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August 15, 2020 www.reviewofoptometry.com

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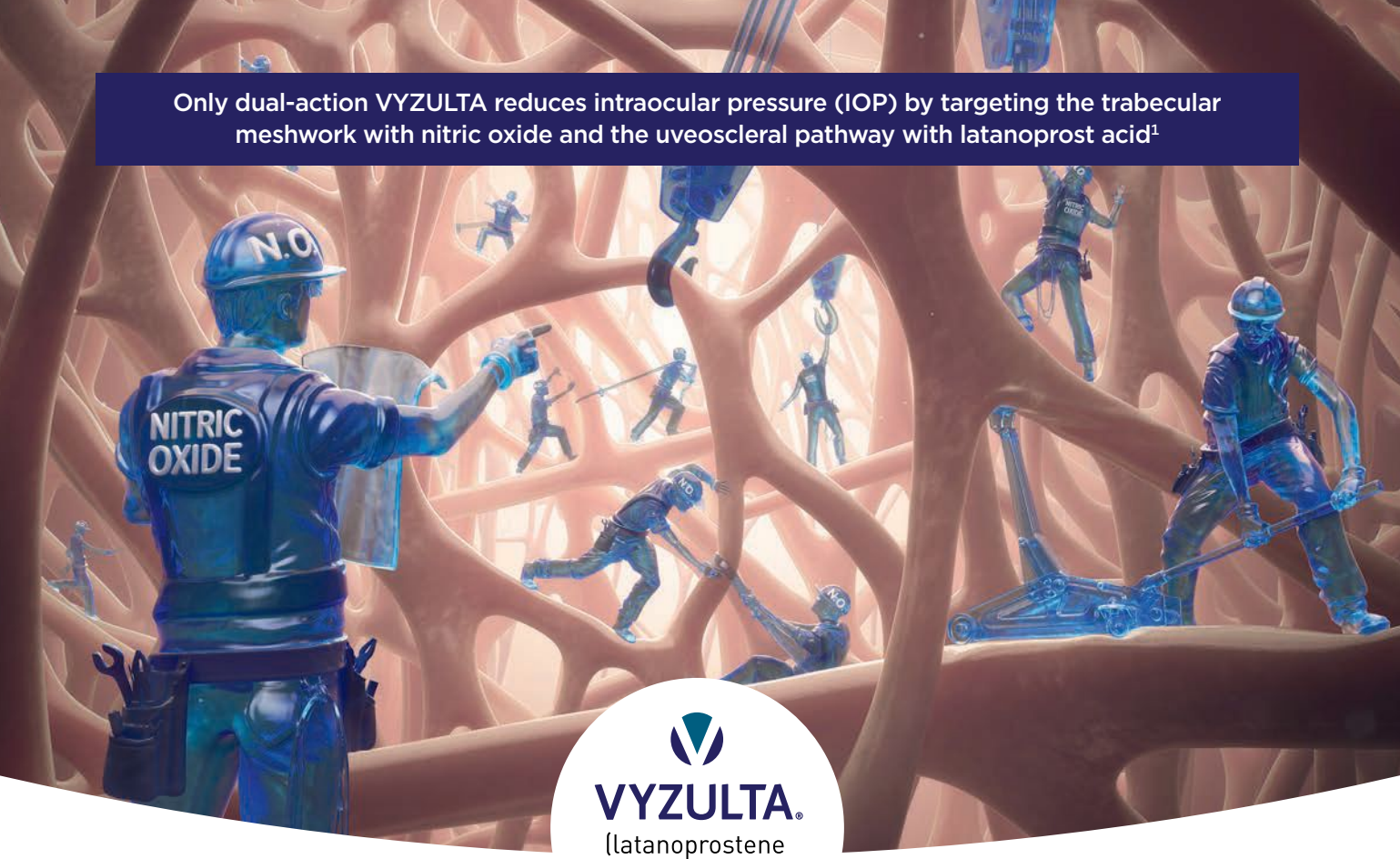

VYZULTA®
(latanoprostene bunod ophthalmic solution), 0.024%

EXPAND THE TRABECULAR MESHWORK WITH THE POWER OF NITRIC OXIDE[2-6]

VYZULTA achieved significant and sustained long-term IOP reductions vs Timolol 0.5% in pivotal trials[7]

P<0.001 vs baseline at all pre-specified visits over 12 months in a pooled analysis of APOLLO and LUNAR clinical trials (N=831)

VYZULTA demonstrated safety profile in clinical trials

Only 6 out of 811 patients discontinued due to ocular adverse events in APOLLO and LUNAR clinical trials[1,8,9]

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INDICATION

VYZULTA® (latanoprostene bunod ophthalmic solution), 0.024% is indicated for the reduction of intraocular pressure (IOP) in patients with open-angle glaucoma or ocular hypertension.

IMPORTANT SAFETY INFORMATION

- Increased pigmentation of the iris and periorbital tissue (eyelid) can occur. Iris pigmentation is likely to be permanent
- Gradual changes to eyelashes, including increased length, increased thickness, and number of eyelashes, may occur. These changes are usually reversible upon treatment discontinuation
- Use with caution in patients with a history of intraocular inflammation (iritis/uveitis). VYZULTA should generally not be used in patients with active intraocular inflammation
- Macular edema, including cystoid macular edema, has been reported during treatment with prostaglandin analogs. Use with caution in aphakic patients, in pseudophakic patients with a torn posterior lens capsule, or in patients with known risk factors for macular edema

IMPORTANT SAFETY INFORMATION cont'd

- There have been reports of bacterial keratitis associated with the use of multiple-dose containers of topical ophthalmic products that were inadvertently contaminated by patients
- Contact lenses should be removed prior to the administration of VYZULTA and may be reinserted 15 minutes after administration
- Most common ocular adverse reactions with incidence ≥2% are conjunctival hyperemia (6%), eye irritation (4%), eye pain (3%), and instillation site pain (2%)

For more information, please see Brief Summary of Prescribing Information on adjacent page.

References: 1. VYZULTA Prescribing Information. Bausch & Lomb Incorporated. **2.** Cavet ME. *J Ocul Pharmacol Ther*. 2018;34(1):52-60. DOI:10.1089/jop.2016.0188. **3.** Wareham LK. *Nitric Oxide*. 2018;77:75-87. DOI:10.1016/j.niox.2018.04.010. **4.** Stamer DW. *Curr Opin Ophthalmol*. 2012;23:135-143. DOI:10.1097/ICU.0b013e32834ff23e. **5.** Cavet ME. *Invest Ophthalmol Vis Sci*. 2015;56(6):4108-4116. **6.** Kaufman PL. *Exp Eye Research*. 2008;861:3-17. DOI:10.1016/j.exer.2007.10.007. **7.** Weinreb RN. *J Glaucoma*. 2018;27:7-15. **8.** Weinreb RN. *Ophthalmology*. 2016;123(5):965-973. **9.** Medeiros FA. *Am J Ophthalmol*. 2016;168:250-259.

BAUSCH + LOMB

BRIEF SUMMARY OF PRESCRIBING INFORMATION

This Brief Summary does not include all the information needed to use VYZULTA safely and effectively. See full Prescribing Information for VYZULTA.

VYZULTA® (latanoprostene bunod ophthalmic solution), 0.024%, for topical ophthalmic use.

Initial U.S. Approval: 2017

1 INDICATIONS AND USAGE

VYZULTA® (latanoprostene bunod ophthalmic solution) 0.024% is indicated for the reduction of intraocular pressure (IOP) in patients with open-angle glaucoma or ocular hypertension.

4 CONTRAINDICATIONS

None

5 WARNINGS AND PRECAUTIONS

5.1 Pigmentation

VYZULTA® (latanoprostene bunod ophthalmic solution), 0.024% may cause changes to pigmented tissues. The most frequently reported changes with prostaglandin analogs have been increased pigmentation of the iris and periorbital tissue (eyelid).

Pigmentation is expected to increase as long as latanoprostene bunod ophthalmic solution is administered. The pigmentation change is due to increased melanin content in the melanocytes rather than to an increase in the number of melanocytes. After discontinuation of VYZULTA, pigmentation of the iris is likely to be permanent, while pigmentation of the periorbital tissue and eyelash changes are likely to be reversible in most patients. Patients who receive prostaglandin analogs, including VYZULTA, should be informed of the possibility of increased pigmentation, including permanent changes. The long-term effects of increased pigmentation are not known.

Iris color change may not be noticeable for several months to years. Typically, the brown pigmentation around the pupil spreads concentrically towards the periphery of the iris and the entire iris or parts of the iris become more brownish. Neither nevi nor freckles of the iris appear to be affected by treatment. While treatment with VYZULTA® (latanoprostene bunod ophthalmic solution), 0.024% can be continued in patients who develop noticeably increased iris pigmentation, these patients should be examined regularly *[see Patient Counseling Information (17) in full Prescribing Information]*.

5.2 Eyelash Changes

VYZULTA may gradually change eyelashes and vellus hair in the treated eye. These changes include increased length, thickness, and the number of lashes or hairs. Eyelash changes are usually reversible upon discontinuation of treatment.

5.3 Intraocular Inflammation

VYZULTA should be used with caution in patients with a history of intraocular inflammation (iritis/uveitis) and should generally not be used in patients with active intraocular inflammation as it may exacerbate this condition.

5.4 Macular Edema

Macular edema, including cystoid macular edema, has been reported during treatment with prostaglandin analogs. VYZULTA should be used with caution in aphakic patients, in pseudophakic patients with a torn posterior lens capsule, or in patients with known risk factors for macular edema.

5.5 Bacterial Keratitis

There have been reports of bacterial keratitis associated with the use of multiple-dose containers of topical ophthalmic products. These containers had been inadvertently contaminated by patients who, in most cases, had a concurrent corneal disease or a disruption of the ocular epithelial surface.

5.6 Use with Contact Lens

Contact lenses should be removed prior to the administration of VYZULTA because this product contains benzalkonium chloride. Lenses may be reinserted 15 minutes after administration.

6 ADVERSE REACTIONS

The following adverse reactions are described in the Warnings and Precautions section: pigmentation (5.1), eyelash changes (5.2), intraocular inflammation (5.3), macular edema (5.4), bacterial keratitis (5.5), use with contact lens (5.6).

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.

VYZULTA was evaluated in 811 patients in 2 controlled clinical trials of up to 12 months duration. The most common ocular adverse reactions observed in patients treated with latanoprostene bunod were: conjunctival hyperemia (6%), eye irritation (4%), eye pain (3%), and instillation site pain (2%). Approximately 0.6% of patients discontinued therapy due to ocular adverse reactions including ocular hyperemia, conjunctival irritation, eye irritation, eye pain, conjunctival edema, vision blurred, punctate keratitis and foreign body sensation.

8 USE IN SPECIFIC POPULATIONS

8.1 Pregnancy

Risk Summary

There are no available human data for the use of VYZULTA during pregnancy to inform any drug associated risks.

Latanoprostene bunod has caused miscarriages, abortion, and fetal harm in rabbits. Latanoprostene bunod was shown to be abortifacient and teratogenic when administered intravenously (IV) to pregnant rabbits at exposures ≥ 0.28 times the clinical dose. Doses ≥ 20 µg/kg/day (23 times the clinical dose) produced 100% embryofetal lethality. Structural abnormalities observed in rabbit fetuses included anomalies of the great vessels and aortic arch vessels, domed head, sternebral and vertebral skeletal anomalies, limb hyperextension and malrotation, abdominal distension and edema. Latanoprostene bunod was not teratogenic in the rat when administered IV at 150 mcg/kg/day (87 times the clinical dose) *[see Data]*.

The background risk of major birth defects and miscarriage for the indicated population is unknown. However, the background risk in the U.S. general population of major birth defects is 2 to 4%, and of miscarriage is 15 to 20%, of clinically recognized pregnancies.

Data

Animal Data

Embryofetal studies were conducted in pregnant rabbits administered latanoprostene bunod daily by intravenous injection on gestation days 7 through 19, to target the period of organogenesis. The doses administered ranged from 0.24 to 80 mcg/kg/day. Abortion occurred at doses ≥ 0.24 mcg/kg/day latanoprostene bunod (0.28 times the clinical dose, on a body surface area basis, assuming 100% absorption). Embryofetal lethality (resorption) was increased in latanoprostene bunod treatment groups, as evidenced by increases in early resorptions at doses ≥ 0.24 mcg/kg/day and late resorptions at doses ≥ 6 mcg/kg/day (approximately 7 times the clinical dose). No fetuses survived in any rabbit pregnancy at doses of 20 mcg/kg/day (23 times the clinical dose) or greater. Latanoprostene bunod produced structural abnormalities at doses ≥ 0.24 mcg/kg/day (0.28 times the clinical dose). Malformations included anomalies of sternum, coarctation of the aorta with pulmonary trunk dilation, retroesophageal subclavian artery with absent brachiocephalic artery, domed head, forepaw hyperextension and hindlimb malrotation, abdominal distention/edema, and missing/fused caudal vertebrae.

An embryofetal study was conducted in pregnant rats administered latanoprostene bunod daily by intravenous injection on gestation days 7 through 17, to target the period of organogenesis. The doses administered ranged from 150 to 1500 mcg/kg/day. Maternal toxicity was produced at 1500 mcg/kg/day (870 times the clinical dose, on a body surface area basis, assuming 100% absorption), as evidenced by reduced maternal weight gain. Embryofetal lethality (resorption and fetal death) and structural anomalies were produced at doses ≥ 300 mcg/kg/day (174 times the clinical dose). Malformations included anomalies of the sternum, domed head, forepaw hyperextension and hindlimb malrotation, vertebral anomalies and delayed ossification of distal limb bones. A no observed adverse effect level (NOAEL) was established at 150 mcg/kg/day (87 times the clinical dose) in this study.

8.2 Lactation

Risk Summary

There are no data on the presence of VYZULTA in human milk, the effects on the breastfed infant, or the effects on milk production. The developmental and health benefits of breastfeeding should be considered, along with the mother's clinical need for VYZULTA, and any potential adverse effects on the breastfed infant from VYZULTA.

8.4 Pediatric Use

Use in pediatric patients aged 16 years and younger is not recommended because of potential safety concerns related to increased pigmentation following long-term chronic use.

8.5 Geriatric Use

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

13 NONCLINICAL TOXICOLOGY

13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

Latanoprostene bunod was not mutagenic in bacteria and did not induce micronuclei formation in the *in vivo* rat bone marrow micronucleus assay. Chromosomal aberrations were observed *in vitro* with human lymphocytes in the absence of metabolic activation.

Latanoprostene bunod has not been tested for carcinogenic activity in long-term animal studies. Latanoprost acid is a main metabolite of latanoprostene bunod. Exposure of rats and mice to latanoprost acid, resulting from oral dosing with latanoprost in lifetime rodent bioassays, was not carcinogenic.

Fertility studies have not been conducted with latanoprostene bunod. The potential to impact fertility can be partially characterized by exposure to latanoprost acid, a common metabolite of both latanoprostene bunod and latanoprost. Latanoprost acid has not been found to have any effect on male or female fertility in animal studies.

13.2 Animal Toxicology and/or Pharmacology

A 9-month toxicology study administered topical ocular doses of latanoprostene bunod to one eye of cynomolgus monkeys: control (vehicle only), one drop of 0.024% bid, one drop of 0.04% bid and two drops of 0.04% per dose, bid. The systemic exposures are equivalent to 4.2-fold, 7.9-fold, and 13.5-fold the clinical dose, respectively, on a body surface area basis (assuming 100% absorption). Microscopic evaluation of the lungs after 9 months observed pleural/subpleural chronic fibrosis/inflammation in the 0.04% dose male groups, with increasing incidence and severity compared to controls. Lung toxicity was not observed at the 0.024% dose.

U.S. Patent Numbers: 7,273,946; 7,629,345; 7,910,767; 8,058,467.

Distributed by:

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VYZ.0109.USA.20 Issued: 5/2020

VOL. 157 NO. 8 ■ AUGUST 15, 2020

IN THE NEWS

A study investigated differing perceptions of marijuana as glaucoma therapy. **With few glaucoma specialists recommending marijuana (7.6%), and even fewer patients using it (2.6%), while half of marijuana dispensaries endorse its use, public confusion seems likely**. "As legal access and public acceptance of marijuana escalates, physicians should be aware of these perceptions when educating patients," the researchers noted.

Weldy E, Stanley J, Koduri V, et al. Perceptions of marijuana use for glaucoma from patients, cannabis retailers, and glaucoma specialists. Ophthalmology. July 2, 2020. [Epub ahead of print].

A new study suggests **a combined treatment of 0.01% atropine and orthokeratology may be effective for childhood myopia control**. The study enrolled 154 children (ages eight to 12) who had a spherical equivalent of -1D to -6D. It found subfoveal choroidal thickness significantly increased in the atropine and ortho-K, ortho-K and placebo and atropine groups. **The one-month change in subfoveal choroidal thickness was larger in the atropine and ortho-K group** compared with patients prescribed atropine alone.

Li Z, Hu Y, Cui D, et al. Short-term effects of atropine combined with orthokeratology (ACO) on choroidal thickness. Contact Lens & Anterior Eye. June 30, 2020. [Epub ahead of print].

In elderly patients with large cup-to-disc ratios, a positive temporal raphe sign on OCT imaging is associated with faster conversion to normal-tension glaucoma (NTG). A study evaluated 72 eyes of untreated patients at least 65 years old with large vertical cup-to-disc ratios (≥0.7). During 5.5 years of follow-up, the researchers found that 19 eyes converted to NTG. The temporal raphe sign was seen in 94.7% of converters but only 5.7% of non-converters at baseline.

Ha A, Kim YK, Kim JS, et al. Temporal raphe sign in elderly patients with large optic disc cupping: its evaluation as a predictive factor for glaucoma conversion. Am J Ophthalmol. July 8, 2020. [Epub ahead of print].

Desk Work Tied to Dry Eye

Computer use and drier working environments may be factors. **By Jane Cole, Contributing Editor**

Despite sustained exposure to dust, debris and other environmental factors, construction workers are four times less likely to develop dry eye symptoms compared with office workers, a study in *BMC Ophthalmology* suggests.

The cross-sectional, observational investigation evaluated dry eye symptoms and associated risk factors in 304 subjects (149 construction workers and 155 office workers) who were given an Ocular Surface Disease Index (OSDI) questionnaire. Participants were approximately 34 years old and worked at their current job for at least six months. Most of the individuals were male (63.5%).

More than half (55%) of the subjects presented dry eye symptoms with an OSDI score greater than 12. The average OSDI score was 21.30, and was lower in the construction group (12.45) compared with the office workers (28.51). Considering participants who had moderate and severe symptoms (23 to 100 points), office workers had dry eye symptoms 4.15 times more frequently than construction workers.

Additionally, women had higher OSDI scores than men (32.47 vs. 14.87, respectively).

The researchers suggest different factors may have affected the results, but the outcome was likely influenced by office workers' exposure to sustained computer use in significantly drier environments.

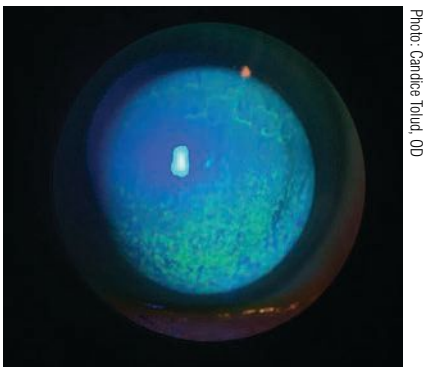

Photo: Candice Tolud, OD

This DED patient has punctate epithelial keratitis and decreased tear break-up time.

Offices in the study were 50% drier than the outdoor air, they add.

The findings underline the serious need to inform the population that office work—which represents the largest job-force in Western countries—may increase the risk of developing dry eye symptoms. Researchers also suggest the importance of educating individuals on how to minimize these risks, including the avoidance of long, uninterrupted periods of computer work, breaks to allow for regular blinking and ciliary relaxation and to demand better humidity controls in the workplace.

"This highlights the pernicious effects on the ocular surface of the office environment, which poses a significant risk for the development or worsening of dry eye symptoms," the researchers wrote in their paper.

Hernandez-Llamas S, Paz-Ramos AK, Marcos-Gonzalez P, et al. Symptoms of ocular surface disease in construction workers: comparative study with office workers. BMC Ophthalmology. July 20, 2020. [Epub ahead of print].

NEWS STORIES POST EVERY WEEKDAY MORNING AT www.reviewofoptometry.com/news

Iowa Gains Expanded Scope of Practice

ODs win battle to treat patients with injectable meds.

Iowa optometrists recently joined the growing number of practitioners allowed to treat certain ocular conditions with injections. Iowa's bill (HF 310), approved on June 29, now clarifies that ODs with the proper training and board approval can administer subconjunctival injections to treat ocular conditions, intralesional injections to treat chalazia, botulinum toxin (including for cosmetic purposes) and injections to counteract an anaphylactic reaction.[1]

"This is the culmination of several years of work—four years of legislative battles, but five years of work," says Brian Kirschling, OD, president of the Iowa Optometric Association. "We are very pleased to get it to the governor's desk and get it signed."

Already through the house, the bill passed in the senate at the beginning of March on a 41 to eight vote, he explains. Then COVID hit and everything shut down. The bill had some language changes that required another round in the house, and on June 3rd, the house passed the bill on a 91 to six vote.

"We are very pleased to get that kind of support among our state legislators," Dr. Kirschling says. "There is an ophthalmologist serving in the Iowa senate, which has been a roadblock in the last couple of years, but we are happy to still support in the senate despite that."

Part of the success is due to exceptional leadership, according to Dr. Kirschling. The Association's executive director, Gary Ellis, has been at the helm for 25 years.

"It is very helpful to have longevity when it comes to our optometric association's front office," he says. "Those relationships built at the state capital with legislators don't happen overnight. Gary and his crew deserve a lot of the accolades, along with our docs who sat in and fought the subcommittee and committee battles."

Training Opportunities

While the update was expected, as it's been in the works since 2015, the timing of the decision in light of COVID-19 is disappointing, says Brian Chou, OD, of San Diego.

The bill also specifies that those looking to implement these treatment modalities must have sufficient education and clinical training, whether from an accredited college or university or equivalent education provider. The Iowa Optometric Association has already been offering workshops to ODs for several years in preparation for the expanded scope.

"Going forward, we will continue to offer that on an expanded basis for our ODs who don't have that skillset; our younger ODs graduating from optometry school already have that training and skillset under their belt," Dr. Kirschling explains. "For docs who wish to learn those skills, the opportunities are available to them."

The expanded scope will vastly affect patient care in rural states like Iowa, Dr. Kirschling adds. "Optometrists practice in nearly all of Iowa's 99 counties and, traditionally, that has allowed Iowa optometrists to be front-line providers of full-scope eye care."

1. Iowa Legislature. House File 310, an Act relating to the practice of optometry. www.legis.iowa.gov/legislation/BillBook?ga=88&ba=HF310. Accessed July 1, 2020.

Peripheral CXL Helps Clear Neovascularization

Corneal crosslinking (CXL) may be able to reduce corneal neovascularization and, in turn, serve as a novel treatment option to improve graft survival after high-risk penetrating keratoplasty (PK), a study in *Cornea* suggests.

The retrospective case series included five patients with progressive corneal neovascularization and the need for high-risk PK due to graft rejection and/or keratitis who received CXL and PK recently. CXL was performed before or in combination with PK, and researchers assessed the effect of CXL on neovascularization based on slit-lamp images. Patients were followed to determine the incidence of adverse effects and graft rejection.

None of the patients had any intraoperative or postoperative complications. Researchers found peripheral CXL resulted in a mean reduction of 70.5% with no revascularization issues. Additionally, all transplants remained clear and without immune reactions with an approximate follow-up of 16 weeks.

The findings suggest peripheral CXL may be a new option to regress pathologic corneal blood vessels in patients and may be a new treatment option, especially in those who are high-risk patients before keratoplasty, the investigators note. ■

Choy BNK, Ng ALK, Zhu MM, et al. Randomized control trial on the effectiveness of collagen crosslinking on bullous keratopathy. Cornea. July 1, 2020. [Epub ahead of print].

Hoster Succeeds Henne as Publisher

Jobson Medical Information has announced that Michael Hoster, a 13-year veteran of the company, has been named Publisher of the Review Group of publications and services. This includes the titles *Review of Optometry*, *Review of Ophthalmology*, *Review of Cornea and Contact Lenses* and *Retina Specialist*, as well as a host of affiliated websites, e-newsletters and other digital products designed to provide robust clinical insight and education to optometrists and ophthalmologists.

Mr. Hoster assumed the position previously held by veteran publisher and industry icon James Henne since 2014. "Mike has been an instrumental player at the Review Group for 13 years, playing key roles on our editorial and sales teams," said Marc Ferrara, president of Jobson's Optical Group. "Of course, we will all miss Jim Henne, who has done an outstanding job leading the Review Group. Jim's insights, leadership skills and witty charm make him a very unique leader."

Mr. Hoster has spent his entire professional career at Jobson, beginning as an Associate Editor for *Review of Optometry* in 2007. He also served as the magazine's Managing Editor from 2012 through 2014. Mr. Hoster transitioned to *Review*'s sales team in 2015. "Mike has become an extremely valuable team member over this period and has developed a keen understanding of the markets we serve and the products we deliver," added Mr. Ferrara.

Michael Hoster, at left, and James Henne.

"The Review Group has a sterling reputation for providing the most cutting-edge, clinically relevant information available to the eye care community," said Mr. Hoster. "Jim has been an invaluable leader to our group, a consummate mentor to me and a true inspiration to our entire company. I look forward to following in his footsteps and working with our team in an effort to serve all the needs of our readers and industry partners."

CXL Risky for Bullous Keratopathy

Corneal collagen crosslinking (CXL) appears to reduce corneal thickness in patients with bullous keratopathy (BK), at least in the initial four weeks after surgery, researchers from Hong Kong suggest. However, their study also found that patients who underwent CXL had no greater improvements in pain, corneal clarity or vision compared with the control group and that the short-term benefits of the procedure were unlikely to outweigh its potential risk of recurrent epithelial defect.

The study enrolled 42 patients with BK, of whom 26 were randomized to receive CXL, and 16 were placed in the placebo group that received the same riboflavin solution, but underwent a sham debridement and UV light treatment. The patients were assessed at baseline and up to 12 months after treatment.

The central corneal thickness in the CXL group was reduced by 37.6µm and 63.8µm at two and four weeks, respectively, which was significantly higher than the control group. However, there was no statistical difference in central corneal thickness reduction between the two groups at 12 weeks and during later follow-ups. While the CXL group reported lower pain scores throughout the one-year follow-up, the same was true of the control group, suggesting a placebo effect, the researchers say.

Of note: CXL was associated with more recurrent epithelial defect (12%), and two of the three subjects with epithelial defect required amniotic membrane transplant.

"Considering its side effects of recurrent epithelial defect, which might require further treatment, including amniotic membrane transplant, CXL might not be warranted as a treatment alternative in patients with BK," the researchers wrote in their paper. ■

Choy BNK, Ng ALK, Zhu MM, et al. Randomized control trial on the effectiveness of collagen cross-linking on bullous keratopathy. Cornea. July 1, 2020. [Epub ahead of print].

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Be a Part of Our 2020 Income Survey

Many optometrists had high hopes for 2020. "The year of vision" was expected to put eye care front and center in the public's mind—then COVID-19 hit and forced the field to readjust. Practices are riding out regional lockdowns, social distancing has become the norm and PPE is now a line item in everyone's budgets.

As part of our annual income survey, we want to hear how all this has affected you financially.

For some, the shift toward medical practice and urgent care has been a saving grace; for others, it's been tough to stay in the black as patients reconsider online glasses and contact lens sales.

If you're an OD practicing in the United States, please take a few minutes to respond to our annual income survey and share your financial experience over the last year. The results will be published anonymously in the December issue. All personal and financial information is confidential and used for no other purpose than this survey.

Just in case you need a little extra push, here's an incentive: upon completing all of the questions in the survey, you'll be entered to win a $100 American Express Gift Card. It only takes a few minutes, as there are only a handful of questions.

