXICOLOGY

Carcinogenesis, Mutagenesis, Impairment of Fertility

Carcinogenesis Long-term studies in animals have not been performed to evaluate the carcinogenic potential of lotilaner.

Mutagenesis Lotilaner was not genotoxic in the following assays: Ames assay for bacterial gene mutation, *in vitro* chromosomal aberration assay in cultured human peripheral blood lymphocytes, and *in vivo* rat micronucleus test.

Impairment of fertility In a two-generation study of reproductive performance in rats, F0 male and female rats were administered lotilaner at oral doses of 40 mg/kg/day for 80 days reduced to 20 mg/kg/day for 47-50 supplementary days. Reduced pregnancy rates and decreased implantation rates were observed in F0 females at doses 20 mg/kg/day (approximately 556 times the RHOD on a body surface area basis), which were also associated with maternal toxicity (i.e., decreased body weight and food consumption). No effects on fertility were observed in F0 females at the dose of 5 mg/kg/day (approximately 139 times the MRHOD on a body surface area basis). No effects on fertility were observed in F1 males at the oral dose of 20 mg/kg/day (approximately 556 times the RHOD on a body surface area basis), and no effects on fertility were observed in F1 males and females at the oral dose of 5 mg/kg/day (approximately 139 times the RHOD on a body surface area basis).

PATIENT COUNSELING INFORMATION

Handling the Container Instruct patients to avoid allowing the tip of the dispensing container to contact the eye, surrounding structures, fingers, or any other surface in order to minimize contamination of the solution. Serious damage to the eye and subsequent loss of vision may result from using contaminated solutions.

When to Seek Physician Advice

Advise patients that if they develop an intercurrent ocular condition (e.g., trauma or infection), have ocular surgery, or develop any ocular reactions, particularly conjunctivitis and eyelid reactions, they should immediately seek their physician's advice concerning the continued use of XDEMZY.

Use with Contact Lenses Advise patients that XDEMZY contains potassium sorbate, which may discolor soft contact lenses. Contact lenses should be removed prior to instillation of XDEMZY and may be reinserted 15 minutes following its administration.

Use with Other Ophthalmic Drugs Advise patients that if more than one topical ophthalmic drug is being used, the drugs should be administered at least 5 minutes between administrations.

Missed Dose Advise patients that if one dose is missed, treatment should continue with the next dose.

RX only

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FDA-APPROVED TREATMENT FOR
DEMODEX BLEPHARITIS (DB)

INDICATIONS AND USAGE

XDEMZY (lotilaner ophthalmic solution) 0.25% is indicated for the treatment of *Demodex* blepharitis.

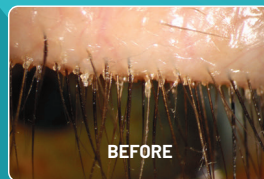
IMPORTANT SAFETY INFORMATION:

WARNINGS AND PRECAUTIONS

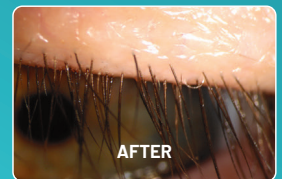
Risk of Contamination: Do not allow the tip of the dispensing container to contact the eye, surrounding structures, fingers, or any other surface in order to minimize contamination of the solution. Serious damage to the eye and subsequent loss of vision may result from using contaminated solutions.

Use with Contact Lenses: XDEMZY contains potassium sorbate, which may discolor soft contact lenses. Contact lenses should be removed prior to instillation of XDEMZY and may be reinserted 15 minutes following its administration.

Real results



BEFORE



AFTER

44% and 55% of patients taking XDEMZY in SATURN-1 (N=209) and SATURN-2 (N=193), respectively, achieved a significant improvement in their eyelids (reduction of collarettes to no more than 2 collarettes per upper lid) at Day 43 vs 7% (N=204) and 12% (N=200) of patients taking vehicle (P<0.01 in each trial).*

All images are of actual patients who participated in clinical trials for Tarsus Pharmaceuticals.

ADVERSE REACTIONS: The most common adverse reaction with XDEMZY was instillation site stinging and burning which was reported in 10% of patients. Other ocular adverse reactions reported in less than 2% of patients were chalazion/hordeolum and punctate keratitis.

Please see next page for a Brief Summary of the full Prescribing Information.

Reference: XDEMZY [prescribing information]. Tarsus Pharmaceuticals, Inc; 2023.

*The safety and efficacy of XDEMZY for the treatment of DB were evaluated in a total of 833 patients (415 of whom received XDEMZY) in two 6-week, randomized, multicenter, double-masked, vehicle-controlled studies (SATURN-1 and SATURN-2). Patients were randomized to either XDEMZY or vehicle at a 1:1 ratio, dosed twice daily in each eye for 6 weeks. All patients enrolled were diagnosed with DB. The primary efficacy endpoint was defined as the proportion of patients with collarette reduction to no more than 2 collarettes per upper eyelid at Day 43 (SATURN-1: XDEMZY N=209, vehicle N=204, P<0.01; SATURN-2: XDEMZY N=193, vehicle N=200, P<0.01).

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