This is also your chance to share candid stories from the front lines of what will hopefully be a once-in-a-career disruption. Tell us what you've been through!

Thank you for your participation—we wouldn't know where the field stood financially without you!

Take the Survey
Visit www.surveymonkey.com/r/2020incomesurvey or scan the QR code.

AI Helps Triage Glaucoma Patients During COVID-19

In light of COVID-19, researchers recently explored ways clinicians can best prioritize glaucoma patients who need to be seen and who can wait—and they found artificial intelligence can help.

Researchers from the University of Michigan analyzed data from a large electronic health record repository to create a scoring system that considered a patient's glaucoma severity and their risk of disease progression against their risk of morbidity from COVID-19.

"Since the COVID pandemic began, ophthalmologists and optometrists have been trying to decide which of our patients' clinic appointments should get postponed and rescheduled and which ones should be kept, carefully considering the benefits and risks of their coming in to the clinic to see us," says researcher Joshua D. Stein, MD.

For patients with sight-threatening conditions such as glaucoma, this can be a difficult decision because delays in care can result in progression that can lead to irreversible blindness, he adds. Yet, on the flipside, many patients with glaucoma are also elderly with other medical comorbidities, and if they are exposed to COVID-19 as a result of seeking eye care services, the risk of morbidity and mortality can be high, Dr. Stein says.

The study's automated system generated a score that captures these competing risks for each patient, he explains.

Furthermore, as federal, state and local restrictions are lifted and it is safer for patients to come in to seek eye care, clinicians can also make use of the algorithm scores to prioritize which ones are in greater need for follow-up care ahead of others, making it easier to identify those who would most benefit from coming in to the clinic, Dr. Stein adds.

The study identified 1,034 patients with upcoming glaucoma clinic appointments from March to April 2020. The team developed a risk stratification tool that calculated a glaucoma severity and progression risk score and a COVID-19 morbidity risk score that were added together for a total score for each patient.

The mean glaucoma severity and progression risk score was four points, while the mean morbidity risk score was 27.2 points— a mean total score of 31.2 points.

The study assessed different triage thresholds (zero, 25 and 50) to demonstrate varying degrees of caution regarding the adverse outcomes, whether related to COVID-19 exposure or the risk of glaucoma progression. In this sample, a threshold of zero meant 93.8% of the scheduled appointments could safely be postponed for up to three months. The total score thresholds of 25 and 50 points suggested 64.6% and 26.6% of appointments could safely be postponed, respectively.

The study also validated the total scores from the algorithm against glaucoma specialists' recommendations based on the review of patients' records and found the two aligned. ■

Bommakanti NK, Zhou Y, Ehrlich JR, et al. Application of the sight outcomes research collaborative ophthalmology data repository for triaging patients with glaucoma and clinic appointments during pandemics such as COVID-19. JAMA Ophthalmology. July 17, 2020. [Epub ahead of print].

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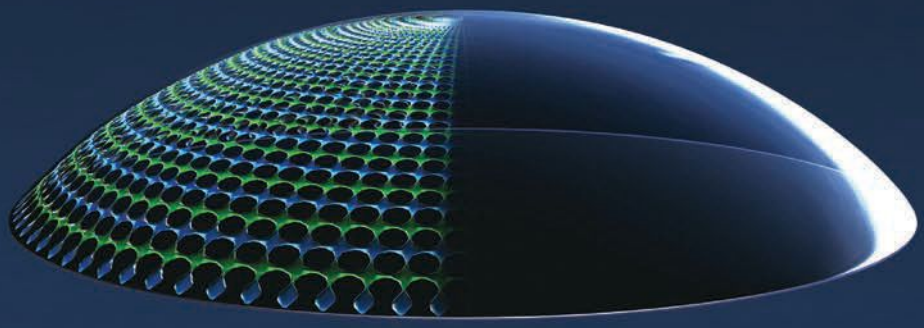

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*Menicon data on file April 2016

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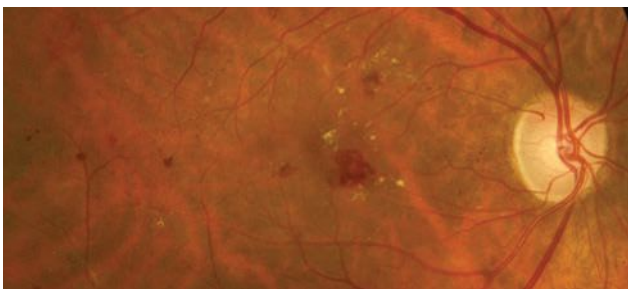

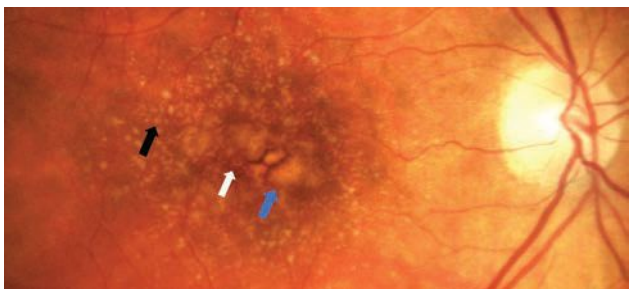

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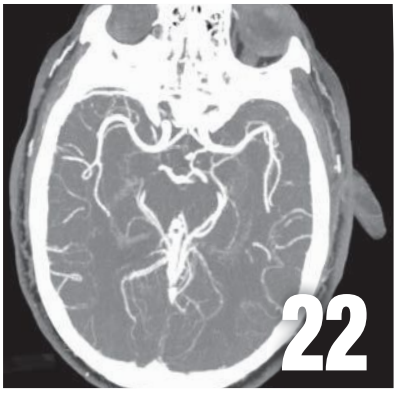

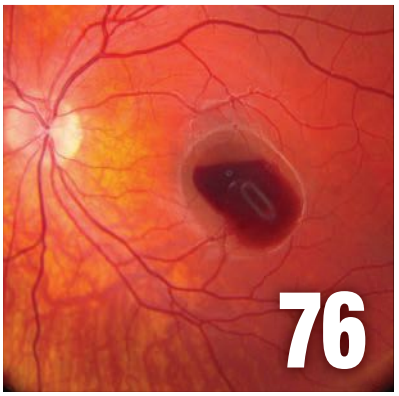

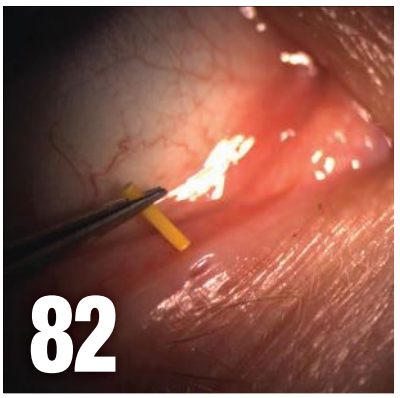

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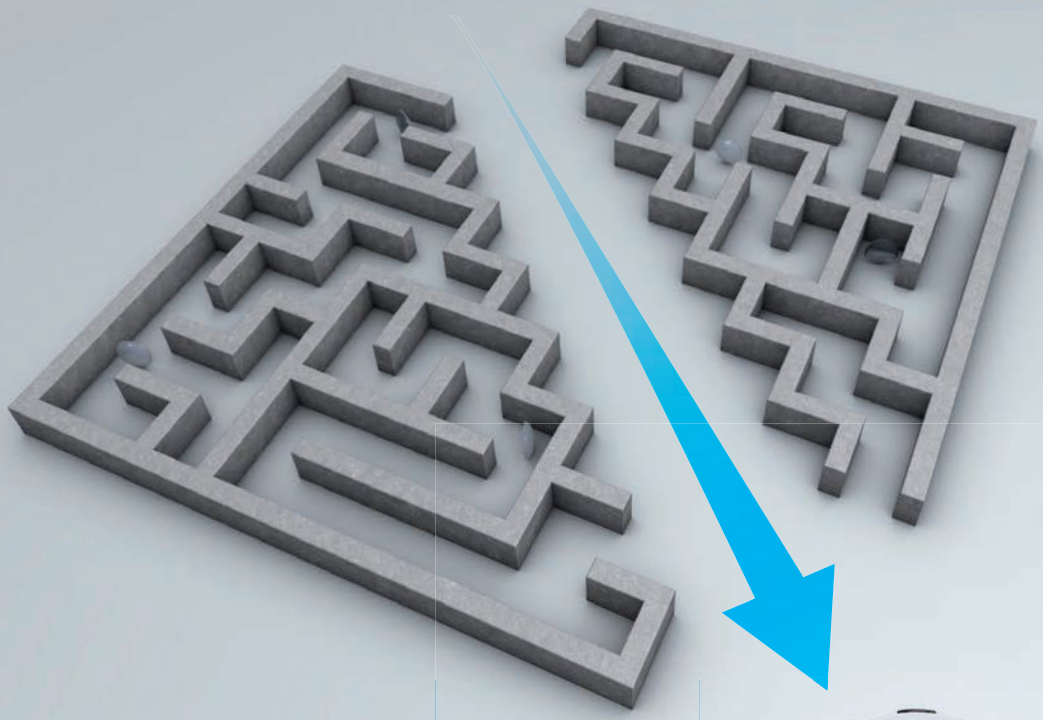

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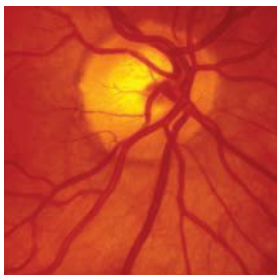

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Outlook

By Jack Persico, Editor-in-Chief

Dueling Pandemics

Will COVID-driven changes in behavior accelerate myopia development?

The COVID stories that consume most of our attention concern its tragic death toll and the anxiety that pervades our efforts to respond to the threat, or even just live through it. But a global phenomenon also brings with it second-order effects—unanticipated "consequences of consequences" playing out in the background.

For instance, the shelter-at-home orders yielded a research bonanza for environmental scientists. Since March, they've been recording pollution levels that reflect actual, rather than hypothetical, low levels of auto emissions. They'll now be able to model the effects of reduced traffic with much greater accuracy.

What second-order effects do we see in eye care? For one, COVID has brought telehealth to mainstream practice. While impractical for most clinical responsibilities, telehealth should stick around for follow-up visits and other aspects of care that don't require specialized equipment.

It also decimated CE conferences. Meeting planners are nervously waiting to see if attendees will be content with, or even prefer, virtual events as a staple of education from now on.

But I wonder if COVID's biggest unforeseen effect is to essentially launch a giant clinical trial of myopia's environmental influences. The literature says children need at least two hours of outdoor time each day to mitigate myopia development. We're now six months into a pandemic that fundamentally reshaped of our daily routines. With schools and daycares closed, and summer camps and vacations off the table for most families, we're all spending enormously more time indoors. As school reopening looks dicey, some kids could be forced to live for a year under circumstances least conducive to emmetropization: home-schooling in front of a screen for hours a day with outdoor time severely limited.

Being the father of a four-year-old, this has crossed my mind more than once. With no other kids to play with thanks to social distancing and not even an open playground to enjoy, we're lucky to keep my son outside for 30 minutes a day. The rest of his time is devoted to an endless array of near vision tasks indoors.

If my son ends up myopic when he might not have otherwise, that's unfortunate but certainly negligible compared with the horrific first-order COVID consequences. Still, myopia was already a pandemic in its own right before COVID barged in and potentially kicked it into high gear.

I can understand if you've had enough myopia control articles for a while. It surely has dominated optometric education of late. But, for those who are interested, this month's article, "Add Multifocals to Your Myopia Toolbox" is a good place to start. The authors lay out a plan for making this technique work in your practice—something few ODs are doing despite all the media coverage. As noted in the article, only 6.8% of all contact lens fits in 2018 were for myopia control, which amounted to just 2.3% of contact lens fits for kids.

COVID will be brought under control one day. Will myopia? The need for interventions, and the opportunities they offer, are manifestly clear. ■

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Updates Come in Threes

Consider replacing or upgrading tests patients and doctors dislike.

By Paul M. Karpecki, OD, Chief Clinical Editor

When I ask patients which tests they dislike most, visual field (VF) testing, IOP measurements and, believe it or not, refraction are the top three. A simple plan to improve your patient's positive experience—and boost your practice success—might be to increase education and upgrade your technology for these tests.

Visual fields. New algorithms such as SITA Fast could help patients complete the test sooner. Although SITA Standard is more precise than SITA Fast at lower VF sensitivities, this difference is unlikely to affect the monitoring of change or deterioration.[1]

Fully objective VF testing with the ObjectiveField analyzer (Konan Medical) shows equal accuracy to the standard subjective testing.[2,3] The tool depicts statistically independent clusters of visual stimuli at multiple locations in the patient's visual field.[4] The resulting pupillary responses from each visual stimuli provides a map of VF function.

IOP measurements. It's no secret that patients hate the air-puff test. Today, clinicians can use new tools such as the iCare ic100 tonometer and the Ocular Response Analyzer (ORA, Reichert) instead. The iCare ic100 uses rebound technology to measure IOP, while the ORA measures hysteresis, corneal-compensated IOP and Goldman tonometry.

Refraction. New patient-friendly systems have grown in the last decade, ranging from digital refractors to point-spread function (PSF) refractors (VMax), the latter of which uses a different stimuli that is easier for patients to differentiate.[5]

These systems allow you to show the patient their previous refraction and the new one to help them decide on a new pair of spectacles.

Three Tests ODs Don't Like

There are also clinically important tests clinicians and staff struggle with:

The swinging flashlight test. Although extremely valuable to rule out a brain tumor and other life-threatening neurological conditions, pupillary testing challenges even the most seasoned clinician. One solution is Eyekinetix (Konan Medical), a 40-second objective test that provides an accurate assessment of pupillary function, including RAPD measurements.

Phoria testing. Approximately 1% to 3% of all glasses have prism in them, yet both clinicians and patients often struggle with the necessary testing for prism, such as the Maddox Rod and Von Graefe phoropter tests.[6,7] The neuroLens is a new automated device that takes one to three minutes to provide a comprehensive assessment of the patient's eye alignment and synchronization. It then provides the precise amount of prism recommended, which can be used to create a contoured prism that, in my opinion, far exceeds the success of previous prism options.

AMD testing. Examination with a 90D lens and evaluating fundus photos for small drusen and pigmentary changes isn't easy. A cross-sectional study of 644 adults revealed that doctors missed AMD about 25% of the time.[8] A new objective test that may help with the early identification of AMD is dark adaptometry (AdaptDx, Maculogix).[9] In addition, a new device for measuring carotenoids that can assist in testing and monitoring for AMD is the BioPhotonic scanner (Pharmanex). Research suggests this objective hand scanner is a more accurate corollary to macular pigment than the current subjective macular testing methods.[10]

We know what patients dislike and what isn't providing us with accurate clinical information. Armed with this knowledge and new technologies, we can make changes to enhance our practice and provide patients a better experience. ■

Note: Dr. Karpecki consults for companies with products and services relevant to this topic.

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You've Won an Island Getaway!

Just kidding, but working in private practice is more like being on a deserted island than you might think. **By Montgomery Vickers, OD**

Ages ago, after I saw the movie *Castaway* with Tom Hanks as a poor FedEx executive stranded on a remote and uninhabited island in the South Pacific, I started to wonder how I would have handled the situation—you know, being a FedEx executive. Seems like a tough job. How in the world can they put something in a box and deliver it anywhere in the world within just a couple of days? Being stranded on a deserted island must be easier.

But if I *were* stranded on an island, would I be able to survive with the same determination that Hanks's character displayed over the four long years he was stuck there?

Now, Hanks was only acting, and he was even nominated for an Academy Award—no small feat considering he only had to remember two pages of dialog, most of it spent chatting with a volleyball.

Your Own Island

Anyway, imagine yourself in his position. You have to fend for yourself. You alone must acquire food and drink, or die trying.

Sounds more and more like private practice optometry, doesn't it? No wonder the corporate world seems so attractive. You show up, follow their system and never have a volleyball as your best friend.

Of course, Hanks was stranded for four years. Barring a lottery payout, private practice will last 30+. He had it easy.

Still, all things considered, I would rather be in private practice with all of its challenges and accomplishments, good days and bad. I would never give up the shared joy of providing patients victories in their visual and personal lives. Nor would I give up the shared hugs when they, or I, experience life's losses.

I encourage all of you doctors, new and seasoned, to carefully consider your future and your profession's. Where do you want to be in your life? Our education has set us free so why not fly off the island or, better yet, create your own beautiful paradise right where you are?

At a certain point Hanks, the stranded fellow, had to accept reality. And so do we. The reality is that some doctors are just not the private practice kind. Plus, financial realities might make the corporate-run practice the best choice for some. That's OK; they are just as educated, hard working and caring as any given private practice doctor. So, as we say in Texas, get off your high horse.

We're Not Alone

Going into private practice can be challenging. Reimbursements are always threatened, patients make more and more decisions based on who takes their insurance (or who their sister's hairdresser sees) and increased online competition that's drifting toward online eye exams that might as well be performed by unknown and unvetted techs in the South Pacific.

Some days it may even seem like it would be easier to search for water on a lost island than recheck a recent refraction on a patient who bought crappy glasses online.

Just remember, no matter where or how you practice, you will always have the relationship you build with each and every patient who needs your help.

Unfortunately, some would rather save a few bucks than see their world at its clearest. It doesn't matter. It doesn't matter. You can't leave them stranded. Care for them and you'll thrive as an optometrist. It has to be easier than being a FedEx executive. ■

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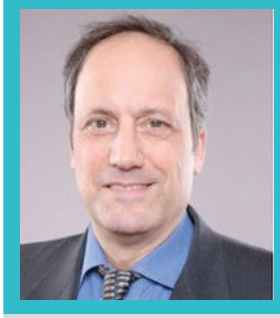

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Curtain Call

Understanding a vision loss patient's symptoms clearly will help identify TIA.

Edited by Paul C. Ajamian, OD

Q I just saw a 64-year-old female patient who casually mentioned that she noted a 'black shade' temporarily obscuring her superior field in one eye. How seriously do I take this?

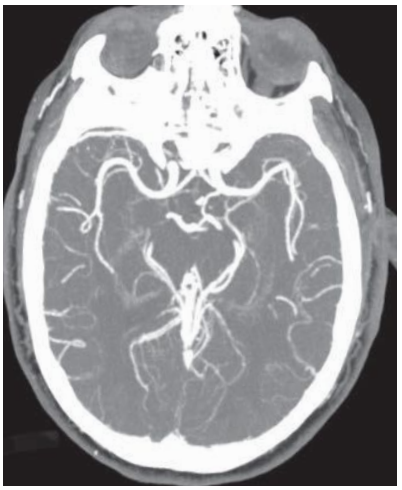
A "A chief complaint of transient monocular vision loss (TMVL) should always raise a red flag," says Kristen Thelen, OD, assistant professor of ophthalmology at Emory Eye Center in Atlanta. "Slow down, and take a detailed look at the patient's medical history and chief complaint to assess the gravity of the situation."

Retinal Ischemia

There are ample causes of TMVL, but transient ischemic attack (TIA) is the most common. Retinal ischemia can be a result of underlying vascular disease, such as giant cell arteritis (GCA), atherosclerosis or cardiac abnormalities. These conditions can be visually devastating or, worse yet, result in a stroke.

Due to the gravity of these vascular etiologies, evaluate patients with TMVL urgently. "Age is a key factor when determining the most appropriate next step," Dr. Thelen says. "Patients older than 50 who experience TMVL need a work-up to rule out GCA."

Asking your patients about jaw claudication, headache and scalp tenderness is important, but even in the absence of symptoms, order blood work in a timely fashion. Also consider cartotid artery disease and listen for bruits in-office as an initial screening.



A well-timed CTA can rule out an ischemic or hemorrhagic event for your patient.

Symptom Assessment

Transient vascular events are typically painless and occur within seconds. Patients often describe a progressive "shade" or "curtain" that leads to "dim" or "black" vision. The entire episode usually lasts a few minutes but never more than an hour.

Photopic symptoms such as flashes, jagged lines and colors are rarely associated with vascular occlusive events. Those tend to be more migrainous or caused by retinal traction. "Remember that ocular migraines with visual auras are typically binocular," Dr. Thelen points out. Showing your patient a picture of a typical migraine aura can help in ruling that diagnosis in or out.

Don't Delay

Retinal TIAs, such as branch retinal, central retinal and ophthalmic artery occlusions, have the same mechanism as central nervous system TIAs and carry the same risk of stroke and cardiovascular disease. According to a 2012 study, nearly 25% of patients with acute retinal ischemia had acute brain infarctions.[1]

"We should refer our TMVL patients with a suspected vascular etiology to a stroke center or hospital emergency department (ED) for a same-day work-up," Dr. Thelen advises. "We send hemispheric TIAs without a second thought, so we should have the same standard for retinal TIAs."

Make sure to follow appropriate stroke guidelines. Calling the ED ahead of time and sending patient records always helps, Dr. Thelen adds. The initial work-up will include a CT scan of the brain to rule out bleeding, and labs to rule out GCA. If the patient is a six or higher on the NIH stroke scale, computed tomography angiography (CTA) is usually ordered to rule out large vessel occlusion (i.e., middle cerebral artery stroke). Additional tests include carotid duplex, MRI of the brain and orbits and MRA of the head and neck.

"I connect with the patient a week after sending them to the ED to make sure everything went smoothly," Dr. Thelen notes. "Patients are typically grateful you sent them for a work-up, and they appreciate the follow-up call as well." There is usually no need for a follow-up eye exam, so use the phone call as an opportunity to remind them to keep their annual eye appointments. ■

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SIGHT SCIENCES

A Little VT Goes a Long Way

This pair of cases highlights the technique's usefulness in those patients who could never get by with lenses alone. **By Marc B. Taub, OD, MS, and Paul Harris, OD**

Thus far, our column has focused on concepts related to corrective lens prescribing, giving detailed advice on managing astigmatism, hyperopia, exotropia and more. We have yet to tackle cases that, upon exam, scream "vision therapy." Over the next two installments, we'll show the benefits of VT, first in younger patients and then in an older population. This intervention has its detractors to be sure, and some ODs may view it as worthwhile but too onerous to implement in practice, but we have had ongoing success with it in appropriate patients.

Case One

Stuart was 15 years old when he was referred from another office to be included in a study on convergence insufficiency. He had double vision, with one eye turned outward, and had been experiencing headaches while reading for two years by the time he presented. He struggled in school and performed poorly on standardized testing.

Once in the exam room, it became obvious that, although the patient would not qualify for the study, he would need vision therapy. Cover testing showed 16 prism diopters of constant alternating exotropia at distance and 16 prism diopters of intermittent alternating exotropia at near, which occurred about half of the time.

Among other things, vision therapy helps patients go on to find success in their educational endeavors.

On the Worth Four-Dot Test, he reported seeing only two red dots at distance, an indication of right eye suppression.

The tricky part of this case was the patient's greater frequency of exotropia at distance. We have many tools that stress near point distance but few that focus on further distances. It didn't help that this case took place prior to the invention of many of the options we have now that enable vision therapy at distance.

At the start of VT, we focused on near tasks, as there was a greater chance of success with this approach due to the intermittent nature and better functioning of the patient's exotropia at near. Ensuring the patient understood the "feeling" of binocular vision and depth at near was the key to transferring those skills to distance. Without an understanding of what convergence feels like, a patient would have trouble voluntarily converging.

We used traditional vision therapy equipment, including a Brock string and vectograms, along with home support, such as the Home Therapy System computer program. After 21 sessions of VT, the patient's complaints had subsided, and cover testing showed 16 prism diopters of intermittent exotropia occurring 10% of the time at distance and eight prism diopters of exophoria at near.

These findings were consistent for a year post–vision therapy, at which point he left for college and was more successful in school. He planned to attend graduate school to study business.

Case Two

Jake was eight years old when he first came into our office. He was falling behind in school, specifically reading, and in danger of being held back. His mother had learned about vision therapy and knew that it would help her son improve.

The patient's primary care examination showed nothing out of the ordinary, so a visual processing exam came next. This evaluates eye movements, vision and visual

spatial skills with different tests, including the ReadAlyzer, Test of Visual Perceptual Skills, Gardner Test of Reversal Frequency and Beery-Buktenica Developmental Test of Visual-Motor Integration.

To put it bluntly, this kid's vision was a train wreck; not one test result was above the 20th percentile.

Over the course of 18 months, we made serious progress in helping our patient get on the right track. Not only did we focus on visual processing and oculomotor skills, but we also targeted visual efficiency skills. We believe that to best help a person optimize their visual performance, we must also work on accommodation and binocular skills.

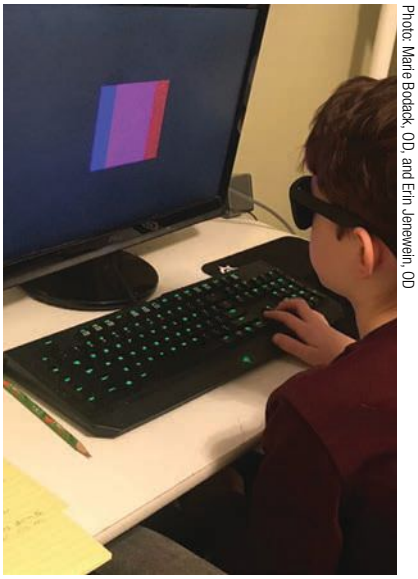


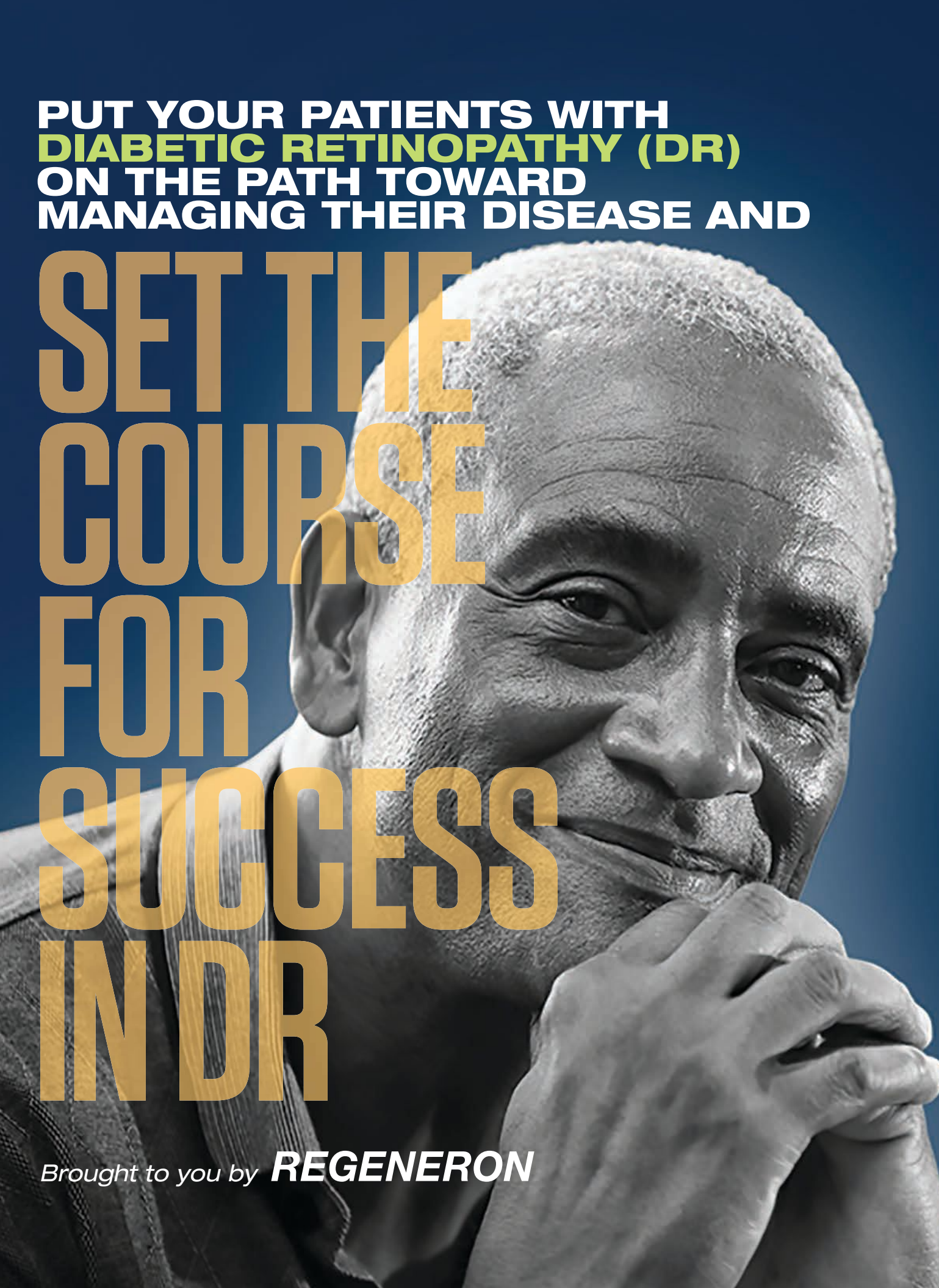
Photo: Marie Bodack, OD, and Erin Jenewein, OD

Home support allows patients to complete vision therapy exercises through computerized systems.

In cases like this, where there are so many challenges, VT must take a global approach and work on building skills from the ground up. This is not a quick process by any means; good vision therapy and meaningful change take time.

Slowly but surely, Jake started performing better in vision therapy sessions and, most importantly, in school. His grades started creeping up into the B- and C-range, and occasionally, an A would show up on his report card. He is now an accomplished college student.

In both cases, we were able to help kids find short- and long-term success. Undoubtedly, lenses are immensely powerful tools. VT can be just as powerful and is worth including on your tool belt. ■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- Severe nonproliferative DR (NPDR) within 2 to 4 weeks
- Proliferative DR (PDR) within 2 to 4 weeks
- High-risk PDR with or without macular edema within 24 to 48 hours

Ensure patients have followed up with a retina specialist who can treat DR

Monitor your patients with DR[3,4]

The AOA recommends frequent monitoring of patients[3]

- At least every 6 to 8 months in patients with moderate NPDR and more frequently for patients with greater disease severity[3]

Refer patients to a specialist who can treat DR[3,4]

Regeneron is committed to helping you partner with your patients for comprehensive care of DR, as well as for care of other retinal diseases.

AOA = American Optometric Association.

References: 1. Diabetic Retinopathy. Centers for Disease Control and Prevention website. http://bit.ly/2BKTVCTS. Accessed August 7, 2019. **2.** Early Treatment Diabetic Retinopathy Study Research Group. Fundus photographic risk factors for progression of diabetic retinopathy. ETDRS report number 12. *Ophthalmology*. 1991;98(5 suppl):823-833. **3.** Care of the Patient With Diabetes Mellitus: Quick Reference Guide. American Optometric Association website. http://bit.ly/2M22OUJ. Accessed August 7, 2019. **4.** Ferrucci S, Yeh B. Diabetic retinopathy by the numbers. *Rev Optom*. June 15, 2016. http://bit.ly/2KNNJ4E. Accessed August 7, 2019.

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Special Rules for Special Lenses

Carriers and contract language dictate how you handle the paperwork for medically necessary contact lenses. **By John Rumpakis, OD, MBA, Clinical Coding Editor**

Despite a decline in profitability for refractive corrections, specialty practices are booming as the demand for specialty contact lenses increases.

Here, we take a deep dive into the world of coding for medically necessary and specialty contact lenses because it often differs based on the carrier and the contract language you must abide by.

No Cherry-picking

Many make medically necessary contact lenses a profit center in their practice, sometimes charging $2,000 to $3,000 for a medically necessary contact lens "package" consisting of professional services and materials, even if the patient has coverage for those services under a contracted plan that may reimburse much less.

However, a practitioner contracted with a plan cannot ignore one portion of a plan's coverage. When you provide specialty contact lens services for a patient, you must use all of their coverage benefits, even if it doesn't reimburse as much.

What's Wrong Matters

In addition to medical carriers, many managed vision care plans provide coverage for medically necessary contact lenses.

These clinical conditions typically have coverage: aphakia, nystagmus, keratoconus, aniridia, corneal transplant, hereditary corneal dystrophies, anisometropia ≥3.00D in any meridian, high ametropia ≥10.00D in any meridian, irregular astigmatism, achromatopsia, albinism, polychoria, anisocoria (congenital), pupillary abnormalities.

Providing selective benefits when you are a contracted provider and the patient has coverage can create significant exposure for audit and financial penalties.

Code Services Correctly

The CPT's contact lens fit section begins: "The fitting of a contact lens includes instruction and training of the wearer and incidental revision of the lens during the training period." These codes describe the fit if performed according to the CPT, all of which begin with, "prescription of optical and physical characteristics of and fitting of contact lens, with medical supervision of adaptation":

- 92310: corneal lens, both eyes, except for aphakia
- 92311: corneal lens for aphakia, one eye
- 92312: corneal lens for aphakia, both eyes
- 92313: corneoscleral lens

Note: While CPT's 92313 code description does not specify laterality, the CMS indicates that it is considered a unilateral fit.

Additional useful codes include:

- 92071: Fitting of contact lens for treatment of ocular surface disease (considered a bilateral code).
- 92072: Fitting of a contact lens for management of keratoconus, initial fit. (Because this is a bilateral code, also report materials using either 99070 or the appropriate HCPCS Level II material code. According to the CPT, "For subsequent fittings, report using E/M service or general ophthalmological services." For every follow up, use a 9921X or 92012 code to follow the keratoconic cornea. The contact lens is the treatment paradigm.)

In many situations, revision of the lens during the training period and medical supervision of adaptation are accomplished during the first dispensing visit. Once you have either ordered the final lenses or provided the patient with their prescription, the patient is considered fit for the lenses, and the service period for that particular code is over.

Should complications arise, bill for office visits using the established patient ophthalmologic (9201X) or E/M (9921X) codes because you are managing an ocular condition or complication, not performing a contact lens check.

Materials Are Separate

Typically, we use only a few HCPCS Level II contact lens material codes:

- V2530: contact lens, scleral, gas impermeable, per lens
- V2531: contact lens, scleral, gas permeable, per lens
- V2627: scleral cover shell
- V2599: contact lens, other type (N/A)

These are all based on a per-lens reimbursement, and the lens type and V codes must match. Many carriers now request invoices to support the lenses provided.

Lens advances are allowing us to treat a broader array of diagnoses with better outcomes; knowing how to code and bill properly is just as important. ■

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44th Annual Contact Lens Report

The Building Blocks for a Specialty Contact Lens Practice

Shifting your focus offers rewards for both your patients and practice, but roll up your sleeves for the work needed to become an expert.

By Jane Cole, Contributing Editor

While any optometrist can dispense mass-market soft contact lenses, fitting the full complement of contact lenses—including specialty lenses such as rigid gas permeables (GPs), sclerals, orthokeratology (ortho-K) and hybrids—takes time and commitment. Still, experts say, no matter where you are in your career, becoming a contact lens specialist offers significant benefits for the practitioner, the patient and the practice.

"Becoming an expert in anything starts with a passion for the subject. A specialty in contact lenses can be exceptionally rewarding; however, it will take a level of dedication that requires true clinical interest, not simply a financial goal," says Cory Collier, OD, co-owner of a specialty lens practice in Florida.

Here, contact lens experts offer some pearls on the steps you can take to grow your contact lens practice beyond the basics.

Image: Brian Fischer, OD

Dr. Fischer fits a patient with 7.50D of corneal astigmatism in a scleral lens. After the fitting, she experienced much clearer and more stable vision during her daily activities, including sports.

Learn From the Best

To become a contact lens specialist, proper training is crucial, says Jeffrey Sonsino, OD, a contact lens specialist in Nashville. Students and recent graduates who already know they want to focus on a contact lens specialty can consider completing a cornea and contact lens residency. Those already in practice can specialize, too, although the path is more challenging, Dr. Sonsino says.

The knowledge required to appropriately treat patients using advanced contact lenses can't be accomplished with a one-day course with a lab manufacturer, Dr. Sonsino says. Instead, he first suggests a serious study of textbooks, including optometrist Edward Bennett's classic *Clinical Manual of Contact Lenses* and *Contemporary Scleral Lenses: Theory and Application* by Melissa Barnett, OD, and Lynette John, OD, along with a careful review of recent literature such as the Collaborative Longitudinal Evaluation of Keratoconus (CLEK) studies and papers on scleral lenses authored by Langis Michaud, OD, and Greg DeNaeyer, OD.

"It's not sexy or easy to tell people to go read, but my first question to docs who send me questions is, did you put in the time and effort?" Dr. Sonsino says.

As for in-person learning, contact lens seminars abound and practitioners should be selective on which ones they choose, experts advise.

Continuing education lectures at the major meetings typically gather the best and brightest. At these meetings, you can find practical workshops that will allow you to test drive the lenses and learn about best practices, evaluation techniques and fitting tips and tricks. However, with limited time, don't expect to learn an entire area of optometry; instead, set your expectations to picking up one or two clinical pearls per hour of attendance, Dr. Sonsino says.

Other non-branded educational events run the gamut in contact lens education. The non-profit Gas Permeable Lens Institute (GPLI) hosts free monthly webinars by leaders in the field, according to Dr. Sonsino.

Start Slowly

Once you hit the books and build your educational background, it's time for hands-on learning. The next step is simply to start fitting lenses and keep doing it, according to Andrew Fischer, OD, who practices in Indiana. "It's a learning process, so, with time, a contact lens specialist will slowly learn the nuances and become comfortable with more advanced fits."

When starting out, Dr. Fischer suggests fitting normal corneas or mild keratoconic eyes for an easy introduction.

An up-and-coming specialist should focus on two to three specific lens designs in each category, learn everything about those designs and gain relevant clinical experience with each, Dr. Collier says. "Having an expert level of knowledge on select options is far more valuable than a superficial level of knowledge on many designs," he says. After you've mastered a selection of fitting sets, you can add more as you go.

"Once you have a relationship with a lab, some will loan out sets for specific patients or allow you the opportunity to try the product before purchasing," Dr. Collier adds.

Your first fitting sets should provide options for a wide variety of corneas, explains Heidi Miller, OD, of the UC Davis Eye Center. "Select a few options, and become well versed in them. Otherwise, each lens fit will feel like 'the first lens fit.'"

According to Stephanie Woo, OD, who practices in Nevada, it's best to start with one fitting set of scleral lenses until you know it well. Then, once you are comfortable, you can add other types.

Still, scleral lenses aren't the "be-all and end-all" for a true contact lens expert, says Dr. Fischer.

"It's important to weigh multiple factors during the fitting process, including a patient's personality and vision expectations, expected lens adaptation, cost to the patient and corneal health, when considering which modality to choose," he says.

If the clinician lays the proper groundwork and completes a significant review of the available literature, most will be champing at the bit to get started with advanced cases, Dr. Sonsino says. "The lens designs will be dictated by the patient's case. But it is always a good idea to identify a few options within each category. The key is to make sure that you are open-minded to each category."

No Lens Left Behind

Next, interested optometrists have to consider all the lens options and become comfortable with each, including commercial soft lenses, custom soft lenses, corneal GPs, hybrids and scleral lenses.

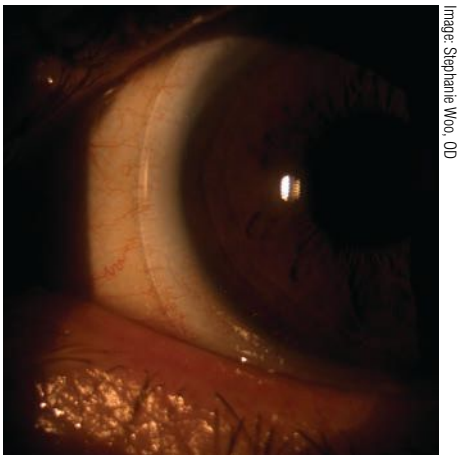


Image: Stephanie Woo, OD

This post-LASIK patient was successfully fit with a scleral lens.

You can't call yourself a contact lens specialist unless you are well versed in every type of specialty lens, according to Dr. Sonsino. "Check the rule book, it's in there," he jokes.

This means developing proficiency with each lens type, and that includes the multifocal versions of each modality.

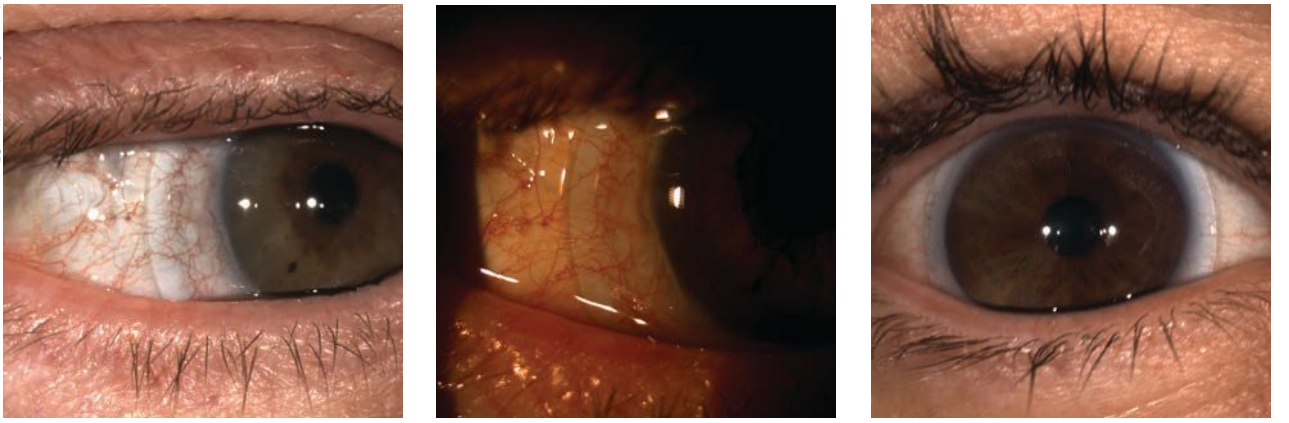
"Again, you treat the patient in front of you. If that includes presbyopes, you must have the most advanced treatment options in your tool belt," Dr. Sonsino says.

Even if you are still working on your expertise with a given lens, "you have to be able to understand the benefits and limitations of each, feel confident identifying appropriate patients for each and be willing to refer to colleagues in the event the best option for the patient isn't an option you are comfortable working with," Dr. Collier says.

Specializing the Specialized

Two billion people had myopia in 2010, and that number is expected to grow to nearly five billion by 2050.[1] Thus, myopia management options, such as ortho-K and soft, center-distance multifocal lenses, are crucial tools for a specialty contact lens practice, according to Dr. Miller.

Images: Stephanie Woo, OD



Scleral lenses with blanching at the edge, at left, or edge impingement, center, require modification to find a good edge alignment, such as the lens at right.

"As the general public learns more about myopia and its increasing prevalence, they will be looking for practices that can provide treatment options to manage myopia progression."

While discussing myopia management options with all pediatric families, it is also critical to bring up the need for outdoor exposure, she adds.

Ortho-K uses custom GP contact lenses to reshape the cornea to temporarily reduce refractive error.[2] Ortho-K is primarily used as a correction for low-to-moderate myopia (up to -6.00D) with or without astigmatism (up to -1.75D).[2]

With soft multifocals, the center of the lens provides the distance vision correction while the periphery is designed to reduce hyperopic defocus.[2] This mechanism minimizes the stimulus for myopia progression by focusing the light in front of the peripheral retina.[2]

"Offering myopia management is very important," Dr. Fischer says. "As we continue to learn more about myopia and its associated risks at higher levels, we recognize how important it is to intervene early and do all we can to limit myopic progression and try to mitigate future ocular health risks."

Add Technology to the Mix

A corneal topographer is an absolute must for a contact lens specialty practice, Dr. Collier says. "It's an essential piece of equipment in the evaluation of the corneal surface, contact lens design and follow-up care."

Topographers provide a more comprehensive evaluation of the cornea than traditional manual keratometers, which measure only about 3mm to 4mm of the central cornea; topographers measure the entire corneal surface.[3] Corneal curvature can be assessed on any portion of the cornea, a virtue that's particularly useful when designing larger diameter GP lenses.[3]

In addition to a topographer, Dr. Sonsino suggests adding a pachymeter and anterior segment optical coherence tomography. "The good news is that with this equipment, the rest of your patients benefit as well. You will be picking up more keratoconus, glaucoma and retinal problems as a result."

Get Close With Your Labs

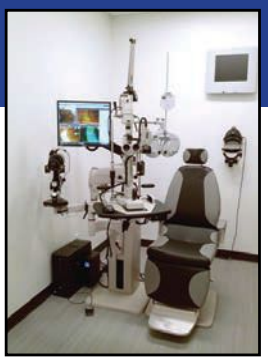
A good relationship with your GP labs is paramount, Dr. Sonsino says. "*Labs* is plural because it is never a good idea to depend on one design or one supplier. Choosing your labs is among the most critical decisions."

Dr. Miller recommends you consider geographic location of the lab, the shape of the eyes you're trying to fit and add-on options such as multifocal choices, front surface toric power, Hydra-PEG (Tangible Science) coating, a variety of lens materials with varying Dk for increased oxygen permeability and quadrant-specific changes to landing zone. She also adds that warranty periods and availability of consultation are important when choosing a lab.

Dr. Sonsino suggests you consider several business-specific attributes when deciding on potential lab partners, including whether the lab supports the Contact Lens Manufacturer's Association and GPLI and whether it is an independent lab or if it is owned by a larger corporation damaging your business in other ways (soft lenses).

Labs can also provide valuable trouble-shooting advice—a perk that shouldn't be overlooked when choosing labs. "The lab consultants know their lenses the best, so when you run into problems, reaching out to them for help is definitely the first step," Dr. Woo says. "They can help you make necessary adjustments to the lenses."

Keep a close relationship with your patients . . . at a distance.



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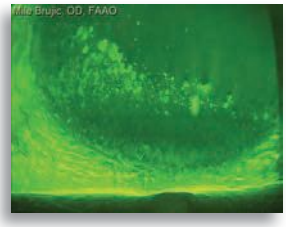

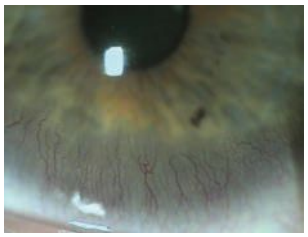
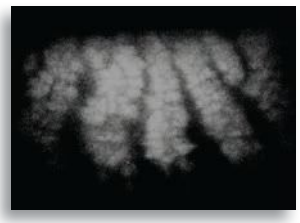
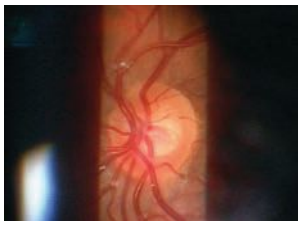

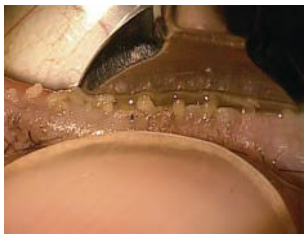

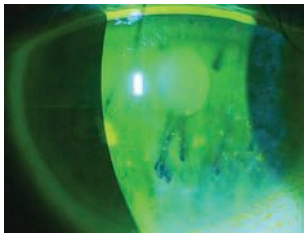

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During your first year as a contact lens specialist, Dr. Miller suggests you talk through the fitting process with a consultant. "I receive a wealth of knowledge each time I speak to a consultant. I may fit a patient in a certain type of lens a few days a week, but these consultants have experience troubleshooting hundreds of patient cases." They are also known to pass along recommendations and tricks gleaned from other doctors, she adds. "Their expertise helps you excel during the learning curve."

Billing Tips From the Experts

Many resources are available to help contact lens specialists get over any billing hurdles, including the GPLI, which offers numerous lectures and webinars on the topic, Dr. Fischer says. "I leaned heavily on these resources early on. I also sought advice from my mentors who have been fitting and billing specialty lenses much longer. Their experience is invaluable."

As for the cost of these specialty lenses, doctors should be transparent with patients, Dr. Woo explains. Let patients know what is covered as far as services and materials and then present any additional costs.

Prior to initiating a fit, Dr. Fischer shows patients printed handouts that include pricing for different modalities, and he reviews the information with them. The pricing sheets outline everything from standard soft lenses and myopia management options to corneal GP lenses and sclerals, he says.

Needless to say, when tangling with insurance, coverage varies widely from one plan to another, as well as vision care plans vs. medical plans. But Dr. Fischer says most of the vision care plans his office accepts have great coverage for medically necessary contact lenses for conditions such as keratoconus, pellucid marginal degeneration, corneal scarring, high ametropia and high anisometropia, he says.

The best way to verify what is covered is to speak with the insurance provider and get prior authorizations before submitting, which can help prevent problems after the fitting process and also avoid unexpected expenses to the patient, Dr. Fischer says.

On the other hand, Dr. Fischer has found other medical conditions such as dry eye do not have as good coverage and reimbursement when it comes to contact lens fitting fees and materials. Typically, the exam codes and appropriate special testing such as topography, pachymetry and endothelial cell count can apply to medical insurance deductibles, but contact lens fitting and material fees are rarely covered, he adds.

Schedule Adjustments

Since specialty lens fittings generally take more time than garden-variety soft contact lenses, it may be necessary to make some scheduling adjustments.

To help with the increased demands on your time, Dr. Fischer suggests training one or two staff members to serve as the "specialty lens liaison."

"The liaisons can help with the pretesting measurements, initial insertion of trial lenses, insurance questions, insertion and removal training and even ordering," Dr. Fischer says. "This frees up a lot of time for the doctor or contact lens fitter and allows them to provide care to more patients."

For new contact lens specialists, allow for extra time in the beginning, such as a one-to-two hour timeframe for a new fitting, Dr. Woo suggests. "Then as you get more comfortable and proficient, you may adjust the schedule."

Enjoy the Benefits

Offering specialty contact lens services in your practice is an incredibly rewarding experience, Dr. Collier says. "Patients consistently tell me they don't know what they would do without the lenses we provide them. The life-changing capability of specialty contact lenses is extraordinary."

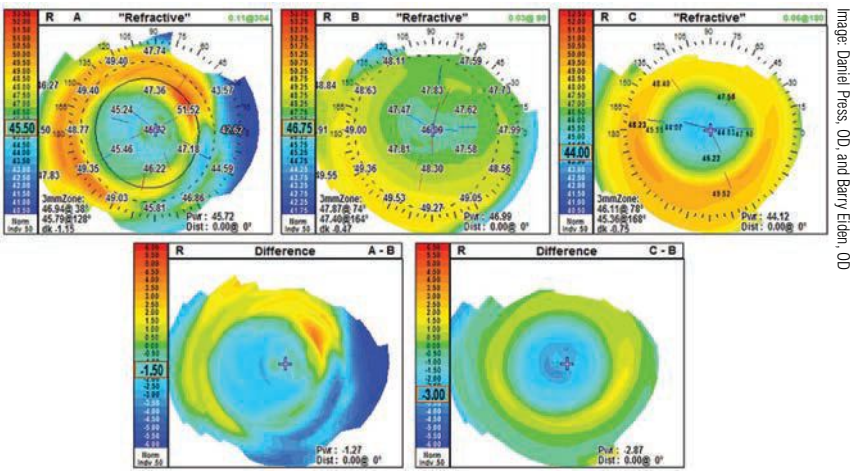

Image: Daniel Press, OD, and Barry Elden, OD

Topograpy is an essential tool for a specialty contact lens fitter. These refractive difference maps help illustrate ortho-K's treatment effect. In map A, the patient is wearing a multifocal lens. Map B is the naked cornea, and map C is the same patient after a night of ortho-K.

Advances in contact lenses: An opportunity to better serve patients

Fellow of the American Academy of Optometry and owner of a Florida-based eyecare practice looks at the contact lens market and shares patient-centered strategies

April Jasper, OD
Advanced Eyecare Specialists
West Palm Beach, FL

Contact lens wearers remain a substantial and growing proportion of the patient base for most eyecare practitioners (ECPs). In a 2019 survey, 55% of ECPs said they expect their contact lens practice to increase in the coming year.[1]

Perhaps not surprisingly, this survey also found that daily disposable lenses accounted for 39% to 50% of contact lens fits and refits in 2019. Daily disposable lenses are favored for their convenience and are associated with better patient-reported adherence to the wearing schedule than lenses that are replaced every 2 weeks.[3] Indeed, 64% of ECPs said they thought the daily disposable soft lens category had the greatest potential for growth.[1]

The most popular contact lens material regardless of replacement frequency is silicone hydrogel, which accounts for 65% of fits.[1] Since their introduction to the market two decades ago, silicone hydrogel materials have undergone continual evolution, aimed at preserving their high oxygen permeability while increasing water content and wettability.[2]

> *82% of silicone hydrogel daily disposable wearers expressed strong interest in a contact lens that could prevent or reduce dryness, suggesting a need for further innovation in this category*[4]

The trends toward increasing adoption of the daily disposable modality and advances in silicone hydrogel material chemistry have converged in recent years with the development of silicone hydrogel daily disposable lenses.

Despite the popularity of these lenses, survey data indicates that half of silicone hydrogel daily disposable wearers experience symptoms of lens dryness and 69% settle for less comfort in order to wear lenses for the entire day.[4] Additionally, 82% of these wearers expressed strong interest in a contact lens that could prevent or reduce dryness, suggesting a need for further innovation in this category.[4]

LISTENING TO PATIENTS

Contact lens wearers may attribute their dryness symptoms to a variety of sources, such as the use of digital devices.[4] And while it is true that sustained screen time is often associated with reduced blink rate and increased tear film instability, we must address other factors that can contribute to contact lens dryness and discomfort.[5]

Often enough, the slit-lamp exam reveals an underlying issue, such as meibomian gland dysfunction, that must be addressed before successful contact lens wear can commence. And sometimes it is clear either from the appearance of their existing contact lens surface or from the patient's comments that overwearing may be to blame for their symptoms.

However, building a relationship that enables us to understand patients' goals and expectations for contact lens wear can be almost as important as the physical exam. At the beginning of a visit, our patients fill out a brief questionnaire about their occupation, hobbies, and ocular symptoms. This allows me to enter the exam room with a fact or two to initiate a conversation. A warm greeting and a personal comment at the beginning of the exam can go a long way toward opening up the flow of dialogue.

Through the course of each exam, I try to find a way to ask two essential questions. First, "What about your current glasses or contact lenses do you wish were different or better?" Framing the question in this way—as a "wish"—gives patients an opportunity to share even those things that they may think are impossible or that I would frown upon. Maybe they wish they could be less dependent on glasses, maybe they would like to wear their contacts overnight, or maybe they wish their contact lenses were more comfortable at the end of the day. The second question I ask is, "What are your goals for today?" This helps me further understand what is important to the patient—what their ideal outcome would be at the end of the visit.

Setting the stage with these questions helps facilitate a positive interaction later in the exam, when I can, for example, tell a patient about an innovative contact lens option that may allow greater freedom from spectacles, facilitate overnight wear, or offer more comfort. Knowing more about the patient's wishes and goals helps guide my recommendations and how I frame them, setting a firm foundation for future visits in which a patient's needs, vision, or the available contact lens technology changes.

LOOKING AHEAD

While contact lens technology has advanced enormously over the last two decades, more innovation is coming. Patients in my practice know when they come back each year that I will be there, listening to their wishes and goals, and ready to tell them about innovative options for their vision correction needs.

64% of ECPs believe daily disposables are the soft lens category with the greatest growth potential[1]

65% of contact lens fits in 2019 were in silicone hydrogel materials[1]

69% of current silicone hydrogel daily disposable wearers are settling for less comfort in order to wear lenses all day[4]

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Creating a niche within the practice builds a loyal patient base and is an asset to any practice that wants to provide services beyond the standard dilated exam and glasses, Dr. Fischer says. Many patients who need specialty lenses have had poor experiences in the past and have dropped out or are discouraged, he says.

"By being fully invested in your patients and specialty contact lens care, you are providing a service that many offices will not be able to provide. This alone will keep your patients happy, seeing well and in your practice."

Specialty lens practices are also more insulated from online contact lens sellers because these lenses are highly specific and cannot be purchased online, Dr. Fischer says.

Additionally, increased fees allow doctors to focus their attention on fewer patients while reaping higher net gains, Dr. Collier adds.

For Dr. Sonsino, the reduced patient caseload has been a boon.

"When you schedule half the number of patients, it makes your life much more enjoyable," he says. "When I went from an academic medical practice where I saw 25 patients in a half-day to private practice where I see 14 in a full day, I saw my quality of life improve drastically. My kids know my name!"

If you're at the stage where you are going to consider yourself a contact lens specialist and incorporate custom soft and GP lenses into your practice, you need to be all in, the experts agree. "If you're not fully committed, please do what's best for the patient, which would be to send them to a practitioner who is proficient in GP lens fitting," Dr. Woo says. "Think about how you would want to be treated as a patient." ■

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Finding the Motivation to Be a Specialist

Even the pros were once new to the game. Here, a few contact lens specialists share anecdotes about their humble beginnings:

Early interest. Throughout high school and during his undergrad studies, Dr. Fischer worked as a technician at his local optometrist's office. Prior to starting optometry school, he sat down with the practice owners and shared his goal of working with them after graduation.

"Thankfully, they were open to exploring that opportunity, too."

Together, they identified a few services not offered within a few hours of their location: dry eye and specialty contact lenses.

"Since then, I've done all I could to learn and grow in these areas."

During Dr. Fischer's fourth-year rotations, he worked in locations that had dry eye clinics and/or a thriving specialty lens practice, which solidified his drive to focus on these specialties. After graduation, he elected to do a residency, where he was matched with a dry eye and specialty contact lens focused private practice in Seattle. The residency laid the groundwork for Dr. Fischer to take his knowledge and set up his Dry Eye and Contact Lens Center back home at his practice in southern Indiana.

Swayed by happy patients. Dr. Woo, a scleral lens expert, first became interested in contact lenses during her third year as an optometry student.

"Witnessing keratoconus patients see clearly for the first time was incredibly rewarding," she said.

From there, Dr. Woo decided to pursue a cornea and contact lens residency, which gave her the opportunity to work with a variety of lens types, in addition to an extra year spent with specialty contact lens patients.

"This was, by far, the best career choice I could have made."

After her residency, Dr. Woo returned to Arizona and joined a private practice that did zero specialty contact lens fits.

"I implemented specialty lenses slowly but surely," she says.

Inspired by the Academy. Early in Dr. Sonsino's schooling, he was exposed to the Cornea and Contact Lens Diplomates of the Academy, which gave him the impression almost everyone at the helm of optometry—the leaders, researchers and inventors—was a member of this elite group.

"It was intoxicating, and I knew I wanted to be among them."

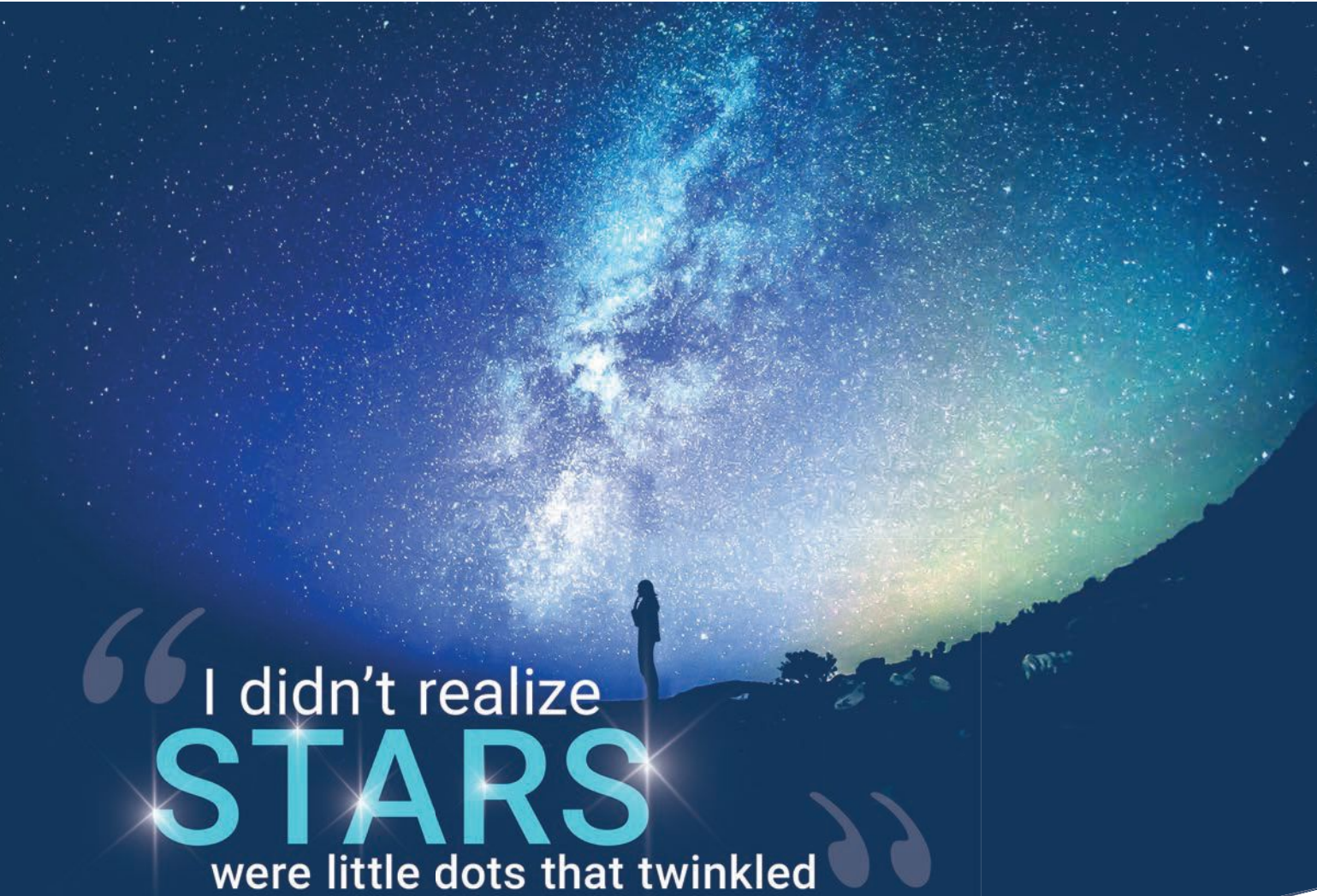
Dr. Sonsino says it took the first 10 years of his career to build the expertise and confidence, but in 2012, he was accepted as a Diplomate of the Academy's Cornea, Contact Lenses and Refractive Technologies Section. "Since then, the giants in the field have not only mentored me but have become my friends."

One case changed everything. Dr. Miller's interest in contact lenses began during in her third year of optometry school when she started shadowing contact lens residents.

An encounter on dispense day with a keratoconus patient who was new to GP contact lenses sealed her fate as a contact lens specialist.

"Seeing how emotional that day was for this patient and how excited they were to finally see the leaves on trees and 'in HD,' I knew I wanted to fit specialty contact lenses and impact my patients' lives forever. It is a very rewarding experience despite the difficulty and time it may take to fit a patient in a specialty contact lens."

Dr. Miller later completed a cornea and contact lens residency and was hired at an office that wanted to incorporate specialty contact lenses into their practice. She eventually developed an ortho-K clinic and then added scleral and prosthetic lenses to the practice.



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44th Annual Contact Lens Report

Are You Making the Most of the Newest Soft Lenses?

Improvements in function, comfort and design can make the wear experience better for patients. By Melissa Barnett, OD

A specific contact lens recommendation can make all the difference in a patient's contact lens wearing success. While a robust arsenal of soft contact lens options is available on the market, the practitioner may find it difficult to select the right contact lens for each patient. Even more options have come out in just the last year or two, compounding the problem—and the opportunity. Let's examine some of the newest state-of-the-art contact lens technologies available today.

Keep It Personal

Commence this process with taking your patient's history. First, ask if there is a history of contact lens wear. If so, inquire whether they are happy with their lenses or if there is something that could improve their wearing experience. Ask if they would like to improve their vision, stability of vision and comfort. Take note of how long during the day and how often during the week they wear their lenses.

Asking about a history of contact lens wear or discontinuation of contact lens wear is also important.

The Eyeris display senses that trial lenses of a particular power have been removed and automatically orders the missing trials.

Inquire about the specific issue with prior contact lens wear.

If there is no history of contact lens wear, ask the patient how often they plan to wear their lenses, all-day or only occasionally.

Always take into account the patient's occupation and daily activities. Inquire if the patient is interested in changing their eye color.

Explain to them that the choice of contact lens can help elevate their vision and comfort throughout their day, and the more specific they can be, the more you can be, too.

Make sure to ask if the patient desires lenses that provide relief when using digital devices or transitioning between different light conditions.

Perhaps there is a need for reading correction. It is also important to take note of any history of dry eyes, allergies or ocular surface disease.

Dryness and Discomfort

The main reason why patients discontinue contact lens wear is due to poor vision and reduced comfort. Furthermore, approximately 20% of neophyte contact lens wearers discontinue contact lens wear within the first year.[1]

In the global market, contact lens dropout is approximately equal to the number of new wearers

each year.[1] The rate of contact lens dropout ranges from 15% to more than 20%.[2,3] These rates are incredibly high, especially with the advancements in contact lens materials and designs. In a study that evaluated the impact of contemporary materials and designs on contact lens discontinuation, the primary reasons for stopping were discomfort and dryness; the secondary reasons were red eyes and cost.[4]

The Tear Film and Ocular Surface Society's International Workshop on Contact Lens Discomfort recommends multiple approaches to manage this chronic problem.[5] Recommendations include eliminating the lens care system by changing to a daily replacement modality, changing the lens care solution or care system, altering the frequency of contact lens replacement, or changing the lens design or material. Tear supplementation may be added, including topical artificial tears or prescription eyedrops, lacrimal inserts and punctal occlusion.

To decide which lens to recommend for each patient, also consider the effects of dry eye disease (DED). This can negatively affect quality of life, with symptoms such as grittiness, foreign body sensation, debilitating ocular pain and photophobia.[6] Visual fluctuation and distortion may also occur.

Tear film stability is important in contact lens wearers. If ocular surface disease is present, the quality of the tear film is diminished, increasing contact lens discomfort. Dry eye significantly increases the chance of contact lens drop out.[7]

For contact lens wearers, especially those with dry eye, it is important to ask which products are being used for the face and eyes. Many cosmetic products contain chemicals that may increase ocular irritation, blepharitis, meibomian gland toxicity and even cause, or exacerbate, DED. It is pertinent to discuss product use with all patients in order to optimize the ocular surface for all contact lens wearers, especially those with dry eye.

Switching to a daily disposable may result in a more comfortable, clean and healthier wear experience. These lenses are thinner and lighter, which may improve dryness and comfort. Also, these lenses are convenient since they do not need to be cleaned or disinfected each night.

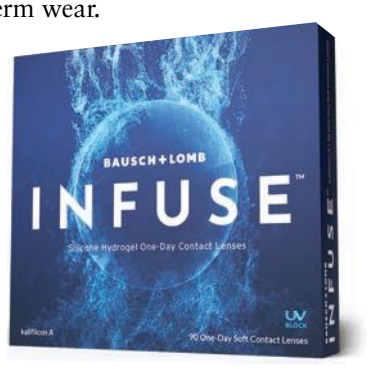
Precision1 by Alcon is a recent mainstream daily disposable contact lens option. It can address the common reasons why new wearers discontinue contact lens wear within the first year: poor vision, poor comfort and handling issues. This daily disposable, silicone hydrogel contact lens is available in a new lens material, verofilcon A, with Class 1 ultraviolet blocking capabilities.

Precision1 is made with a thin layer of moisture at the lens surface to help support a stable tear film and deliver lasting visual performance from morning to night, according to company literature.[8] The water content at the lens core is 51% and is greater than 80% at the surface.[8] As soon as I began fitting patients with this lens, they reported good vision and comfort.

The Eyeris daily contact lens is another new daily disposable, made from hioxifilcon A material. The lens has a Dk/t of 31.25. With the lowest modulus in the industry, it was designed for comfort and to resist end-of-day drying. The powers range from -13.00D to +6.00D in quarter-diopter steps from -7.50D to +4.50D.

Eyeris lenses are available online, but only through the company directly and participating doctors, to guard against improper order filling.

We can also look forward to the imminent arrival of the Infuse daily disposable silicone hydrogel lens from Bausch + Lomb within the next few months, in a new material called kalifilcon A. Infuse has a Dk/t of 134, a water content of 55% and is designed to increase ocular surface homeostasis, according to B+L. The company says the lens's ability to improve water retention will help encourage long-term wear.



Novel daily replacement lenses can alleviate issues that drive dropout.

This patient who complained about eye strain from computer and digital device use did well using Acuvue Oasys with Transitions in both eyes.

Photosensitivity

Many patients spend long hours on their computers, phones and tablets, as well as reading, driving or playing sports. They often ask for ways to reduce digital eye strain symptoms.

Acuvue Oasys with Transitions (Johnson & Johnson Vision Care) is a new option you can offer these patients. The lenses adapt to changes in light intensity, filter blue light and provide UV protection. Computer and digital device users experience relief as the lenses adjust during use. Acuvue Oasys with Transitions lenses filter up to 15% of light in the blue light range indoors and 55% outdoors.[9,10]

The lenses protect against indoor light, glare, squinting and fatigue. Those who are bothered by light and glare indoors or outdoors are good candidates, and many of my patients with headaches and migraines have found relief with these lenses. For night driving, the lenses reduce glare and halos, which my patients with mild to moderate cataracts especially appreciate.

Although these lenses are not designed as a substitute for sunglasses, my patients who are athletes also appreciate the automatic adjustment to different lighting conditions.

I have my patients trial these lenses for 10 to 14 days, then wear their habitual lens for a few days. This process enables the majority of my patients to appreciate the benefits of this technology.

Two Problems, One Lens

The patient's type and amount of refractive error, astigmatism and presbyopia are critical for contact lens selection. Historically, a high percentage of those who have discontinued lens wear are astigmatic.[11] Astigmats remain over-represented in the dropout population, and yet toric contact lenses are still underprescribed.[12] A high proportion of astigmats, including those who have previously dropped out, can be successfully refit with lenses that correct for astigmatism.[13] In addition, toric lenses can deliver additional visual quality-of-life benefits.[14]

In my practice, astigmats specifically complain of blurry or fluctuating vision with digital device use at the end of the day.

In a study of emerging presbyopes, the reasons for drop out were divided between vision and discomfort. Convenience was also noted as a reason for discontinuation.

Contact lenses that correct for astigmatism are the second largest contact lens segment, and nearly one third of all adults who require vision correction could benefit from this design.[15] Bausch + Lomb's Ultra for Astigmatism's stable toric lens design might benefit these patients. Their latest option, the Ultra Multifocal for Astigmatism contact lenses, introduced in 2019, are an excellent option for patients with refractive error including astigmatism who have presbyopia.

This monthly replacement option combines the Ultra's lens design with the 3-Zone Progressive multifocal design from the Ultra for Presbyopia lens. These lenses correct for astigmatism and provide good binocular distance and near vision, along with lasting comfort.

These new multifocals are straightforward to fit and provide an excellent option for presbyopic astigmatic patients. Multifocal optics are designed to provide clear vision at all distances, including intermediate vision and enhanced binocular vision. These lenses have been a helpful option for my patients with astigmatism and presbyopia.

Another option to correct both astigmatism and presbyopia is the new Biofinity Toric Multifocal by CooperVision. The company says this lens's toric geometry is designed to provide a predictable orientation and stable fit for consistently clear vision at all distances with multiple correction zones as well as help reduce dryness and maintain good comfort throughout the day.

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In-office diagnostic fitting sets of toric multifocal lenses can help you properly fit patients with astigmatism and presbyopia.

Color Lenses

This category tends to be a missed opportunity in many practices. I ask every patient if they are interested in changing their eye color, whether on a daily basis or occasionally.

For those interested in changing or enhancing their eye color, Alcon's new lens line, Dailies Colors, offers a daily replacement option for color enhancement. The company says it designed these for natural-looking color enhancement: the inner ring provides brightness and adds depth, the primary color enhances eye color and the outer ring defines and emphasizes the iris. I find patients like the color options and find that these lenses look natural on the eye.

Myopia

Interest in myopia management continues to grow. Myopia is an emergent public health issue, affecting patients worldwide, particularly in Asia.[16] Escalating rates of myopia prevalence are associated with increased risk of retinal detachment, glaucoma, cataract and myopic retinopathy.[17-20]

In January 2020, CooperVision introduced MiSight, a single-use contact lens FDA approved to slow myopia progression. A clinical trial compared MiSight's dual-focus optics with a single vision contact lens of the same material and overall geometry.[21]

Of 109 patients who completed the clinical trial, the unadjusted change in spherical equivalent refraction was -0.73 D (59%) less in the test group compared with the control group. The mean change in axial length was 0.32mm (52%) less in the test group compared with the control group. Of interest, changes in spherical equivalent refraction and axial length were highly correlated.

Children as young as eight years old may be fit with MiSight lenses.

Sharing clinical studies with patients and their parents and explaining long-term risks associated with myopia helps educate them and encourages to choose a myopia management option. Even if a parent is not interested in myopia management, I document the discussion to revisit at a later time.

Patients who like color enhancement lenses may not be aware of daily replacement options.

Offer the Best

There are various ways to gather information about new contact lens options. Lectures at live or virtual meetings provide the latest thinking from experts. Published articles can also direct you to the best ways to obtain knowledge about these novel and up-and-coming designs and technologies. Each of your contact lens representatives can also be wealth of knowledge and are superb at providing valuable information.

In my practice, I like to be the first to offer new technologies to my patients. I want my patients to hear about the latest and greatest contact lenses from our practice first. Even if a patient is not receptive to contact lenses or a new type of lens at that time, I document their response to revisit at a later time.

If a patient is unsure if they want to try contact lenses, I provide resources, such as brochures or website information about the lens that might pique their interest. An in-office contact lens diagnostic trial lens fitting may also persuade them. I always give them the option of returning to their prior lenses if they do not like the new ones.

I liken trying new contact lenses to test driving a new car. Even if a person is currently happy with their car, added features and benefits with the newer models may interest them or be a major benefit to them; the same applies for contact lenses.

I like to inform my patients about imminent technologies even before they are available, such as the new Infuse silicone hydrogel lens by Bausch + Lomb, the one-day Acuvue Oasys and other novel daily replacement lenses currently in the pipeline.

Even if my patient is not a candidate for a specific lens, their friend or family member might be. For example, a longstanding patient with keratoconus who wears scleral lenses was in for an appointment. From our conversations, I learned that his daughter was an excellent high school tennis player. I discussed a new contact lens technology that may be perfect for tennis players, which prompted him to bring in his daughter for a contact lens refit for this updated technology. Building this relationship not only helps the patient trust the doctor, it's a practice building opportunity.

Some practices have talking points that the doctor, technician and staff can use to help explain new contact lens technologies.

Some key phrases include:

- "We have a new, innovative contact lens that provides additional convenience and health benefits."

Educate parents on myopia management options to select the best-suited option for their child.

- "We have a personalized contact lens that is made just for you. It will provide [insert characteristic] to help with your [vision/comfort needs].
- "You deserve the opportunity to try the best contact lenses that are available. That is why I want you to try [name] contact lens."

Developing these conversations is beneficial to have a clear, consistent messaging in the practice.

It is incredibly rewarding to have a variety of contact lens options to provide good vision and comfort and provides the opportunity to fulfill a need, solve a problem or both. Narrowing down the right recommendation for each patient requires clear communication and close attention to their vision and comfort goals while optimizing their ocular health. ■

Dr. Barnett is a principal optometrist at the UC Davis Eye Center in Sacramento, CA. She is a fellow of the American Academy of Optometry, a diplomate of the American Board of Certification in Medical Optometry and a fellow of the British Contact Lens Association. Dr. Barnett serves on the Board of the American Optometric Association Contact Lens and Cornea Section.

Dr. Barnett is a consultant for Alcon, Bausch + Lomb, CooperVision and Johnson & Johnson Vision Care.

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Add Multifocals to Your Myopia Toolbox

These contact lenses are proving themselves to be an excellent treatment option. Here's what you need to know. **By Kara Tison, OD, and Carol B. Parker, OD**

Currently, 34% of the world is myopic—approximately 42% of the US population and 80% of some Asian populations.[1-3] Projections show that more than 50% of the global population will be myopic by 2050 with one billion at risk of subsequent sight-threatening complications.[1-3] In addition to rising numbers, the severity of the condition is also increasing.

The pathogenesis of myopia is tied to a combination of environmental and genetic factors. Researchers believe myopia progresses due to peripheral hyperopic defocus along the horizontal meridian.[4] This defocus stimulates the growth or elongation of the eye. As axial length increases, the risk for myopic macular degeneration, glaucoma, retinal detachment and cataract increase.[1,3,5-7] Highly myopic patients (refractive error >-6.00D, axial length >26mm) have an increased risk for visual impairment, as one-third will experience blindness or low vision.[1,4-6]

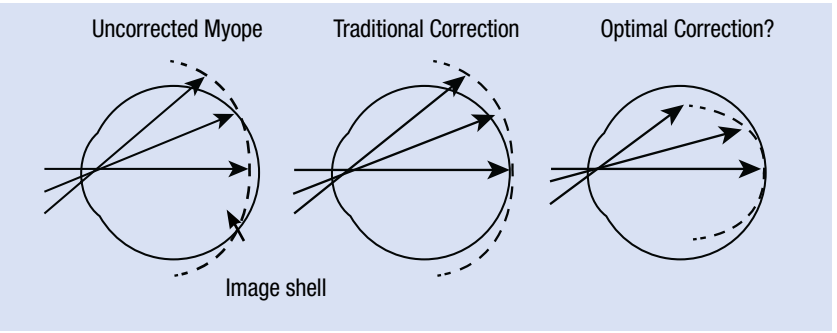

Fig. 1. This graphic illustrates myopic and hyperopic defocus, and the possible target for ideal correction. *Image: adapted from Smith EL. Optom Vis Sci. 2011;88(9):1029-14.*

Now more than ever is the time to start implementing myopia control therapies in your practice. Several treatment options exist, ranging from lifestyle changes to corneal reshaping. But one modality, multifocal contact lenses, fits neatly into the optometrist's toolbox.

Starting Therapy

Cycloplegic spherical equivalent refractive errors are the best predictors for myopia onset.[8] For example, research shows six-year-olds with a low degree of hyperopia (+0.75D or less) are at risk for becoming myopic.[8] Clinicians should monitor children yearly, as myopia progresses at an increased rate for children between the ages of seven and 12, those who have a higher baseline myopia and patients who have experienced a prior myopia progression of >-0.50D a year.[5]

Axial elongation has the greatest occurrence the year before the onset of myopia, and once myopia is present, axial length growth continues for an average of five years.[5]

In addition, myopia shows a higher increase in the winter months. The exact reason for this is

unclear but may be due to more schoolwork or less outdoor time.[4] It is thought that younger age is inversely related to effectiveness; thus, it is important to intervene when the patient is younger because they tend to progress more aggressively.

When starting myopia control, clinicians should consider the age of onset, current refractive errors, previous myopia control treatments, rate of progression, ethnicity, lifestyle and family history of myopia. We should not recommend myopia control therapies until myopia is visually significant (greater or equal to -0.50DS).[5,9,10] Some practitioners choose to wait until they observe progression to initiate myopia therapy.[11]

The ultimate goal of myopia control is halting axial elongation with a secondary effect of slowing refractive error. Clinically, most practitioners are only able to measure success by monitoring progression of refractive error.

Without intervention, refractive errors, on average, continue to change by 0.50D to 1.00D per year during eye elongation.[5] Fortunately, we now have viable treatment options to help slow the progression of myopia, with some showing more success than others (*Table 1*). Low-dose atropine, orthokeratology and soft multifocal contact lenses are current popular myopia control treatment options. Here, we focus on multifocal contact lenses.

Myopia Control Theories

The mechanism behind myopia control is not well understood, as little is known about the specific signal and pathways that regulate eye growth.[4,7,12] When regulating eye growth, the peripheral portion of the eye plays a larger role than the central part of the eye. With traditional contact lenses and glasses, the central retina is in focus, while the peripheral retina experiences a hyperopic defocus (*Figure 1*). Researchers first suggested hyperopic retinal defocus in the 1970s as a potential mechanism for myopia progression.[12,13]

Research shows that axial elongation can be delayed by creating a myopic defocus on the peripheral retina. Orthokeratology and soft multifocal contact lenses are both thought to eliminate the hyperopic defocus and provide a peripheral myopic blur to the retina, which slows eye growth.[4,7,12] Little is known regarding the amount of myopic blur needed to effectively slow growth, although current research suggests that increasing the degree and extent of peripheral myopic defocus can improve myopia control outcomes (*Table 2*).[2,5,7]

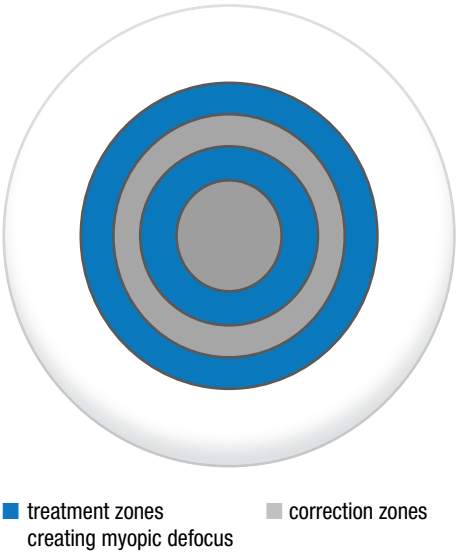

Fig. 2. The MiSight lens has two treatment zones, creating a peripheral myopic defocus that causes the image to focus in front of the retina and slow axial elongation. Myopia is corrected in all gaze positions. *Image: adapted from CooperVision.*

Multifocal Benefits

Historically, multifocal soft contact lenses were designed for correcting presbyopia; however, they have also been used for myopia control and one lens is now FDA approved for myopia management.[14] Research suggests the center-distance, or extended depth-of-focus, lenses slow myopia by reducing peripheral hyperopic defocus.[14] Research suggests this lens modality can slow myopia by approximately 50% to 87.5%.[14,15]

The lenses can provide benefits for those who do not want to wear

Table 1. Myopia Control Research

Therapy Method	Conclusion
Under-correction of myopic refractive error	Ineffective
Gas-permeable contact lenses	Ineffective
Outdoor time	Effective at reducing onset of myopia, ineffective for myopia control
Bifocal/multifocal spectacles	Statistically significant but clinically not significant[4,15]
Executive bifocal	Approximately 39% slowing of refractive error[9] *Did not assess axial elongation
Orthokeratology	Approximately 45% reduction of axial elongation[2,4]
Bifocal/multifocal contact lenses	50% to 87.5% effect on refractive error, 29% to 55% effect on axial elongation[14,15]
0.01% atropine	Approximately 59% slowing of refractive error and no effect on axial elongation[5,21]

Factors Influencing Myopia Development

Genetics is just one component of the inheritance pattern of myopia development. For example, a child with two myopic parents is at a higher risk of developing the condition than children whose parents are not myopic.[4,14] Research shows East Asian children between the ages of 11 and 15 are eight times more likely to be myopic than Caucasians.[5]

Additionally, time spent outdoors, a close working distance while reading and length of time of reading are environmental factors that may affect the development of the condition.[4,5,27]

Few preventative measures exist for this condition, although research shows that an average of two hours of outdoor time per day can help reduce the onset of myopia.[14] The exact mechanism is unknown, but theories include brightness of light exposure, increased short wavelength and ultraviolet exposure (UV) exposure.[5]

Once a patient does become myopic, outdoor time does not slow the progression of myopia.[7,28,29] Additionally, one study showed a 50% reduction in the number of children progressing into myopia with the use of 0.025% atropine.[4]

spectacles or use long-term medication. Contact lenses can improve the visual quality of life for myopic children and can improve self-esteem, athletic competence and societal acceptance.[15,16] In addition, research shows one lens can reduce lag of accommodation and showed improvement in accommodative amplitude in patients.[2]

Another advantage of this treatment option is that most optometrists are already familiar with soft multifocal lenses.

Some parents have concerns regarding contact lens use with children. However, with proper education on wear time, modality and lens hygiene, clinicians can help reduce the risk of adverse events such as microbial keratitis.[1] A child has more risk of visual impairment from complications of high myopia than from microbial keratitis.[1]

Daily replacement contact lenses can help to reduce the risk of infections, as one study found this modality had 12.5 times lower risk of inflammatory issues compared with other lens replacement schedules.[17] Most of the newer myopia-control contact lenses are daily disposable designs.[1]

Fitting Tips

The multifocal soft contact lens parameters, such as wear time, add power and pupil size, vary with each patient and may affect the fitting and clinical outcomes of myopia control.[13]

Wear time is an important factor in slowing myopia progression.[18] When evaluating efficacy of a lens, studies usually require a minimum of six hours of wear time per day.[13] In daily practice, the suggested wear time for adequate myopia control is seven to eight hours a day.[13]

The add power of a lens is what induces myopic blur and halts eye growth, and research shows improved myopia control with higher add powers.[19] The BLINK study is the first trial to evaluate soft multifocal contact lenses (distance-center design) with a low (+1.50D) vs. high (+2.50D) add over a three-year period.[20] The results of the BLINK study were not available at the time of publication, but once they are, they may modify the previous recommendation of high add powers for soft multifocal contact lenses to achieve adequate myopia control therapies.[5]

Some children may have difficulty adapting to multifocal soft contact lenses with high add powers. Practitioners should consider visual acuity, contrast sensitivity and subjective quality of vision when adjusting the prescribed contact lens power.

An increase by -0.25D to -0.75D may improve distance visual acuity and decrease symptoms. If visual function does not improve, clinicians can consider adjusting the add power, if available.[15]

Pupil size can affect both the refractive power of the multifocal lens and the patient's visual function and should be considered when fitting these contact lenses.[13,21,22] Visual distortions can increase in low lighting and when larger pupil sizes are measured with the light distortion index.[21]

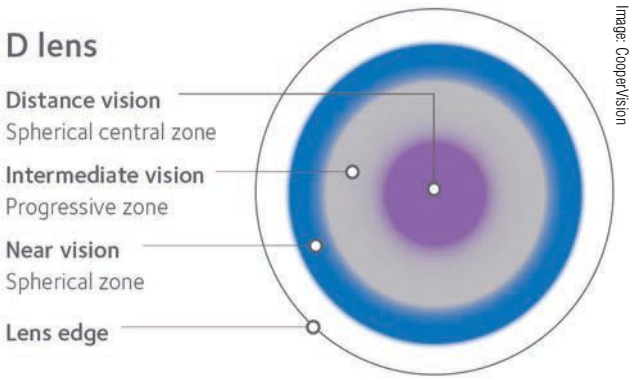

Image: CooperVision

Fig. 3. CooperVision's Proclear and Biofinity both employ a distance-center design that is an effective off-label option for myopia control.

Multifocal Options

Industry is beginning to offer products designed—or at least effective off-label—for myopia management.

MiSight (CooperVision) is currently the only FDA approved multifocal lens for myopia management, and the company's online training (https://coopervision.com/practitioner/myopia-management) is required to fit the lens. The lens is indicated for myopia control in patients between the ages of eight and 12 with a myopia correction of -0.75D to -4.00D with ≤0.75D of astigmatism.[24]

MiSight is a daily disposable lens with a dual focus design (*Figure 2*). The four-ring structure combines distance correction zones with peripheral treatment zones designed to control the progression rate of myopia.[23,24] The lens power is chosen by refracting to the most plus or least minus and calculating the spherical equivalent for any astigmatism.[24] If the patient has 1.00D or greater of astigmatism, spectacles over the contact lenses are suggested to minimize ghosting.

Research shows the lens provides a 59% reduction in mean cycloplegic spherical equivalent refractive error and 52% reduction in axial elongation compared with spherical lens wearers in a three-year study.[23]

NaturalVue multifocal (Visioneering Technologies) is a daily disposable lens used for myopia control in other countries but remains an off-label option in the United States. The lens uses an extended depth-of-focus design to help slow myopia progression. Because of the design, the expectation is that visual acuity is similar to that with spectacles.[2] The lens has a universal add power effective up to +3.00D. The manufacturer recommends starting with the best spectacle refraction, using the red/green (duochrome) test for the final binocular sphere power and then using one click into the green (-0.25D) as the starting lens.[25]

NaturalVue shows an 81.25% halting of myopia progression and 6.25% regression over a six to 25-month period.[2] It also shows a 55% reduction in axial length.[26] NaturalVue parameters range from +4.00D to -12.25D in 0.25D steps. Patients with up to 1.00D of astigmatism may be successfully fit in these lenses.

CooperVision has two monthly replacement distance-center multifocal lens designs that can be

Table 2. Center-distance Dual-focus Lenses for Myopia

	MiSight	NaturalVue MF	Biofinity MF	Proclear MF
Power	-0.25D to -6.00D	+4.00D to-12.25D	+6.00D to -10.00D	+6.00D to -8.00D
Base Curve	8.7	8.3	8.6	8.7
Diameter	14.2	14.5	14.0	14.4
Add	one single design	one single design	+2.50/+2.00 recommended	
Design	concentric ring	extended depth-of-focus		
Tint	visitint			
UV	none	class 2	none	none
Material	omafilcon A	etafilcon A	comfilcon A	omafilcon B
Water Content	60%	58%	48%	62%
Dk	27	20	128	21
Replacement	daily	daily	monthly	monthly
Fitting	minimum minus	duochrome first green; use manufacturer calculator for starting lens	studies show -0.50 to -0.75sph over-minus as needed	

used off label for myopia therapy: ***Proclear*** and ***Biofinity*** (*Figure 3*). A two-year study using the Proclear lens showed a 50% reduction in myopia and 29% reduction in axial elongation.[4,16] The ongoing BLINK study will provide information regarding the Biofinity multifocal lens for myopia control.

When using the Proclear and Biofinity multifocal designs for myopia control, clinicians should first consider using a +2.50D add power.

There are no current studies regarding multifocal toric contact lenses and the impact of myopia progression. However, if the patient has over 1.00D of astigmatism, the ***Proclear Toric multifocal***, ***Proclear Toric multifocal XR*** and ***Biofinity toric multifocal*** are available. If clinicians choose to use a custom lens, a smaller optical zone is preferred to affect a larger retinal area and allow greater myopia control.[4]

Ongoing research will provide more information for future treatments and rebound effects, optimum designs and exact amounts of peripheral myopia defocus needed.

Other Treatment Options

To complement contact lenses, or supplant that option in unsuitable patients, clinicians have other avenues to explore:

Atropine is a nonspecific muscarinic receptor antagonist that causes cycloplegia and mydriasis. Muscarinic receptors are found in the human ciliary muscle, retina and sclera.[27] The exact mechanism of action is unknown, but data suggests atropine acts on the retina or sclera to inhibit elongation and prevent eye growth.[4,5,7,27] Because the patient is dilated, UV light may also increase collagen crosslinking within the sclera, which slows scleral growth.[4]

Studies suggest 0.01% atropine has similar effects on refractive error compared with higher concentrations.[30] Low-dose atropine has fewer reported side effects and less rebounding effects once discontinued compared with higher doses. So far, research shows no signs of retinal damage in patients with long-term atropine use.[4] While 0.01% atropine can slow myopia progression by 59%, axial elongation is not affected.[4,31]

Currently, the World Health Organization recommends limiting atropine treatment to two years.[5] Due to the long-term daily use, clinicians should take into account the corneal toxicity from preservatives or prescribe preservative-free atropine.[5]

Orthokeratology, a long-established treatment for myopia control, shows a reduction in axial length by approximately 45%.[4] With this modality, clinicians can only monitor effectiveness due to axial length because the treatment eliminates the refractive error, and once orthokeratology is stopped, a baseline return of the refractive error is variable and usually incomplete.[32]

Orthokeratology uses a rigid gas-permeable contact lens to reshape the cornea. The lens is worn during the night (>8 hours recommended). Physicians using orthokeratology for myopia control have better outcomes with patients who have moderate myopia (-1.25D to -4.00D) and larger pupils.[4]

The FDA has refractive error limitations with orthokeratology of 6.00D of myopia and 1.75D of cylinder. Effects on axial length are encouraging and studies show it is a useful myopia control option for those who are already moderately myopic.[7] It is recommended that orthokeratology treatment is maintained until the age of 14, as there may be a greater rebound if discontinued at a younger age.[4]

Combination treatments may be more effective than stand-alone treatment due to the different mechanisms of action. One study shows a decrease in axial elongation when combining orthokeratology and atropine vs. orthokeratology alone.[4] However, limited research exists on combining therapies, and if initiated, clinicians should have guarded expectations.[15]

Advances in the pipeline may soon help prevent and control myopia. With new designs of orthokeratology, contact lenses and novel spectacle lenses, the future is exciting for myopia management. Newer research has focused on Defocus Incorporated Multiple Segments (DIMS) lenses and has shown decrease in axial length by 60% and slowed refractive error progression by 59%.[33] These lenses are currently marketed outside the United States. Additionally, there are other novel spectacle lenses being investigated that affect peripheral contrast but will have no effect on central vision.[34]

Follow Up and Discontinuation

Once clinicians successfully initiate treatment, regardless of the approach, they should evaluate the patient at least every six months to ensure treatment safety and efficacy.

Soft multifocal contact lenses can be continued as long as no ocular health issues arise. Most studies evaluate one to five years of treatment, so long-term effectiveness remains unknown. In addition, questions remain regarding the mechanism of action and if any rebounding effect occurs with soft multifocal lenses.[4,13]

When deciding when to discontinue myopia control treatments, clinicians should note that every additional year of education is associated with an increase refractive error of -0.27D.[5] One study of post-university graduates who were in front of computers for an extended period of time found they experienced a 10% myopia progression.[4]

The COMET study showed peak myopia deceleration was 11.95 years of age.[10] Further research suggests the average age of myopia stabilization is between the ages of 15 and 16; however, a large majority of myopes will continue to progress into their 20s.[5,10]

Knowing the estimated age of progression and stabilization, while also closely monitoring the patient's refractive status, can help clinicians

determine when to discontinue myopia control treatment. Once treatment is discontinued, continue close monitoring of the refractive error to ensure that there is no progression.

Multifocal soft contact lenses are one of the best ways to control myopia. However, only a small percentage of practitioners are fitting the lenses for this condition. An international survey indicated only 6.8% of contact lens fits in 2018 were for myopia control, albeit this is up from 0.2% in 2011.[9] Of those, only 47.9% were with soft lenses.[9]

Hopefully, myopia fittings will continue to increase with a better understanding of the advantages of soft multifocal contact lenses to reduce myopia rather than leaving patients at a greater risk of future myopic pathologies. ■

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Dr. Parker has more than 32 years of experience fitting specialty contact lenses in private practice, where she continues to be a consultative research optometrist. She recently joined the Robley Rex VAMC, where she is starting the Contact Lens service.

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44th Annual Contact Lens Report

Don't Let the Scleral Surge Pass You By

There's no better time than now to take advantage of the rising demand for this lens modality. By Brooke Messer, OD

It's no secret that scleral lenses single-handedly revived and now dominate the gas permeable (GP) contact lens market. Some practitioners jumped on the scleral lens bandwagon 10 to 15 years ago, while others are just now starting to get their feet wet.

This article, geared toward novice fitters, outlines how to begin providing scleral lens care for appropriate patients.

Stocking Equipment

After you've decided to take the plunge, you'll need to equip your office for scleral lens fitting. There are a few items you should have handy:

Fitting sets. Start by considering the types of patients in your clinic who might need scleral lenses. Then, do your research and speak with lab consultants and colleagues about which lens designs and fitting sets best fit your practice profile.

Most scleral lens experts suggest having at least two fitting sets in your office so you can accommodate the majority of patients who walk through your door. These sets should cover a range of lens parameters and shapes, such as 15mm to 18mm diameters in prolate and oblate designs.

Handling tools. Stock up on plungers, which are tools used to handle lenses. A larger plunger is used to insert scleral lenses and acts like a golf tee to balance the lens as it is applied to the eye. Smaller plungers adhere to the surface of the lens for easy removal.

You can find insertion and removal educational videos at www.sclerallens.org, a site that is supported by the Scleral Lens Education Society.

Have a few mirrors to help patients learn how to apply the lenses.

Lens solutions. Scleral lenses are comprised of a GP material, but because they typically have a high Dk/t, they must be handled accordingly.

Disinfecting solutions should be non-abrasive, as the higher the Dk/t, the easier it is to cause scratches or micro-abrasions to the lens surface. Imperfections on the surface of the lens are ideal places for deposits to attach and contribute to additional glare and starburst issues.[1]

Prior to insertion, the lens is filled with a preservative-free saline solution. There are a number of FDA-approved and off-label filling solutions available. Make specific product recommendations and periodically confirm which products your patients are using. Due to the preservative-free nature of filling solutions, recommending products packaged in a vial is the safest approach.

Determining Candidacy

The first step in prescribing scleral lenses is understanding who benefits from them. These patients commonly have irregular corneas, ocular surface disease or both.[2]

Those with irregular corneas benefit from the surface of a GP lens and its ability to correct irregular astigmatism. They may have keratoconus, a post-surgical cornea—including corneal transplantation—or corneal scarring. If a patient could optically benefit from

a corneal GP lens, it's likely they are a good candidate for scleral lenses.

Sclerals are also ideal for patients who could not adapt to corneal GP lenses due to vision or comfort issues.

Patients with ocular surface disease benefit from the fluid reservoir located against the cornea in scleral lenses—the post-lens tear layer. This reservoir (filled with preservative-free saline solution, artificial tears or even autologous serum) bathes the cornea and better protects it to allow healing, promote comfort and reduce pain.

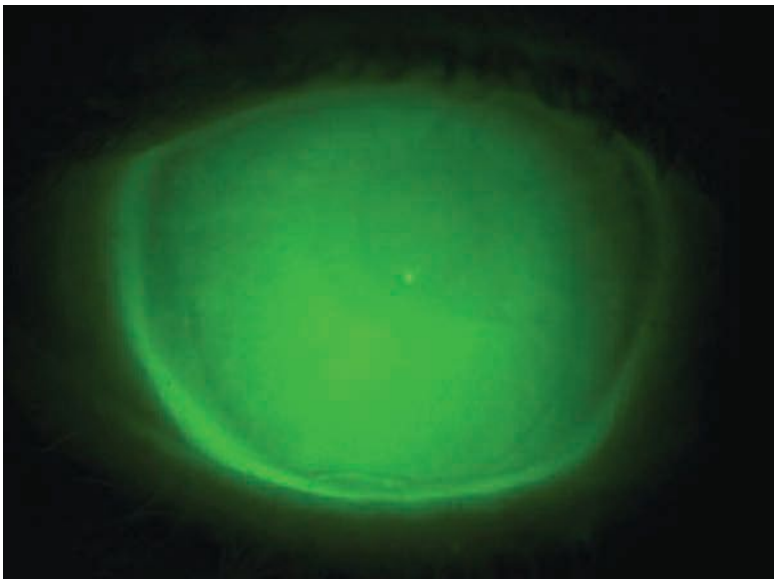

Fig. 1. Observe the sheen of NaFl across the limbus to ensure proper clearance.

Other scleral lens candidates may include patients with lens dryness or a regular cornea shape who struggle to achieve adequate vision with other lens options, including those with high ametropia or astigmatism.[2]

The stability of a well-designed large lens offers a consistent visual experience that is ideal for active patients who need sharp acuity at all times.

Evaluation Process

As with any new patient, obtain a detailed medical and family history, with a focus on ocular history. Ask the patient if they have had any previous contact lens experience, either positive or negative, and if they are able to successfully wear glasses (in cases of irregular corneas).

Next comes basic entrance testing, including refraction, biomicroscopy, posterior segment evaluation and binocular vision assessment. Complete refractions to measure best-corrected acuity, even in cases of advanced corneal irregularity, for long-term monitoring purposes and to justify the need for custom contact lenses to insurance panels. Corneal topography will shed light on a patient's ocular surface profile.

In addition to conducting a typical slit lamp evaluation, note fine ocular surface details and irregularities, including conjunctival pingueculae, melanosis and irregular vessel appearance. Record corneal findings, such as neovascularization, haze and scars, with measurements or photos for continued monitoring after initiating lens wear.

Make sure to determine the visual impact of any lenticular opacities and retinal or optic nerve disease. If a cataract is present, consider referring the patient for surgical intervention first to remove the cataract, reduce the amount of spherical refractive error and improve vision with contact lenses. It can be frustrating for both the patient and the practitioner when vision is still limited by a cataract after completing a scleral fitting.

At this time, enough information should have been collected for the prescriber to determine the patient's candidacy for scleral lenses.

If you are still unsure whether the patient could benefit from scleral lenses due to a significant corneal scar, cataract or other concern, place a diagnostic scleral lens on one eye and perform retinoscopy to evaluate vision potential. This is also a great way to judge the potential for relief in the case of ocular surface disease.

Patient Education

When a candidate for scleral lenses presents in your office, it's important to take a consistent step-by-step approach, especially as your practice relies on you evaluating, educating and fitting every patient according to policy. Not only does this promote professionalism within the field, but it also creates a foundation for growth.

Since there is so much information available on scleral lenses, taking the time to cover several key points with patients right away can save time and money later in the process. These patients typically respond better to transparency and are more compliant.

Consider putting together a contract-like form of all the information you cover that requires your patient's signature after they

have been evaluated but before you pursue further action. This protects your office by limiting the services that a patient may have otherwise declined. Think about having a qualified staff member present the contract and answer any questions, as this discussion can be time-consuming.

Include the following in the patient education part of the process:

- Lens costs and warranty period
- Service fees and insurance coverage
- Payment timing and refund policy
- Care products and wearing/replacement schedule
- Follow-up commitment and troubleshooting

Lens Selection

Once the patient reviews and signs the form, the fitting process can begin. From the diagnostic set, select the lens according to the corresponding fitting guide. While scleral lens diagnostic sets are all slightly different, these general aspects can help with your initial selection:

Lens diameter. Larger corneas need larger lens diameters to appropriately vault the limbus. A larger lens diameter (at least 16.5mm) should also be used for very severe ocular surface disease to ensure more surface coverage. Smaller lenses (15.0mm to 16.0mm) can be used for patients with regular corneas and milder dryness.

Lab consultants can help you select diagnostic sets with appropriate corresponding diameters and, from there, fine-tune measurements.

Corneal shape. Regular and ectatic corneas typically require a prolate lens shape that is steepest in the center and flatter toward the periphery. Post-surgical corneas are flatter centrally and steeper in the mid-periphery. This oblate shape is seen with post-LASIK, post-radial keratotomy, corneal transplants and Intacs (AJL Ophthalmics) rings in some cases of keratoconus.

Some scleral lens diagnostic sets have both oblate and prolate lens shapes to better align with the corneal shape and aid in centration.

Sagittal depth. More severe ectatic conditions require deeper lenses, while regular corneas are typically shallower.

When selecting your first diagnostic lens, start with a shallower sagittal depth for normal-shaped eyes, and move to a deeper sagittal depth for severe ectasia requiring a larger lens.

Lens Fitting

After selecting the lens, rub it with conditioning solution to wet the surface, set it on a large plunger, fill it with preservative-free saline, dab it with a sodium fluorescein (NaFl) strip to dye what will become the post-lens tear layer and apply it to the eye.

Because scleral lenses are large and stable, they are usually fairly comfortable for the patient, and no proparacaine is needed.

With a diffuse light and cobalt filter, evaluate for any bubbles between the lens and the cornea. Very small bubbles do not warrant removal, but if moderate to large bubbles are present, the lens should be removed and re-inserted. The primary causes of insertion bubbles are lid interference during the application process and lack of saline in the lens bowl prior to

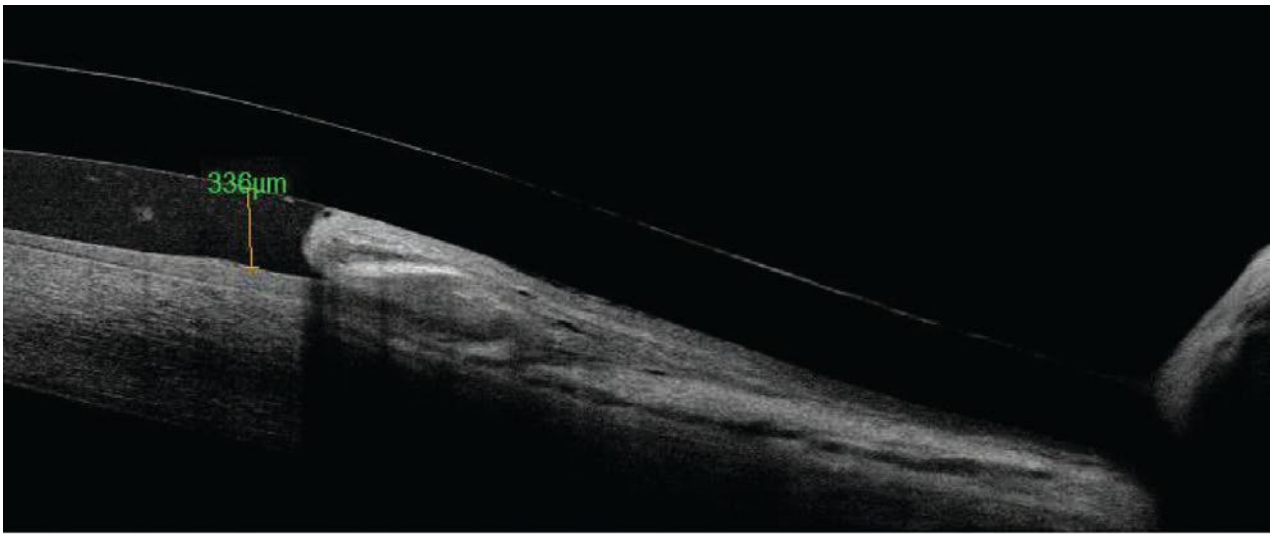

Fig. 2. Anterior segment OCT of the limbal area shows conjunctival prolapse.

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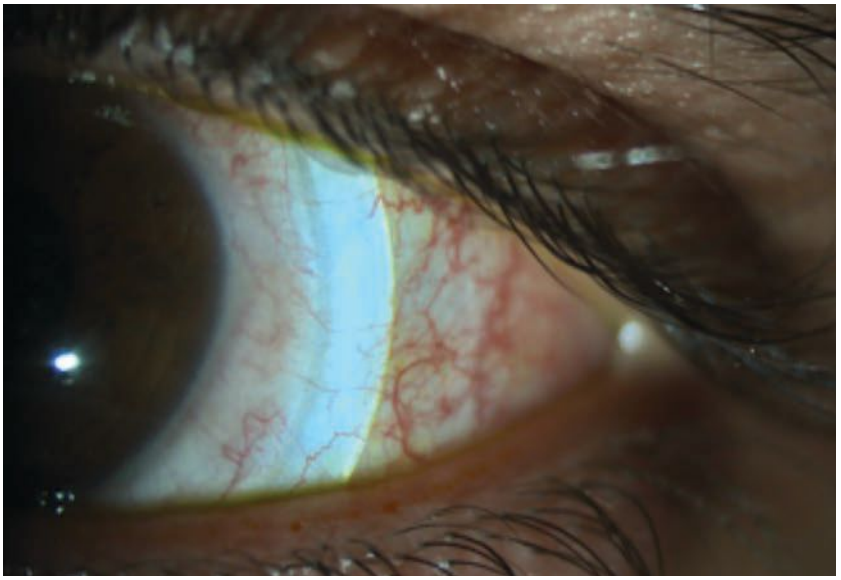

Fig. 3. Blanching occurs under the peripheral curves and can cause limbal vessel engorgement.

application. Rarely is the patient's scleral shape too atypical or toric that it is difficult for the lens to create a seal to the eye.

Once there are no bubbles, evaluate the limbal area. You should see a very faint amount of fluorescein covering it (*Figure 1*).

With an optic section and white light, evaluate the entire system. Posteriorly, you will see the corneal layers, then the fluorescent post-lens tear layer and finally the clear scleral lens.

Compare the thickness of the post-lens tear layer and the scleral lens itself at the point of thinnest clearance over the cornea, or the scleral lens vault. A common mistake new scleral lens practitioners make is evaluating the lens clearance over the line of sight, not at the point of thinnest clearance. This may be at the apex of the cornea in a patient with keratoconus or in the mid-peripheral cornea on a post-surgical eye.

The desired vault of a scleral lens varies by lens design, but on average, 100µm to 250µm is desired.[3] The diagnostic fitting set you choose will indicate the appropriate lens thickness, and you can use that knowledge to estimate the vault of the post-lens tear layer over the cornea.

Keep in mind that the scleral lens will settle by about 96µm to 146µm over a few hours, so you'll want to aim for about 400µm of vault at your initial fitting.[4] Shallow vaults will eventually settle and touch the cornea, which could cause corneal abrasions in the short-term and contribute to scarring if worn long-term. Excessive vaults decrease oxygen available to the cornea.

Moving outward, evaluate the limbus with your optic section to attempt to quantify the amount of clearance. The desired limbal vault is a minimal amount, around 20µm to 40µm.[3]

Shallow vaults over the limbus can damage the limbal stem cells and long-term health of the cornea, and excessive vaults can cause conjunctival prolapse and neovascularization. Anterior segment OCT (AS-OCT) scans are very helpful when troubleshooting the limbal vault (*Figure 2*).

Evaluate the landing curves, or haptics, on the scleral surface. The conjunctival vasculature should appear normal in caliber and uninterrupted in blood flow under the lens at the lens edge. The landing zone should be evaluated in three parts: where the lens meets the conjunctival surface just outside the limbus, or the "heel," under the lens haptics and at the edge of the lens, or the "toe."

When speaking to a lens consultant and adjusting these peripheral curves, describe the lens as "toe-down" if the edge is digging into and impinging the conjunctiva. Impingement often leaves a gutter-like indentation on the scleral surface after the lens is removed and stains with NaFl. This is not to be confused with a mild, wide compression ring that patients often note after lens removal. This compression ring does not stain with NaFl, and the surface bounces back fairly quickly after lens removal, similar to a mark on your wrist after taking off a watch.

"Heel-down" describes a lens that shows interrupted or blocked blood vessels under the lens landing curves closer to the limbus. The cessation of blood flow is called "blanching" and can occur under the heel or toe of the peripheral curve system. Heel-down peripheral curves often cause engorgement of the blood vessels around the limbal area (*Figure 3*).

Lastly, look at the overall position of the lens. Is it significantly decentered inferiorly or laterally? Does it move significantly with blink? Is there edge lift with eye movements?

Aberrometry can highlight higher-order aberrations produced by a decentered scleral lens. Ideally, a scleral lens should be centered or nearly centered in primary gaze with little to no movement on blink. Lens centration and movement will improve as you modify the central vault, limbal clearance and landing zone.

Upon completing your lens evaluation, perform an over-refraction. This is a great opportunity to sharpen your retinoscopy skills, especially as an autorefractor can sometimes be unpredictable with a scleral lens.

Obtain the best-corrected acuity with a spherical over-refraction first, and then add in cylinder to improve vision quality. In nearly all cases, you should order a spherical lens power first, as over-refractive astigmatism can decrease as you improve the fit and centering of the lens.

Lab consultants offer a wealth of knowledge for new scleral lens fitters. Consider speaking with a consultant prior to your first patient for information about their lens designs and preferred way of collecting data. Then, reach out again to place your first few orders until you feel confident enough to complete the process on your own. Consultants can guide you in material selection and other lens treatment add-ons.

Dispense Visit

This is an exciting day for both the patient and the practitioner. The scleral lenses should be prepared for wear according to lab instructions. Some lenses come ready to wear, while others arrive dry and need to be cleaned and conditioned.

Have a dispense kit for the patient ready that includes recommended cleaning, storing and filling solutions, along with a few plungers. Also, provide a form that lists the recommended solutions and how to use them, websites for insertion and removal help and the expiration date on the specialty lens warranty. Patients are given a lot of information at the dispense visit, so it's easy for them to get confused or forget instructions. This form will ensure that doesn't happen.

When the patient arrives, briefly review their history and check their acuities and corneal health to ensure it's safe to insert the lenses.

After the lenses have been placed, use the same evaluation and over-refraction technique as with the diagnostic lenses. Follow with insertion and removal training, and dispense the lenses if the fit and vision are adequate.

Adjusted lenses can be ordered with the lab consultants. If no reorder is needed, the patient can return in about seven to 10 days for a follow-up corneal and lens evaluation.

Follow-ups and Troubleshooting

As you follow your patient through the warranty period, changes to the lens fit will need to be made. Follow-up visits can be a challenge to a new scleral lens fitter because patients usually present with the lenses on, and the practitioner must evaluate them without using NaFl. With practice, you'll become comfortable evaluating the central vault without the use of dye.

Evaluation of the limbal area can be more difficult without NaFl dye; this is where using AS-OCT can be valuable.

Another useful tool for troubleshooting is an anterior segment camera on the slit lamp that can take photos and videos for a consultant to review and suggest changes.

Ferris State University's scleral lens fitting guide can also come in handy.[5]

Once the prescribing process is complete, follow-ups are based on the corneal condition of the patient and the comfort level of the practitioner.

Delicate corneas prone to damage, neovascularization or inflammation should be seen several times per year to monitor corneal health; whereas, corneas that are less likely to have an adverse reaction to a scleral lens can be seen less often, perhaps every six months.

Mastering the art of scleral lens fitting presents a personal and professional commitment. However, the benefits are certainly worth it.

The information presented in this article is just the tip of the iceberg, but there are plenty of resources readily available for you to learn more. ■

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911 In the Exam Lane

Handling medical emergencies in the office can be stressful. Here's how to be prepared. By Chris Kruthoff, OD

As optometrists, we are acutely familiar with and regularly encounter ocular emergencies, be it chemical burns, macula-on retinal detachments or acute angle-closure glaucoma. We are also prepared for conditions with ocular manifestations, such as pupil-involving third nerve palsy, papilledema or central retinal artery occlusions. However, we may be less prepared for systemic emergencies that can arise in the office.

Studies suggest that non-hospital medical offices are often ill-equipped and unprepared for medical emergencies due to rarity, time and financial constraints for training.[1,2] In addition, some offices may not invest in emergency preparedness because of the perceived proximity to hospitals for easy transfer.[1,2] While medical emergencies in the office may be uncommon, proper management is critical to avoid serious complications when they do happen.

This article reviews common medical emergencies you may encounter in the office and how quick thinking and an appropriate response can play a critical role in achieving positive outcomes for your patients.

Initial Assessment

Patient emergencies are stressful situations, and it may be difficult to think and react clearly. To make the initial assessment easier, start with the "ABCDE" approach: Airway, Breathing, Circulation, Disability and Exposure:[2-4]

- ***Airway:*** assess the patient's breath sounds for any strain and check the patient's voice (normal voice means a patent passageway). Stabilize this passageway with a head tilt and chin lift.
- ***Breathing:*** check respiratory rate, chest wall movements and pulse oximetry, if possible. Seat the patient comfortably (or have them lie down, if needed) and provide rescue breaths or further ventilation, if needed.
- ***Circulation:*** evaluate skin color, sweating, capillary refill time (ideally below two seconds) and blood pressure. Stem any bleeding, if present, and elevate the legs to return blood flow to the head, if necessary.
- ***Disability:*** evaluate the patient's level of consciousness—is the patient alert, voice responsive, pain responsive (i.e., via sternal rub with knuckles) or unresponsive—and limb movements and pupillary reflex.
- ***Exposure:*** keeping patient privacy and dignity in mind, expose skin to evaluate for any clues to cause of patient's emergency episode.

This systemic approach is applicable in all clinical emergencies (aside from cardiac arrest, see below), is applicable for children and adults alike and is used by those who deal with clinical emergencies often, including EMTs, critical care specialists and trauma specialists. This technique provides

a good starting point in the proper care for the patient. Further intervention is case dependent. Here is how to manage symptoms that may be more commonly seen in optometry offices:

Fainting

Syncope is defined as a transient, sudden and temporary loss of consciousness with spontaneous and relatively prompt recovery.[5,6] The most common form of syncope optometrists are likely to encounter is vasovagal syncope (i.e., fainting), which can be triggered by an number of common ocular examination components including tonometry, gonioscopy, punctal plug insertion, contact lens insertion and eyedrop instillation.

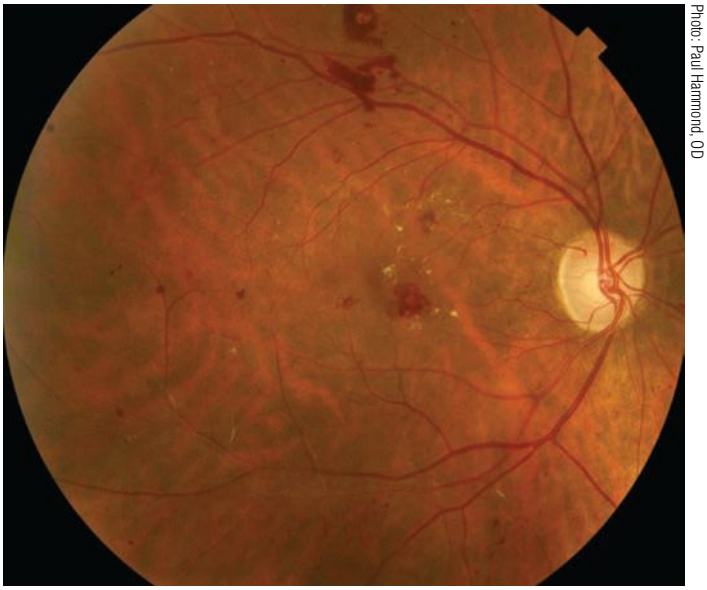

Photo: Paul Hammond, OD

Diabetic patients, such as this one with moderate nonproliferative diabetic retinopathy, are commonplace in the optometry practice, and are more prone to hypoglycemic symptoms, especially those who need insulin to control their blood glucose.

This reflex is complex, involving emotional or orthostatic stress that stimulates the vagal neurons in the central nervous system, causing a decrease in sympathetic output (and concurrent increase in parasympathetic output) to the heart and vasculature of the body. This process results in marked vasodilation, bradycardia and hypotension.[5,7] Ultimately, this combination may lead to inadequate cerebral perfusion, triggering a loss of consciousness.[6] Patients undergoing an episode may exhibit sweating, pallor and hyperventilation and may note symptoms of fatigue, dizziness, blurred vision, loss of hearing and nausea.[5,7]

Recognizing a possible oncoming episode of vasovagal syncope is key, as loss of consciousness may be avoided with early intervention by having the patient sit or lie down if they start noting the above symptoms.[7] Blood flow should be directed towards the head by elevating the patient's legs (the Trendelenburg position), if possible, to help return blood flow to the head, and you should follow the standard ABCDE evaluation.

The patient should return to consciousness in a short period of time, and while they may be weak, it is rare for the patient to exhibit severe confusion.[7] Once the patient has regained consciousness, allow them to remain supine and relaxed, during which time you should reassure and monitor them with periodic checking of blood pressure and pulse strength and rate.

It is prudent to document the episode and note it for future visits, especially if it helps you avoid potential triggers. A single episode of vasovagal syncope with a known trigger usually does not warrant medical workup; however, you should evaluate repeat episodes or unknown cause of a syncope episode to rule out other underlying systemic disorders.[5,7]

Anaphylaxis

This is a serious systemic hypersensitivity reaction that can be life-threatening. Incidence of anaphylaxis is on the rise, particularly due to food allergies in younger patients; insect stings and medication responses continue to be more prevalent in adult patients.[8,9]

This allergic response is driven by IgE antibodies that form after initial exposure to an antigen and bind to mast cells and basophils; subsequent exposure leads to crosslinking of the bound IgE and release of mediators such as histamine.[10]

Patients exhibiting anaphylaxis may present with a sudden onset of a variety of signs and symptoms, including hives, itching, swollen lips/tongue/uvula, shortness of breath, wheezing, reduced blood pressure (age-dependent for children, <90mm Hg systolic for adults), gastrointestinal symptoms such as nausea, vomiting and diarrhea and acute coronary syndrome.[9,10]

According to the National Institute of Allergy and Infectious Disease, to diagnose anaphylaxis or the suspicion of it, the patient should meet one of these three clinical criteria:[11]

- Acute onset (minutes to hours) of an illness with involvement of the skin, mucosal tissue or both and at least one:

  - Respiratory compromise
  - Reduced blood pressure or associated symptoms of end-organ failure
- Two or more of the following that occur rapidly after exposure to a likely allergen:
  - Involvement of skin and mucosal tissue
  - Respiratory compromise
  - Reduced blood pressure or associated symptoms
  - Persistent gastrointestinal symptoms
- Reduced blood pressure after exposure to a known allergen

While a major finding in most cases of anaphylaxis, skin symptoms such as hives may be absent in around 10% of cases and may be delayed in their onset when they do occur, so you should not rely on them as the only determinant when considering anaphylaxis.[8]

After calling for emergency medical services, the essential first-line treatment for an anaphylactic episode is an intramuscular injection of epinephrine into the mid outer thigh, which may be given through clothing if needed.[8,9,12,13] Dosage is dependent on size and age: adults should receive a maximum of 0.5mg, and children should receive a maximum of 0.3mg.[9] This may be delivered via a needle and syringe or an autoinjector such as an EpiPen (epinephrine injection, Mylan) or Auvi-Q (epinephrine injection, Kaléo).

Epinephrine acts quickly through alpha and beta sympathomimetic actions to cause vasoconstriction, increased cardiac output, bronchodilation and inhibition of further inflammatory mediators from mast cells and basophils.[8,9] Second-line agents such as steroids, histamine-1 antagonists or beta-2 adrenergic agonists may be helpful in more chronic situations but are not an acceptable substitute for epinephrine during an acute attack.[9,12]

Patients experiencing an anaphylactic episode should be laid in the Trendelenburg position to maximize blood flow to the head while blood pressure, heart rate and respiratory status are monitored.[9] Patients may need a second injection if they do not respond to the initial dose. All patients should be seen by emergency services after injection, regardless of response, for further monitoring.

Anaphylaxis can occur with any medication, and you should prepare your staff to respond when necessary. Some states allow optometrists to perform fluorescein angiography, which has been known to cause rash/urticaria, laryngeal edema or bronchospasm, cardiovascular events and even death.[14,15] Reports also highlight the potential for anaphylactic reactions to topical eye drop use.[16,17] While the occurrence of an anaphylactic episode in office is rare, it is important to know the signs and symptoms and initiate prompt treatment.

Hypoglycemia

This is the most common and most serious side effect of treatment to lower blood glucose in diabetic patients.[18] Aggressive treatment to decrease hemoglobin A1c may lead to higher risk of hypoglycemic episodes, and this risk is particularly high in patients who are on insulin to control their blood glucose.[18] Symptoms of hypoglycemia present as autonomic changes—trembling, sweating, anxiety, hunger, nausea or tingling—and neuroglycopenic changes such as confusion, difficulty concentrating, drowsiness, vision changes, dizziness and headache.[18,19]

Any number of these signs are caused, most commonly, by insufficient consumption of food, although it may occur due to physical exercise, stress, miscalculation of insulin dose or oscillating blood sugar levels.[18] Hypoglycemia is defined in stages:[19]

1. Mild hypoglycemia (blood sugar between 56 and 70mg/dL): autonomic symptoms present, patient may be aware and self-treat
2. Moderate hypoglycemia (blood sugar between 40 and 55mg/dL): autonomic and neuroglycopenic symptoms both present, patient may be aware and self-treat
3. Severe hypoglycemia (blood sugar <40mg/dL): more severe symptoms, patient needs assistance with treatment and may become unconscious with potential for coma or seizure

As we encounter diabetic patients in increasing levels in practice, it is important to recognize these manifestations of hypoglycemia and treat them before potentially serious or fatal complications occur.

For patients who are conscious, the American Diabetes Association recommends the "15-15" rule—ingest 15g of a simple carbohydrate, such as glucose tablets, four ounces (1/2 cup) of juice or regular soda, one tablespoon of sugar or honey or hard candies (amount varies by what is being eaten), and check blood sugar after 15 minutes; if blood sugar remains below 70mg/dL, provide the patient another serving.[20] This should be adjusted for young children, who usually need less than 15g to return to normal blood sugar readings.[20] Patients in severe hypoglycemia may require more initial carbohydrate consumption (20g) to get a more robust initial spike in blood sugar.[19]

Those who are unconscious require urgent care, and emergency

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response should be contacted immediately. In these cases, it is important to avoid injection of insulin, as it would further reduce blood sugar levels, or to attempt to provide food, drink or other oral therapies, as these are choking hazards. These patients may have glucagon injections that can be administered by a family member intramuscularly or subcutaneously.[19] More recently, glucagon has been formulated as an intranasal spray, which may be easier to administer to patients in need.[21] Patients who are administered glucagon may regain consciousness with resulting nausea or vomiting.[20]

Heart Attack and Cardiac Arrest

Heart disease is among the leading causes of death in the United States.[22] Among the potential manifestations of heart disease is acute myocardial infarction, or heart attack, which is caused by a decrease or stoppage of blood flow to part of the heart, leading to necrosis of the heart muscle, most commonly due to atherosclerosis.[23] Patients with hypertension, high cholesterol and those who smoke are at higher risk of developing cardiovascular disease that may result in heart attack.[22]

Symptoms of heart attack include chest pain or discomfort, jaw or neck pain, arm or shoulder pain and shortness of breath.[24] Women may also have more atypical symptoms including nausea, vomiting, unexplained fatigue and pressure in the lower chest and upper abdomen.[25]

One of the most important steps in managing heart attack is getting these patients to a hospital for emergency cardiac care.[26] For patients who are symptomatic for heart attack, call 911 immediately. Give the patient a dose of 325mg aspirin (without enteric coating) to chew for faster systemic absorption and provide water for them to swallow.[25,26] Monitor the patient until EMTs arrive for transfer to an emergency room with cardiac care.

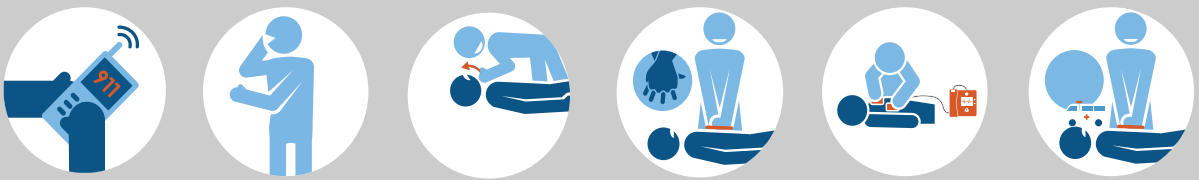
Roughly one in 20 cases of heart attack may lead to sudden cardiac arrest (SCA), where the heart ceases beating altogether.[27] The progression to SCA is perhaps the most devastating outcome of heart attack, as studies show a mortality rate of 37.7% compared with 4% of heart attack patients who do not progress to SCA.

You should bypass the ABCDE assessment for patients experiencing SCA.[3] If you encounter an unresponsive patient, the American Heart Association recommends beginning the administration of cardiopulmonary resuscitation (see, *"CPR First Aid Emergency Procedure"*):[28]

With any concern for heart attack, and especially in cardiac arrest, prompt emergency response is vital.[29] Perhaps the next most important step towards patient survival is the use of an automated external defibrillator (AED). A recent study shows that bystander use of AED for SCA provides a significant increase in survival rate (66.5% vs. 43.0%) and favorable outcome after hospital discharge (57.1% vs. 32.7%) compared with SCA patients who were first given cardioversion by emergency medical services.[30]

All AEDs provide step-by-step instructions in its use, and come equipped with the tools necessary

CPR FIRST AID EMERGENCY PROCEDURE



1. Call 911.
2. Call for assistance from those around and have them find an automated external defibrillator (AED). If nobody is near, quickly get the AED yourself and return to the patient.
3. Check for breathing and pulse.
4. If neither is present, start CPR; it should be administered at a rate of 100 to 120 pushes per minute in the center of the chest. If you use traditional CPR, start with 30 compressions followed by two breaths with the patient's head tilted back to open the airway, then repeat. If there are concerns for COVID-19 transmission and for those who are untrained or not up-to-date on CPR, a hands-only technique without breaths is still an effective option.
5. Once the AED arrives, attach the leads to the patient and follow the instructions provided by the device.
6. CPR should be continued until the patient starts to move or breathe or until emergency services arrive.

An office emergency preparedness kit may include items such as blood pressure cuffs, first aid kit and an AED. Place these items in a well-marked location that is easy to access.

to monitor for pulse and deliver electric shock, when needed.

If your office has access to this device, ensure that all doctors and staff know where it is so they can quickly retrieve it in an emergency. Some offices may not be equipped with an AED due to the high cost and rarity of in-office SCA. In this case, you can consult with other medical practices or businesses nearby to see if they have a device that you can access in the event of an emergency.

Preparation is Key

These emergencies are, fortunately, a rare occurrence in an optometrist's day-to-day practice, but being ready to react when they do happen is critical. Regular refreshers on both CPR and Basic Life Support training will provide you and your staff any new recommendations. Many states require optometrists to be current with these certifications.

You should also have plans in place that prepare staff to jump into quick action when these events occur. Keep emergency items such as a first aid kit, blood pressure cuff, pulse oximeter and an AED in a well-marked place and ensure that all staff know where to access this equipment. Keeping sugary drinks or foods in the office to provide to diabetes patients entering a hypoglycemic episode is prudent.

A set preparedness plan will help guide your team in the case of emergency. Many versions exist through multiple regulatory bodies, including the Centers for Disease Control and Prevention.[31] Regular review of these plans with your staff may be helpful.

However rare these emergencies may be in clinical practice, is important that we remain prepared for whatever walks through the door. Prompt and proper management may play a vital role in achieving a positive outcome for your patient. ■

Dr. Kruthoff is an optometrist at Northwest Eye Clinic in Golden Valley, MN. He is a fellow of the American Academy of Optometry.

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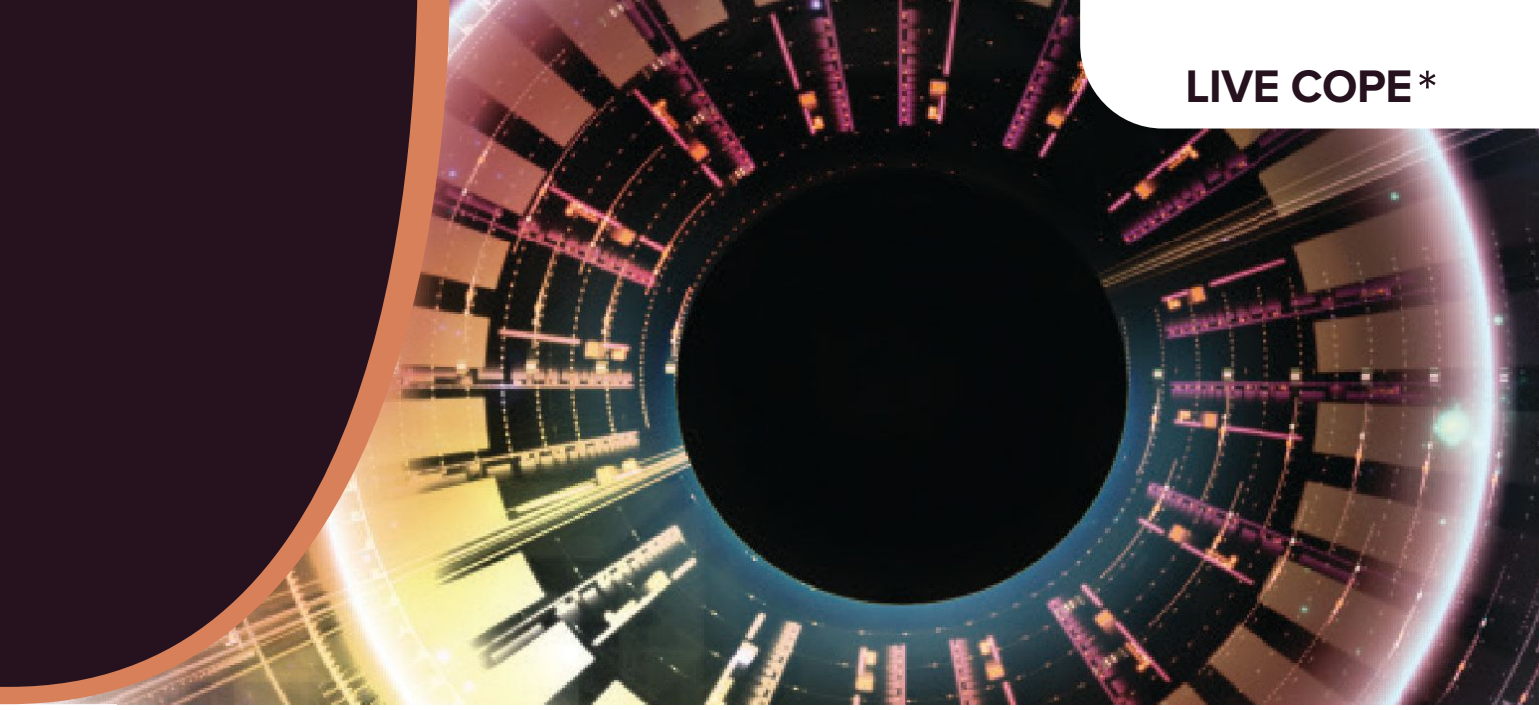

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PEER REVIEWED PRA ARTICLE

UNDERSTANDING AMD PRESENTATIONS AND PROGNOSES

These clinical pearls can help you identify at-risk patients in your practice and care for them over the long haul. **By Jessica Haynes, OD**

To achieve best outcomes, patients with all levels of age-related macular degeneration (AMD) must be identified, properly educated and managed according to current evidence-based standards. Staging of the disease is crucial to determine risk of progression, recommended treatment/management and set an appropriate follow-up schedule. Clinical evaluation begins with the fundus exam, but additional diagnostic tools can help to further evaluate those with AMD, identify risk factors of progression and allow for earlier detection of all disease stages.

Funduscopic Evaluation

Even with significant advances in retinal imaging, the diagnosis of AMD is still most likely to stem from a thorough fundus exam. Findings associated with AMD may not always present in a dramatic fashion and can be masked by media opacity (e.g., cataract) or simply by a less-than-cooperative patient. This, along with other factors, may explain the results of a recent study that found 25% of AMD patients were misdiagnosed as having a normal macula. Of those misdiagnosed, 30% had signs consistent with intermediate AMD and would have benefited from nutritional supplementation.[1]

This type of misdiagnosis presents a huge missed opportunity for risk modification and appropriate patient education. Findings such as drusen, pigmentary alterations, geographic atrophy (GA) and macular hemorrhage can be signs of AMD and should be evaluated carefully, often with additional diagnostic tools.

Drusen are the hallmark finding of AMD. Their size is important in staging AMD and determining risk of progression. They are classified as small (<63µm), intermediate (between 63µm and 124µm) or large (≥125µm).[2,3]

Release Date: August 15, 2020
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Estimated Time to Complete Activity: 2 hours

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Educational Objectives: After completing this activity, the participant should be better able to:

- Identify the early signs of AMD.
- Discuss the clinical metrics that can document AMD-related changes.
- Identify dry AMD and the signs of conversion to wet AMD.
- Describe how disease progression will affect vision.
- Review the changing prognosis of AMD given new therapeutic options.

Target Audience: This activity is intended for optometrists engaged in the care of patients with AMD.

Accreditation Statement: In support of improving patient care, this activity has been planned and implemented by the Postgraduate Institute for Medicine and Review Education Group. Postgraduate Institute for Medicine is jointly accredited by the Accreditation Council for Continuing Medical Education, the Accreditation Council for Pharmacy Education, and the American Nurses Credentialing Center, to provide continuing education for the healthcare team. Postgraduate Institute for Medicine is accredited by COPE to provide continuing education to optometrists.

Faculty/Editorial Board: Jessica Haynes, OD, Charles Retina Institute

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Disclosure Statements:

Dr. Hayes has nothing to disclose.

Managers and Editorial Staff: The PIM planners and managers have nothing to disclose. The Review Education Group planners, managers and editorial staff have nothing to disclose.

Small drusen are subtle and require careful evaluation to visualize. A druse that is easily visible is likely medium to large sized. A major branch retinal vessel is about 125µm in width as it crosses the edge of the optic disc and is a good reference for grading drusen size funduscopically (*Figure 1*).[4]

AMD classification schemes used in major studies, such as the AREDS trials, are fairly involved and not easily incorporated into clinical practice.[5] Fortunately, various authors have provided more clinically applicable summaries (*Table 1*).[6]

In general, patients with only a few small drusen are considered to have age-related changes, not AMD. Those with significant small drusen or any intermediate drusen are diagnosed with early AMD. Those with significant medium sized drusen, any large drusen or pigmentary alterations should be classified as intermediate AMD. Patients with the presence of either GA or choroidal neovascularization (CNV) have advanced stages of the condition.

Patients with CNV have exudative, or wet, AMD, and those without have non-exudative, or dry, AMD. Most notably, the AREDS trials found that those with intermediate-stage AMD benefited from nutritional supplementation.[2]

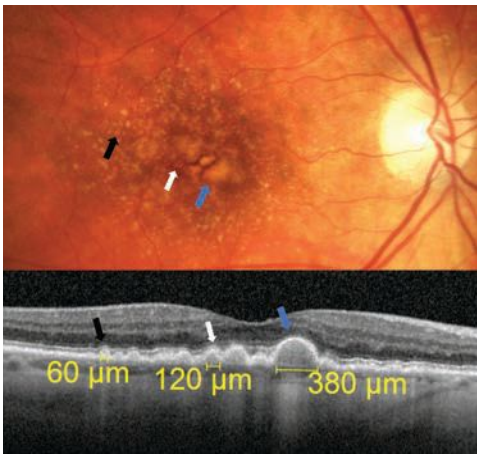


Fig. 1. In these diagonal OCT cross section scans, the black arrow points to a subtle small sized druse, the white arrow points toward a medium sized drusen measuring 120µm and the blue arrow points toward a druse that is easily large sized measuring at 380µm.

Patients with large drusen or any presence of pigmentary changes are at increased risk of developing advanced AMD. AREDS I Report No. 18 developed a point system that can help clinicians determine the five-year risk of progression to late-stage AMD based on the presence of these findings in each eye (*Table 2*).[7]

Patients with these findings must be educated regarding the benefit of nutritional supplementation and their risk for conversion to advanced AMD. They should be monitored with increased frequency and heavily educated about the importance of home monitoring with the Amsler grid or ForeseeHome system (Notal Vision) for early detection of conversion to wet AMD.

Early identification of CNV remains of the utmost importance in preserving vision in those with AMD. Approximately 10% to 15% of AMD patients will go on to develop CNV, risking quickly progressive and severe central vision loss.[8] The classic teaching of CNV appearance describes it as a "grey-green subretinal membrane," but CNV can vary widely in its fundus appearance.

Certain features should raise a red flag for suspicion. These include the presence of macular hemorrhage, particularly subretinal hemorrhage, macular exudates and macular thickening or elevation that could indicate intra- or subretinal fluid as well as large pigment epithelial detachments (PEDs) (*Figure 2*).[9]

In the setting of AMD, these findings with or without patient symptoms warrant further investigation with additional diagnostic tools.

Diagnostic Imaging

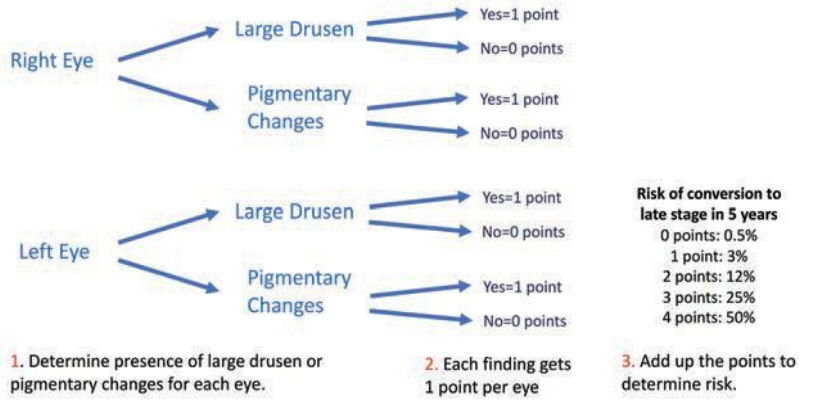
Many tried-and-true tools, as well as new technology, can help clinicians identify AMD:

Dye-based angiography. Intravenous fluorescein angiography (IVFA) was historically the go-to method for detection and classification of CNV. IVFA allows for classification of CNV as either classic or occult.

Table 1. AMD Classification & Management

AMD Stage	Fundus Findings	Management
Age-related Changes	Rare, small drusen	Reduce systemic and environmental risks. Monitor yearly.
Early AMD	Significant small drusen or any medium sized drusen	Reduce systemic and environmental risks. Recommend home monitoring with techniques such as Amsler grid. Monitor every six to 12 months, depending on risk.
Intermediate AMD	Significant medium sized drusen, any large drusen or pigmentary alterations	Reduce systemic and environmental risks. Discuss benefits of nutritional supplementation. Consider home monitoring device such as the ForeseeHome system. Monitor every four to six months, depending on risk.
Advanced AMD	Presence of GA or CNV	Reduce systemic and environmental risks. Discuss benefits of nutritional supplementation. Recommend home monitoring with techniques such as Amsler grid. Immediate referral for possible anti-VEGF injections for those with CNV. Monitor GA every six to 12 months, depending on risk. Consider low vision referral.

Table 2. AMD Staging



Classic CNV shows early, well-defined hyperfluorescence. Occult CNV shows patchy, ill-defined hyperfluorescence that appears later in the study (*Figure 3*).[10] Due to these characteristics, researchers described classic CNV as a net that was located primarily between the retinal pigment epithelium (RPE) and the neurosensory retina, allowing easy visualization, and occult CNV as nets located primarily between the RPE and Bruch's membrane where they could not be easily imaged.

These findings were verified with histological studies and optical coherence tomography (OCT) findings. Occult CNV is more commonly found in AMD than classic CNV.[10,11]

Dye-based angiography has largely been replaced in clinical practice with OCT for the diagnosis and management of CNV; however, this information remains relevant as it sheds light on the variable phenotypical presentation of CNV.[12-14]

OCT. This has become the most widely used diagnostic tool in posterior segment disease, and its value in the evaluation and treatment of AMD is undeniable. OCT allows for visualization of retinal drusen, and many instruments also allow for measurement of drusen size. Typical drusen appear as moderately reflective deposits between the RPE and Bruch's membrane.[15]

Drusen are transient, and over the course of the disease they can increase in size as well as resorb. A large regression of drusen can lead to new onset visual symptoms such as metamorphopsias, and it may be a precursor of advanced AMD, either formation of GA or CNV. Increased monitoring should be considered during periods of drusen regression. OCT can be used to monitor this clinical course (*Figure 4*).[16-19]

OCT can also help to identify a particular phenotype of drusen called reticular pseudodrusen (RPD), which presents as small, hyperreflective deposits that sit on top of the RPE and project upward toward the outer nuclear layer (ONL). They may project through the photoreceptor integrity line (*Figure 5*). This AMD phenotype is especially difficult to differentiate with fundus evaluation alone, and these drusen appear clinically as small- or medium-sized drusen.

Despite the size of RPD, patients with this presentation are at increased risk for both CNV and GA. Their risk is even higher than that of patients with large, soft drusen.[20-26] Patients with RPD may also have poorer visual function than those without RPD.[27-29] Identification of this finding warrants increased frequency of monitoring and patient education regarding higher risk of progression to advanced disease.

OCT imaging can also help clinicians identify GA, a sight-threatening complication of dry AMD. GA causes atrophy of the RPE and photoreceptors, leading to OCT findings of increased light penetrance into the choroid, loss of the photoreceptor integrity line and ONL atrophy.[30]

Perhaps the most notable benefit of OCT in AMD is identifying CNV and monitoring response to treatment. OCT imaging may detect CNV before clinical exam alone and should be considered for AMD patients with new visual symptoms or any clinical suspicion of CNV.

OCT findings present in CNV are variable and can include subretinal fluid, intraretinal fluid, PEDs and hyper-reflective subretinal material.[12-14] Any sign of possible fluid on OCT should raise a red flag for concern of CNV in a patient with AMD.

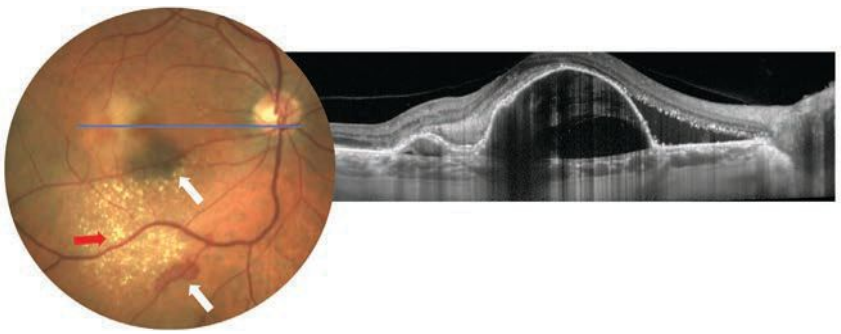


Fig. 2. Possible CNV findings such as subretinal hemorrhage (white arrows), exudates (red arrow) or macular thickening (not readily visible in photo, OCT shows macular thickening from large PEDs) should raise a red flag for further testing.

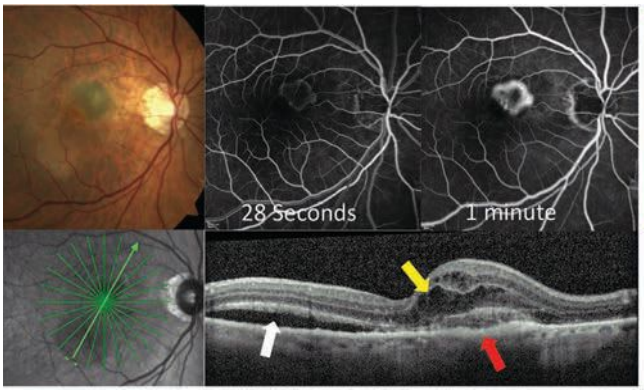


Fig. 3a. This classic CNV shows early hyper-fluorescence at 28 seconds on IVFA with localized area of leakage at one minute. OCT shows the lesion primarily on top of the RPE (red arrow) with overlying intraretinal fluid (yellow arrow) and adjacent subretinal fluid (white arrow).

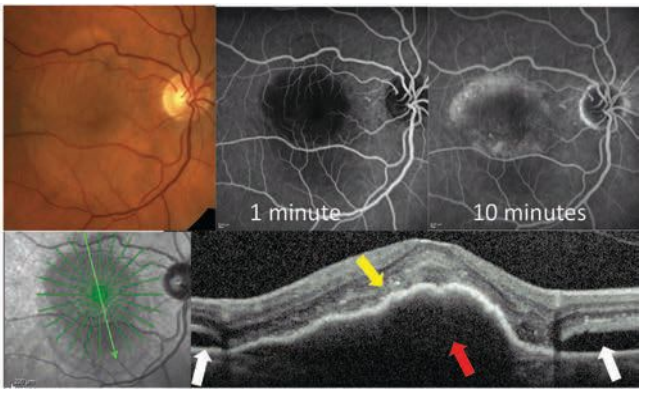


Fig. 3b. This occult CNV shows no leakage early at one minute, and delayed patchy leakage in the later phases. OCT shows the lesion is a large PED (red arrow) with overlying subretinal hyper-reflective material (yellow arrow) and adjacent subretinal fluid (white arrows).

Finally, it is important in patients with outer retinal disease to consider the status of the choroid, which can be visualized with OCT. Certain OCT imaging strategies, such as enhanced-depth imaging, allow for better visualization of the choroid and should be used when available.

In patients with AMD, the choroid tends to be relatively thin.[31-33] Normal choroidal thickness varies due to factors such as age and refractive error but could be considered around 250µm. Choroidal thickness alone is not indicative of a singular disease, but trends can be observed that are useful in developing a more complete clinical picture.

Evaluating the choroid on OCT can help to differentiate AMD from certain masqueraders such as central serous retinopathy that tends to have thicker than average choroid (*Figure 6*).[34]

Fundus autofluorescence (FAF). This is an important diagnostic tool for patients with outer retinal disease. A light source of a particular wavelength is introduced into the eye and certain molecules, called fluorophores, will pick up the light source and autofluoresce. The most prevalent fluorophore in the retina is lipofuscin, primarily housed within the RPE. Disruptions to the RPE alter the autofluorescent signal. As RPE decreases and loses the ability for proper metabolism, increased lipofuscin concentration in the cells causes hyper-autofluorescence. In contrast, RPE cells that have atrophied show hypo-autofluorescence.[35]

FAF is particularly useful in identifying areas of GA and evaluating change over time. GA appears as very dense hypo-autofluorescence. GA with surrounding regions of hyper-autofluorescence is at an increased risk of growth.[36]

FAF is also helpful for patient education, allowing patients and family to understand that there are portions of the retina that see well, while other areas have atrophied, causing missing areas of vision.

This tool can also identify RPD, which has a very distinct FAF pattern. RPD present as small, hypo-autofluorescent circles in a reticular pattern on FAF. These hypo-autofluorescent circles sometimes have a hyper-autofluorescent core.[35,37]

In addition, FAF can be thought of as a general lipofuscin map or a map of the RPE health. Increased alterations to the normal autofluorescent pattern develop as there is worsening disease and decline in RPE function. FAF may demonstrate areas of disease that are not visible on fundus evaluation alone. Patients can present with

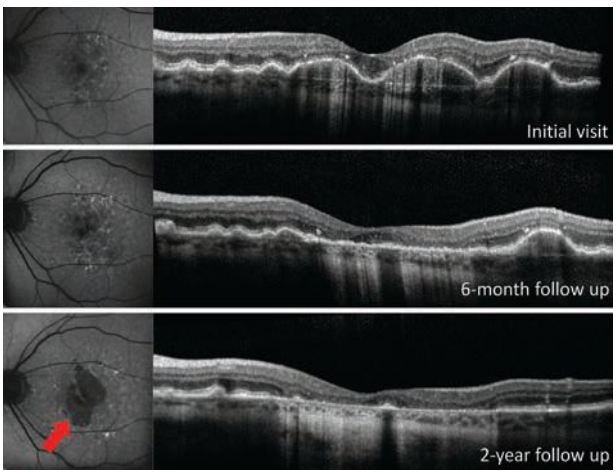


Fig. 4. On FAF, at left, GA shows as prominent hypo-autofluorescence (red arrow). On OCT, at right, GA results in atrophy of the outer retinal layers, including loss of the photoreceptor integrity line and ONL. In addition, there is increased light penetrance into the choroid due to atrophy of the highly reflective RPE layer.

similar funduscopic findings, but a more altered FAF likely indicates more advanced disease (*Figure 7*).[35,37]

OCT-angiography (OCT-A). The use of OCT-A in AMD primarily pertains to its ability to detect vascular flow in the outer retina or avascular region of the neurosensory retina, which allows for detection of CNV. OCT-A can effectively identify both classic and occult CNV; in some cases, it can delineate the size of CNV better than IVFA. OCT-A is dyeless with fast image acquisition, allowing for more frequent testing with less risk.[38,39]

As a fairly new technology, physicians are still determining how to best interpret and use OCT-A test results. In regard to CNV detection, image artifacts can lead to both false positives and false negatives. Projection artifacts are an inherent problem with the technology. Essentially, blood flow in more superficial layers is projected into deeper slabs, making it seem that there is flow in these areas when there is not.

Current systems all have algorithms to decrease projection artifacts, but they are not eliminated entirely. If projection artifacts lead to the appearance of flow in the avascular region, this can give a false positive for detection of CNV when there is no true flow present.[40-42] Other artifacts include movement artifacts, segmentation errors and shadowing. OCT-A images must be properly obtained and interpreted alongside additional clinical information to minimize diagnostic errors.[40-43]

With new technology often comes new clinical challenges, and OCT-A has identified a new subset of CNV. The terms *non-exudative CNV* or *subclinical CNV* are used to describe a CNV visible with OCT-A that has no evidence of fluid on the OCT B-scans or that does not appear to leak on IVFA.[44-47]

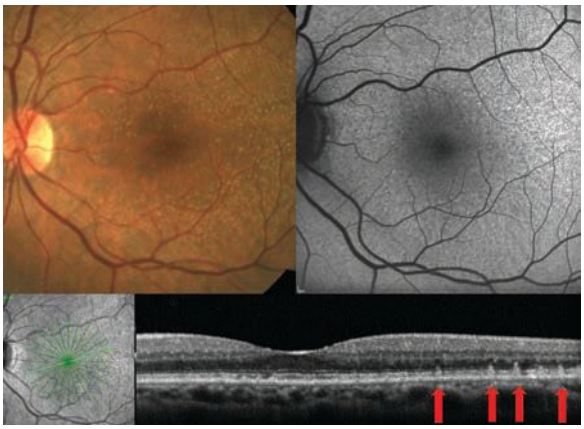


Fig. 5. Fundus examination shows small- to intermediate-sized drusen; however, FAF and OCT show presence of RPD.

Patients with this finding have higher risk of developing exudation, but controversy still exists on the right time to refer or begin treatment. About 20% of subclinical CNV will develop exudation, and if the clinician elects to monitor these patients, they must be followed closely.[45,46] Clinicians should consider a referral to a retina specialist (*Figure 8*).

Visual Function Testing

While these tools each give unique insights into structural alterations of the retina that occur in AMD, they do not provide a measure of visual function. While multiple methods for testing visual function exist, dark adaptation has become a hot topic in AMD.

Recently, research has found that delayed dark adaptation precedes development of clinically visible macular degeneration by up to three years.[48] AdaptDx (MacuLogix) can be used to measure dark adaptation in-office. This instrument was found to be 90% sensitive and 90% specific for identifying patients with AMD.[49]

This can be a useful tool for early identification of at-risk patients and early modification of environmental and systemic risk factors for progression. It can also aid patient education to demonstrate how visual function, and not just retinal structure, is affected.[50] Dark adaptometry results must always be taken into context of the full clinical picture to arrive at an accurate diagnosis.

Progression and Vision

The physiological and functional milestones of AMD differ by type, as do our recommendations to patients:

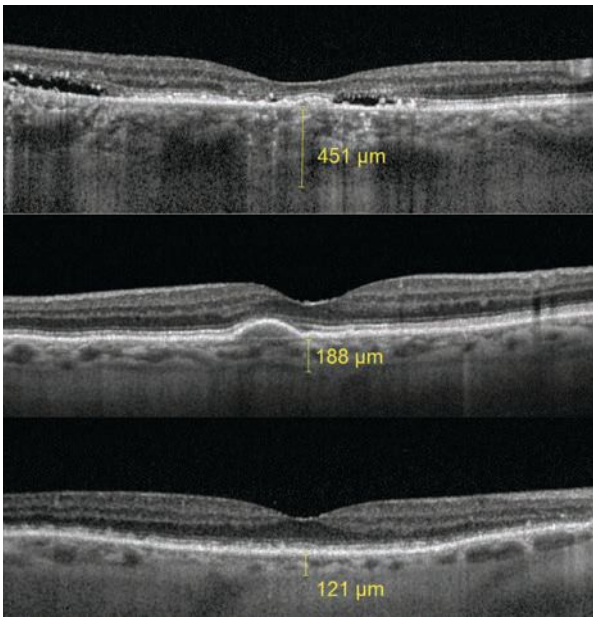


Fig. 6. The top image is a patient with chronic central serous retinopathy and subfoveal choroidal thickness measuring 451µm. The middle image is a patient with large drusen from AMD and subfoveal choroidal thickness of 188µm. The bottom image is a patient with RPD and subfoveal choroidal thickness of 121µm.

Wet AMD. Among patients with AMD, 10% to 15% will develop CNV or wet AMD.[8] This can lead to a sudden alteration in vision with symptoms such as blur, metamorphopsia and scotomas. Without treatment, patients are at a high risk for long-term, severe central vision loss. Early detection of wet AMD and prompt referral for treatment leads to better visual outcomes.[51]

Patients at significant risk for conversion to wet AMD, such as those with large drusen, pigmentary alterations or RPD, should be monitored more frequently. In addition, these at-risk patients should be educated extensively about monitoring monocular vision on a daily basis with tools such as the Amsler grid or ForeseeHome.

The ForeseeHome system relies on hyperacuity to detect conversion to wet AMD. Patients can use the device at home to test their monocular vision daily. The results are monitored remotely through complex algorithms to detect alterations in the retinal structure.

Doctors receive an alert if the patient has been flagged for possible conversion. It is FDA approved for use in patients with intermediate, dry AMD.[52] In a trial of 1,520 patients, 94% of those monitored with ForeseeHome who converted to wet AMD maintained 20/40 or better vision with treatment compared with only 62% of patients who converted while using standard monitoring techniques such as the Amsler grid.[53]

Dry AMD. Fortunately, 85% to 90% of patients with AMD never develop CNV.[8] However, these patients may still suffer vision loss with variable severity and, unfortunately, treatment options are still severely limited. The most visually devastating consequence of dry AMD is the development of GA, which can lead to destruction of central vision and legal blindness.

Many patients with dry AMD maintain good visual acuity throughout their lifetime, but AMD affects vision in more ways than just central acuity. AMD is a degenerative, progressive disease of the choroid, RPE and photoreceptors. It is well established that patients with AMD suffer from decreased contrast sensitivity.[54-56] While a patient may see 20/20 on a high-contrast vision chart, they may struggle to read the newspaper or see a restaurant menu in poor lighting.

AMD also decreases the retina's ability to both light and dark adapt. For example, AMD patients need a longer time for their vision to adjust before leaving the exam room after a dilated fundus evaluation. This translates to many real-life challenges such as ambulating between rooms of differing illuminations or seeing to drive at night with oncoming headlights.

In addition, AMD may cause visual distortions, reduced color vision, scotomas and decreased reading speeds.[57] These factors should be considered when prescribing optical correction or low vision devices for those with macular degeneration.

It is important to educate patients with both dry and wet AMD that while central vision can be severely affected, AMD does not lead to complete blindness. Many patients do not understand that there are varying levels of "blindness," and instead assume that all blinding diseases lead to total darkness.

Treatment and Management

The approach to intervention is also dictated by the dry/wet distinction:

Wet AMD. Historically, wet AMD, although present in only 10% to 15% of AMD patients, was responsible for 90% of legal blindness from AMD. However, this is a statistic from the pre-anti-VEGF

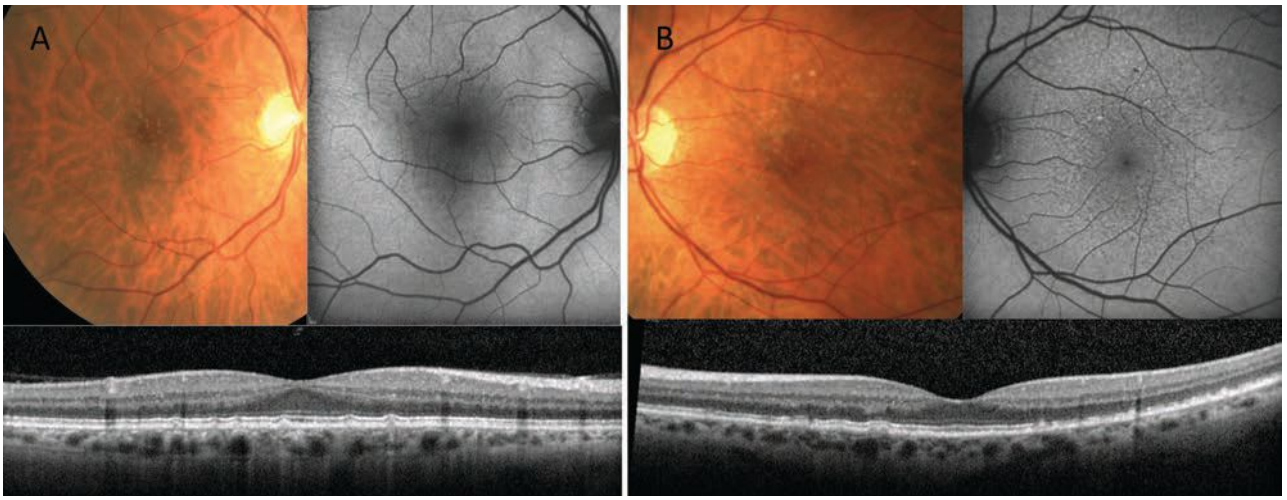


Fig. 7. Both of these patients have small- to intermediate-sized retinal drusen. Patient A's FAF shows fairly normal autofluorescent signal, while patient B has alteration to the FAF greater than the extent of disease seen clinically.

era. Intravitreal anti-VEGF injections can allow for stabilization or even improvement of vision in those that convert to wet AMD, but early detection is crucial to maintain good vision.

In the CATT trial, patients with better visual acuity and smaller CNV lesions at presentation were more likely to achieve better visual outcomes. Those with worse entering acuity gained more letters of acuity, but ultimately never achieved visual acuity levels as good as those with better entering vision.[58]

A retrospective study evaluated patients with entering acuity of 20/40 or better treated with anti-VEGF for CNV. At one year, 81% of eyes maintained 20/40 vision and 75% at two years.[59] In many patients, this type of early detection may be the difference between maintaining driving level vision and an independent lifestyle or not. This is why patient education, including recommendations for at-home vision monitoring, is so important.

In clinical trials for the most recently approved anti-VEGF drug, Beovu (brolucizumab-dbll, Novartis), more than 50% of patients were maintained with 12-week dosing at the one-year mark, making it the longest acting drug on the market.[60] However, the company recently updated Beovu's label to include data on potential risks of retinal vasculitis and retinal vascular occlusion.[61]

No matter the drug used, anti-VEGF therapy for wet AMD carries a high treatment burden for patients and often their families or caregivers as well. Anti-VEGF is a treatment, not a cure, and requires repeat injections for years if not a lifetime. This requires countless office visits and procedures. Treatments themselves may also cause anxiety or discomfort for patients.

Dry AMD. Treatment for this condition remains limited. The AREDS I trial found that nutritional supplementation among patients with intermediate AMD resulted in a 25% risk reduction in the development of advanced stages of AMD.[62] The AREDS II trial modified the original supplement formula based on its results, ultimately suggesting the following: 10mg lutein, 2mg zeaxanthin, 500mg vitamin C, 400 IU vitamin E, 80mg zinc, 2mg copper.[62]

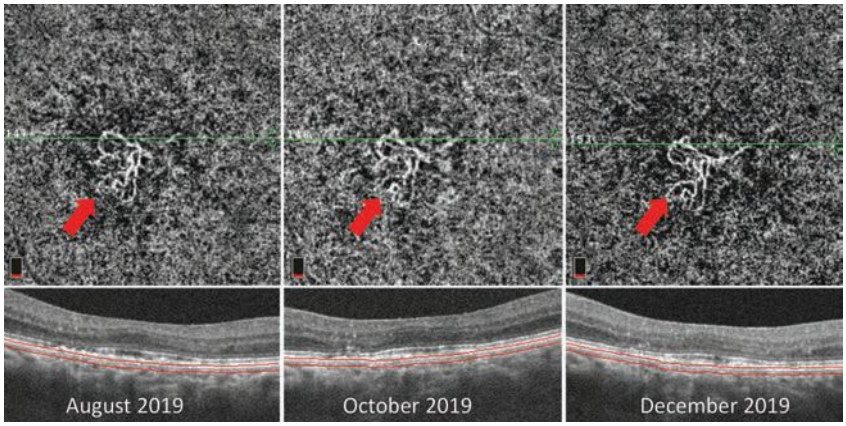


Fig. 8. This patient with CNV located within the choriocapillaris slab of the OCT-A (red arrows) shows negligible overlying fluid on OCT cross section scans. The patient was followed over the course of four months with stable findings. This type of patient is at increased risk for the development of exudation and must be followed carefully or referred for consideration of treatment.

A discussion of vitamin supplementation often devolves into controversy, as individual practitioners dispute which supplement is best to use and when to recommend it. Numerous studies report improvement of various metrics such as microperimetry, macular pigment optical density, contrast sensitivity and subjective visual improvement, among others, with the use of various vitamin supplements.[63-70]

However, there remains a lack of evidence that vitamin supplementation reduces the risk of developing advanced stages of disease in those with early AMD, and standard recommendations, such as those provided by the American Academy of Ophthalmology's Preferred Practice Patterns, still suggest AREDS II type supplementation be reserved for those with intermediate stage AMD.[71] Before recommending a supplement, clinicians must consider a patient's systemic health, diet and medications, including other over-the-counter supplements they may already be taking.

Another focus of dry AMD management is modifying environmental and systemic risk factors, such as diet, exercise and healthy sun protection habits. The number one modifiable risk for AMD is smoking.[72,73] Systemic vascular disease, including hypertension, hyperlipidemia and diabetes, along with obesity all contribute to the disease.[3]

As treatment strategies for AMD evolve, our obligations for earlier disease detection grow larger. Now that we can better treat CNV, early detection is critical in the preservation of

Genetic Testing

Commercially available genetic testing is now an option for patients with AMD.[74] The Macula Risk (ArcticDx) test aims to identify patients at increased risk of progression with use of zinc-based supplements.[74] Controversy surrounding genetic testing still exists with no true consensus regarding the potential harm of vitamin supplementation.[75-78]

vision. Clinicians must continue to be diligent with fundus examinations to correctly diagnose AMD and identify high-risk patients. In addition, optometrists must understand the benefits of ancillary testing, such as OCT and FAF, and when these testing strategies are appropriate. ■

Dr. Haynes is an associate optometrist at the Charles Retina Institute and consulting faculty at Southern College of Optometry in Memphis, Tenn.

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OSC QUIZ

You can obtain continuing education credit through the Optometric Study Center. Complete the test form and return it with the $35 fee to: Jobson Healthcare Information, LLC, Attn.: CE Processing, 395 Hudson Street, 3rd Floor New York, New York 10014. To be eligible, please return the card within three years of publication. You can also access the test form and submit your answers and payment via credit card at *Review Education Group* online, revieweducationgroup.com.

You must achieve a score of 70 or higher to receive credit. Allow four weeks for processing. For each Optometric Study Center course you pass, you earn 2 hours of credit from Pennsylvania College of Optometry.

Please check with your state licensing board to see if this approval counts toward your CE requirement for relicensure.

1. One study found ___ of AMD patients were misdiagnosed as having a normal macula.
a. 10%.
b. 25%.
c. 40%.
d. 55%.

2. What is the size of a large druse?
a. At least 63µm.
b. 100µm.
c. ≥125µm
d. No objective standard exists.

3. Which of these findings indicate increased risk for conversion to advanced AMD?
a. Peripapillary atrophy.
b. Large sized drusen.
c. Pigmentary alterations.
d. Both b and c.

4. At what point does the AREDS I trial recommend nutritional supplementation?
a. No AMD but systemic risk factors.
b. Early AMD.
c. Intermediate AMD.
d. Advanced AMD.

5. Patients with advanced AMD have:
a. Presence of CNV or GA.
b. Large drusen.
c. Large drusen and pigmentary changes.
d. Pigmentary changes.

6. A large regression of drusen/PEDs on OCT has been associated with:
a. Increased risk of developing advanced AMD.
b. Improved visual function.
c. Improved macular pigment optical density.
d. Worsening of dark adaptation.

7. Which of these describes the appearance of RPD on OCT?
a. Hypo-reflective deposits beneath the RPE.
b. Hypo-reflective deposits on top of the RPE.
c. Hyper-reflective deposits beneath the RPE.
d. Hyper-reflective deposits on top of the RPE.

8. Where are typical drusen located?
a. Between RPE and ONL.
b. Between RPE and Bruch's membrane.
c. Within the nerve fiber layer.
d. In the choriocapillaris.

9. Which of the following is *not* true of RPD?
a. They carry increased risk of conversion to advanced AMD.
b. Patients with RPD may have worse visual function than those without RPD.
c. OCT and FAF can help to visualize RPD.
d. RPD are easily distinguished from normal drusen on funduscopic evaluation.

10. Where is lipofuscin primarily found?
a. In the RPE.
b. In the ONL.
c. In the GCL.
d. In the RNFL.

11. How does GA present on FAF?
a. Hyper-reflective.
b. Hypo-reflective.
c. Hyper-autofluorescent.
d. Hypo-autofluorescent.

12. Which of the following are artifacts that may be found on OCT-A?
a. Projection artifacts.
b. Segmentation artifacts.
c. Movement artifacts.
d. All of the above.

13. What percentage of patients with AMD develop wet AMD?
a. 10% to 15%.
b. 20% to 25%.
c. 30% to 35%.
d. 40% to 45%.

14. At what stage of AMD is the ForeseeHome monitoring system FDA approved for?
a. No AMD but systemic risk factors.
b. Early AMD.
c. Intermediate AMD.
d. Advanced AMD.

15. What medical intervention has most dramatically improved patient outcomes in those who develop CNV?
a. Intravitreal anti-VEGF.
b. AREDS II vitamins.
c. Photodynamic therapy.
d. Laser photocoagulation.

16. Which of these characteristics was related to better visual outcomes in the CATT trial?
a. Large CNV at presentation.
b. Worse entering visual acuity.
c. Better entering visual acuity.
d. Treatment with Avastin over Lucentis.

17. What is both the sensitivity and specificity of AdaptDx in identifying those with AMD?
a. 60%.
b. 70%.
c. 80%.
d. 90%.

18. What best describes the current standard of care for medical management of GA?
a. Reduce environmental/systemic risk factors, monitor for conversion to wet AMD and consider risks/benefits of vitamin. supplementation.
b. Intravitreal anti-VEGF.
c. Complement factor inhibitors.
d. Tea tree oil.

19. Why must there always be a strong emphasis on early CNV detection with AMD?
a. Early detection of CNV and prompt treatment leads to better visual outcomes.
b. Early detection of CNV allows for fewer anti-VEGF injections.
c. Early detection of CNV gives the provider the opportunity to discuss vitamin supplementation.
d. Early detection of CNV gives the patient more time to get set up with a retinal referral.

20. Which of these is *not* a risk factor for AMD?
a. Lupus.
b. Smoking.
c. Hypertension.
d. Obesity.

Examination Answer Sheet

Understanding AMD Presentations and Prognoses

Valid for credit through August 15, 2023

Online: This exam can be taken online at revieweducationgroup.com. Upon passing the exam, you can view your results immediately and download a real-time CE certificate. You can also view your test history at any time from the website.

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Answers to CE exam:

1. Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ
4. Ⓐ Ⓑ Ⓒ Ⓓ
5. Ⓐ Ⓑ Ⓒ Ⓓ
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17. Ⓐ Ⓑ Ⓒ Ⓓ
18. Ⓐ Ⓑ Ⓒ Ⓓ
19. Ⓐ Ⓑ Ⓒ Ⓓ
20. Ⓐ Ⓑ Ⓒ Ⓓ

Post-activity evaluation questions:

Rate how well the activity supported your achievement of these learning objectives:
1=Poor, 2=Fair, 3=Neutral, 4=Good, 5=Excellent

21. Identify the early signs of AMD. ① ② ③ ④ ⑤
22. Discuss the clinical metrics that can document AMD-related changes. ① ② ③ ④ ⑤
23. Identify dry AMD and the signs of conversion to wet AMD. ① ② ③ ④ ⑤
24. Describe how disease progression will affect vision. ① ② ③ ④ ⑤
25. Review the changing prognosis of AMD given new therapeutic options. ① ② ③ ④ ⑤

26. Based upon your participation in this activity, do you intend to change your practice behavior? (choose only one of the following options)
Ⓐ I do plan to implement changes in my practice based on the information presented.
Ⓑ My current practice has been reinforced by the information presented.
Ⓒ I need more information before I will change my practice.

27. Thinking about how your participation in this activity will influence your patient care, how many of your patients are likely to benefit? (please use a number): ☐

28. If you plan to change your practice behavior, what type of changes do you plan to implement? (check all that apply)

ⓐ Apply latest guidelines ⓑ Change in pharmaceutical therapy ⓒ Choice of treatment/management approach ⓓ Change in current practice for referral ⓔ Change in non-pharmaceutical therapy ⓕ Change in differential diagnosis ⓖ Change in diagnostic testing ⓗ Other, please specify: _____

29. How confident are you that you will be able to make your intended changes?

ⓐ Very confident ⓑ Somewhat confident ⓒ Unsure ⓓ Not confident

30. Which of the following do you anticipate will be the primary barrier to implementing these changes?
ⓐ Formulary restrictions
ⓑ Time constraints
ⓒ System constraints
ⓓ Insurance/financial issues
ⓔ Lack of interprofessional team support
ⓕ Treatment related adverse events
ⓖ Patient adherence/compliance
ⓗ Other, please specify:

31. Additional comments on this course:

_____

_____

_____

_____

_____

Please retain a copy for your records. Please print clearly.

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By submitting this answer sheet, I certify that I have read the lesson in its entirety and completed the self-assessment exam personally based on the material presented. I have not obtained the answers to this exam by any fraudulent or improper means.

Signature _____ Date _____

Lesson 120000 RO-OSC-0820

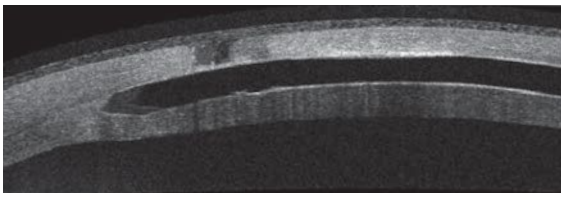
Rate the quality of the material provided:
1=Strongly disagree, 2=Somewhat disagree, 3=Neutral, 4=Somewhat agree, 5=Strongly agree

32. The content was evidence-based. ① ② ③ ④ ⑤
33. The content was balanced and free of bias. ① ② ③ ④ ⑤
34. The presentation was clear and effective. ① ② ③ ④ ⑤

KCN Options: Stiff Competition

If the obvious choices don't suit your patient, alternatives can expand your capability to manage ectasia and its consequences. **Edited by Joseph P. Shovlin, OD**

Q I have several keratoconus (KCN) patients who aren't doing well with their contact lenses. Are there any stabilizing procedures other than corneal crosslinking (CXL) for early disease and full-thickness transplantation for late disease?



Anterior segment OCT of corneal melt over an ICRS.

A Yes, more than it may seem. "Various methods are available for managing KCN depending on the stage and progression status," according to Katelyn Lucas, OD, of Price Vision Group in Indianapolis.

Dr. Lucas says early stages can be managed with glasses or contact lenses, while Bowman's layer transplantation (BLT), deep anterior lamellar keratoplasty (DALK) and penetrating keratoplasty (PK) are performed in advanced cases. She notes that CXL prevents disease progression, and intrastromal corneal ring segments (ICRS) and conductive keratoplasty (CK) reshape the cornea to reduce refractive error.

Weighing Your Options

While no universally accepted treatment guidelines exist for ectasia, Dr. Lucas offers her take on the options:

• ***CXL***. Topical riboflavin and UVA light promote the formation of strong chemical bonds between collagen fibrils to strengthen the cornea, notes Dr. Lucas. Studies investigating the standard Dresden protocol have reported high success rates in halting disease progression and decreasing keratometry readings.[1] Epi-on CXL has produced inconsistent findings, while an accelerated version of CXL that reduces UV exposure time by increasing irradiance has shown promising results.[1] CXL can also be combined with photorefractive keratectomy, thermal keratoplasty, ICRS or LASIK to improve visual acuity.[1]

Crosslinking has succeeded because it's effective and minimally invasive. Other choices may have a narrower range of applicability but can play a role in well-selected patients.

• ***ICRS***. These arc-shaped pieces of polymethyl methacrylate are placed within the stroma to help flatten and reshape the cornea in mild to moderate KCN, Dr. Lucas says. ICRS improve visual outcomes by reducing myopia and astigmatism.[2] Combined ICRS/CXL can amplify the flattening effect and reduce corneal cylinder.[1]

• ***CK***. Radio wave energy heats and shrinks stromal collagen, inducing steepening in flat areas and correcting refractive error.[3] Off-label CK use for KCN can reshape the cornea, reduce astigmatism and decrease keratometry readings.[3] Dr. Lucas notes CK may need to be combined with other procedures to achieve the desired effect, such as ICRS to correct high cylinder and CXL to prevent disease progression.

• ***IOLs***. Contact lens–intolerant KCN patients who have stable disease may benefit from phakic intraocular lenses (IOLs), suggests Dr. Lucas. IOLs can reduce refractive error, myopia and astigmatism in various KCN stages and can combined with CXL, ICRS and corneal transplantation.[1]

• ***BLT***. This technique reduces ectasia in advanced KCN.[4] Corneal ectasia occurs as Bowman's layer destabilizes, necessitating a graft in the mid-stroma to prevent progression and stabilize the cornea.[1] A preliminary study found decreased K readings, improved visual acuity, reduced higher-order aberrations and stabilized disease progression.[1,4]

• ***DALK, PK***. With thin corneas, significant anterior scarring or nonfunctional vision with contact lenses, a DALK is typically recommended, according to Dr. Lucas. The visual results are similar to those of PK, but the patient's own Descemet's membrane and endothelial cells are retained, eliminating risk of endothelial cell rejection and allowing the graft to last the patient's lifetime. The wound also heals better and faster than in PK, and less topical steroid is needed. ■

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AMD Standard of Care is Not Enough

IRIS REGISTRY

20/83 VA

Average at wet AMD diagnosis according to IRIS Registry real-world data[1]

HOME STUDY

≥20/40 VA

Average at wet AMD diagnosis with ForeseeHome[2]

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References: 1. Rao P et al. *Ophthalmology*. 2018;125(4):522-528. **2.** Domalpally A, Clemons TE, Bressler SB, et al. *Ophthalmol Retina*. 2019;3(4):326-335.

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Don't Strain Yourself

This patient cannot remember what led to this change in his vision.

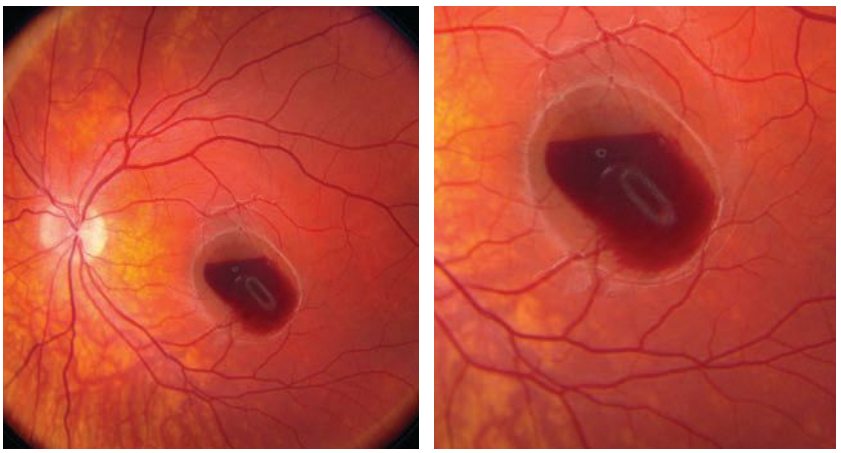
By Mark Dunbar, OD

A 20-year-old white male presented with a sudden loss of vision in his left eye that occurred two days prior. He reported going to a college party on Friday night and waking up the next day with a dark spot that had a red tinge in the center of his vision.

His past ocular and medical histories were unremarkable.

On examination, his best-corrected visual acuity was 20/20 OD, 20/200 OS. Extraocular motility testing was normal. His confrontation visual fields were full-to-careful finger counting OU, and the pupils were equally round and reactive to light; there was no afferent pupillary defect. On Amsler grid testing, he had a central scotoma OS.

His anterior segment exam was unremarkable. Tensions by applanation measured 14mm Hg OU. On dilated fundus exam, the right eye was completely normal. In the left eye, there was a small cup with good rim coloration and perfusion. In the macula, there was a hemorrhage (*Figures 1 and 2*). The vessels and peripheral retinal were normal. We performed an OCT and OCT-A, which are available for review (*Figures 3 and 4*).



Figs. 1 and 2. These fundus photos of the left eye show a retinal hemorrhage involving his macula. Where is the anatomic location of the blood?

Take the Retina Quiz

1. What is the correct diagnosis?
a. Idiopathic choroidal neovascularization (CNV).
b. Hemorrhagic central serous retinopathy.
c. Retinal arterial macroaneurysm (RAM).
d. Valsalva retinopathy.

2. Where is the blood located?
a. Subretinal space.
b. Between RPE and sensory retina.
c. Sub–internal limiting membrane (ILM).
d. Pre-retinal.

3. How should this patient be managed?
a. Observation.
b. Anti-VEGF injection.
c. YAG membranotomy.
d. Pars plana vitrectomy.

4. What is the long-term prognosis?
a. Excellent with treatment.
b. Excellent with close observation.
c. Good with continued anti-VEGF injections.
d. Likely will develop disciform scar formation.

For answers, see page 90.

Diagnosis

Our patient has a classic presentation of Valsalva retinopathy. This condition is a rare retinopathy that is characterized by a preretinal hemorrhage in the macula due to the Valsalva maneuver. Valsalva occurs when a person tries to exhale air forcibly with a closed glottis (windpipe) so that no air goes out through the mouth or nose.

When this occurs, there is a sudden increase in intrathoracic or intra-abdominal pressure. This Valsalva maneuver occurs during various day-to-day activities that cause straining, such as coughing, sneezing, vomiting, exercise and

blowing on musical instruments, among others.[1]

Discussion

In addition to the sudden increase in intrathoracic/intra-abdominal pressure, there is also raised central venous pressure in the head and neck. Because there are no valves in the venous system beyond the heart, the sudden rise in venous pressure leads to the rupture of perifoveal superficial retinal capillaries that cause the preretinal hemorrhage.

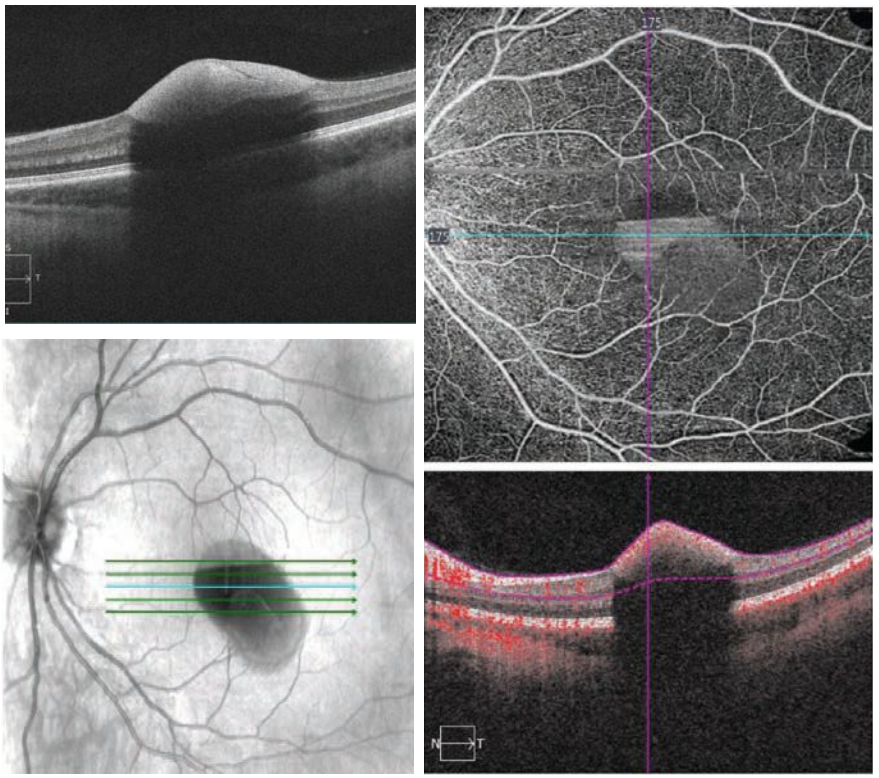
The exact anatomic location of the hemorrhage in our patient is not completely clear. On clinical exam, we know that the blood is anterior because it obscures the underlying retina and the top of the hemorrhage is flat or horizontal, almost having a boat shape. This is classic for a preretinal hemorrhage. However, to be even more specific, it's difficult to know if the blood is under the ILM (sub-ILM) or between the posterior vitreous face and sensory retina. Even with SD-OCT it can be difficult to discern.[2]

In our patient, the posterior vitreous face appears intact, and, as you follow the OCT line scan, it is contiguous with the ILM. The blood appears posterior and indicates that it's below the ILM.

The natural history of Valsalva retinopathy is good, as the vast majority of patients make a complete return to normal vision after the blood resolves. However, this can be a slow process that can take up to several months. One treatment option becoming more common is Nd:YAG laser membranotomy. During this, the laser makes an opening in the posterior hyaloid or ILM so the blood can escape into the vitreous, settling inferiorly and clearing the visual axis.[3] In some instances subretinal or vitreous hemorrhage can occur necessitating surgical intervention. Pars plana vitrectomy may be indicated for patients with significant retinal hemorrhages or dense vitreous hemorrhage.[4]

Even though the clinical presentation for our patient is classic for Valsalva retinopathy, his history is not. When we tried to elicit a history of performing any strenuous activities that could result in Valsalva maneuver, he didn't recall any. Even though he had been to a party the night before, he didn't vomit or remember having any kind of hard cough or sneeze. We also questioned him about engaging in vigorous sexual activity, as Valsalva retinopathy has also been reported during orgasm.[5] He denied this as well.

We elected to follow-up our patient to determine if the hemorrhage would spontaneously resolve. At the follow-up visit a month later, he was still 20/200. Even though the hemorrhage was smaller, there was still significant involvement in his macula. As he was getting anxious that vision was not getting better, we scheduled him back in one month with a retina specialist for consideration of Nd:YAG membranotomy. ■



Figs. 3 and 4. The SD-OCT (left) and OCT-A (right) of the left eye. The OCT-A is an 8mm x 8mm superficial cut through the macula. What does it show?

1. Duane TD. Valsalva hemorrhagic retinopathy. Trans Am Ophthalmol Soc. 1972;70:298-313.
2. Goel N, Kumar V, Seth A, et al. Spectral-domain optical coherence tomography findings of subinternal limiting membrane hemorrhage in the macula before and after Nd:YAG laser treatment. Ophthalmic Surg Lasers Imaging Retina. 2011;42(3):222-8.
3. Durukan AH, Kerimoglu H, Erdurman C, et al. Long-term results of Nd:YAG laser treatment for premacular subhyaloid haemorrhage owing to Valsalva retinopathy. Eye (Lond). 2008;22(2):214-8.
4. Khadka , Bhandari S, Bajimaya S, et al. Nd:YAG laser hyaloidotomy in the management of Premacular Subhyaloid Hemorrhage. BMC Ophthalmol. 2016;16:41.
5. Michaels L, et al. Postcoital visual loss due to valsalva retinopathy BMJ Case. Rep 2014;2014:bcr-2014-207130.

The Art of Juggling

Put your thinking cap on when determining how to best manage different patients and conditions simultaneously. **By James L. Fanelli, OD**

A busy day at the clinic practically dares you not to fall behind schedule. On top of that, your caseload is full of complex patients, some presenting for the first time, with multiple issues. How do you juggle these responsibilities in an efficient yet non-cavalier manner, especially if your schedule, like mine, is packed with appointments backlogged by COVID-19? This column offers a case example that illustrates the importance of prioritizing patient care in a timely, beneficial way.

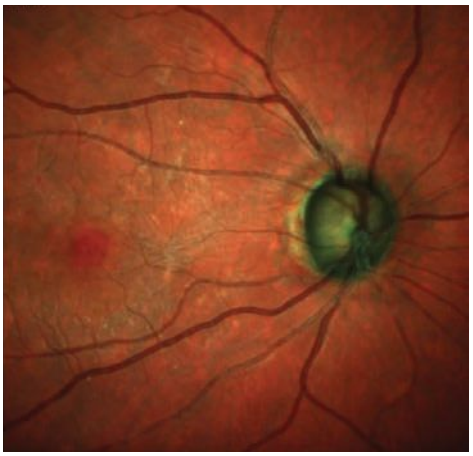


Fig. 1. Observe the thin neuroretinal rim and the ERM just nasal to the foveal avascular zone.

The Case

A 72-year-old Caucasian female presented as a new patient in mid-June. She wanted to establish care after recently moving to the area and heard that I specialize in glaucoma. She also needed an updated pair of glasses, as her current prescription was 2.5 years old and she noticed a change in her vision.

She was taking lansoprazole 30mg QD, levothyroxine 75mcg QD, simvastatin 40mg QD, citalopram 20mg QD, cetirizine 10mg QD, Vyzulta (latanoprostene bunod, Bausch + Lomb) HS OU and generic Cosopt (dorzolamide/timolol, Akorn) BID OD. She had no allergies to meds.

Significant in the patient's ophthalmic history were bilateral cataract extractions with posterior chamber intraocular lens (IOL) implantations. Her right eye was done in 2009 and her left in 2019. A few years after her first cataract surgery, she had treatment with Jetrea (ocriplasmin, ThromboGenics) OD. During last year's surgery, she also had two iStent devices (Glaukos) implanted in the trabecular meshwork of her left eye. This device was not available when her first eye was done.

The patient's entering visual acuities were 20/40-2 OD and 20/25+1 OS and best-corrected acuities were 20/25+3 OD and 20/20-2 OS. Her pupils were equally round and reactive to light with no afferent pupillary defects, and her extraocular muscles were full in all positions of gaze.

Slit lamp examination of the anterior segment was fairly unremarkable. There was mild sectoral iris transillumination OD, which is not uncommon following cataract surgery. One of the iStent devices in the left eye was visible through the slit lamp without angle gonioscopy. The patient's applanation tensions were 21mm Hg OD and 19mm Hg OS, and her pachymetry measures were 563µm OD and 551µm OS.

Through dilated pupils, the posterior chamber IOLs were clear and centered. The capsule in the right eye was opened, and the IOL was pitted from the YAG capsulotomy. The capsule in the left eye was clear and intact. Bilateral posterior vitreous detachments were noted.

Optic nerve exam demonstrated cup-to-disc ratios of 0.8/0.9 OD and 0.7/0.75 OS. The temporal neuroretinal rims were exceedingly thin (OD>OS) and consistent with advanced glaucoma (*Figure 1*).

The macular evaluation showed a foveal aberration OD consistent with a lamellar hole. There was also an epiretinal membrane (ERM) centered between the fovea and the disc OD (*Figure 2*). The left macula was characterized by RPE granulation. The retinal vasculature had both mild hypertensive and arteriolarsclerotic retinopathy OU. The peripheral retinal exam was normal OU.

Following the posterior pole examination, I retook the patient's intraocular pressures (IOPs) and found that they were similar to pre-dilation measures.

There is no question that this patient has advanced glaucoma, OD>OS. Close examination of blue laser imaging shows significant loss of the retinal nerve fiber layer (RNFL) in the right eye (*Figure 3*).

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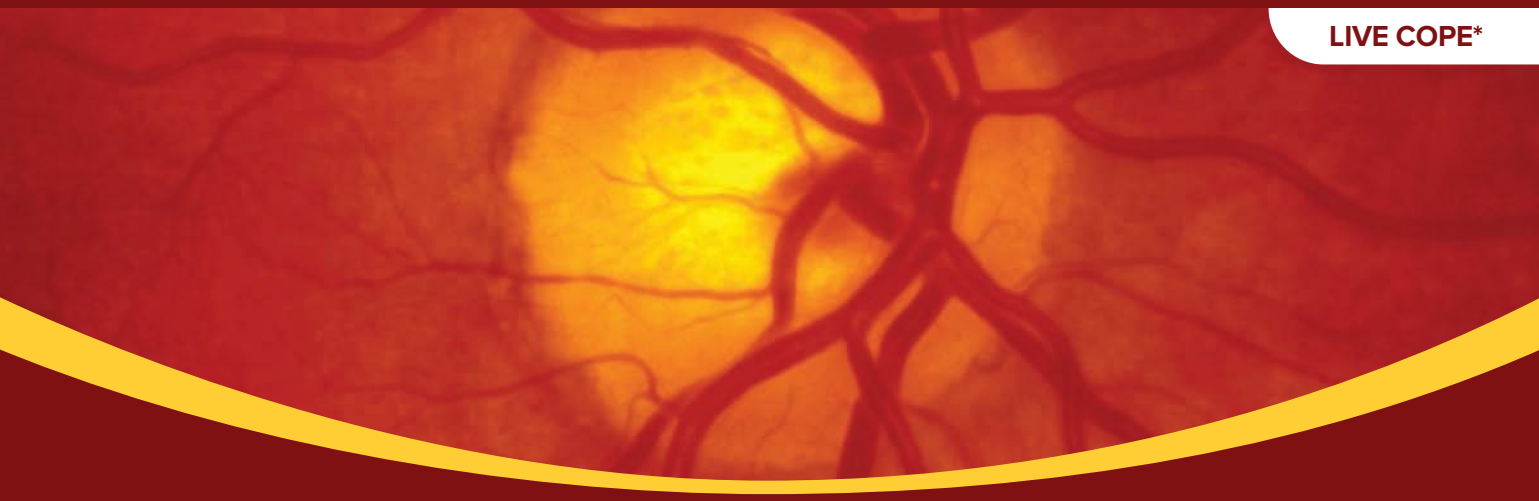

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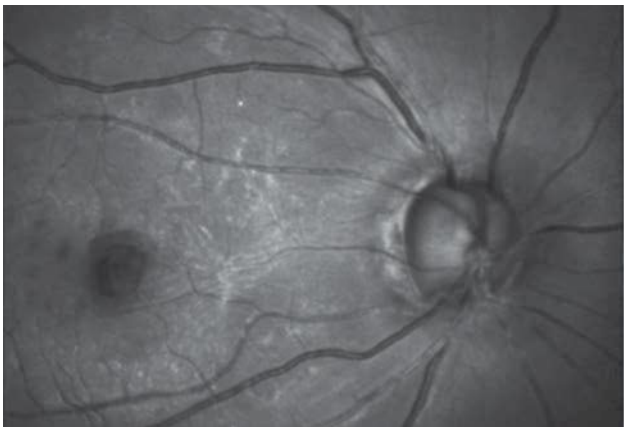

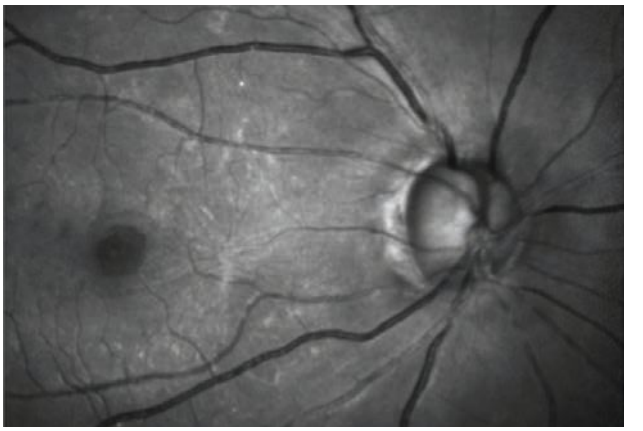

Figs. 2 and 3. Green laser imaging highlights the ERM and the foveal abnormality, at left. Blue laser reflectance imaging shows some fine striations remaining in the superotemporal sector of the arcuate retinal nerve fibers and very few nerve fibers remaining inferiorly.

Though she's only been in for one visit, I'm confident her IOPs are not adequately controlled, given the level of optic nerve damage.

Discussion

During an initial office visit, you need to be aware of the patient's full clinical story. Only then can you determine and prioritize care, including what testing will be done, and when.

Each of us has developed protocols for certain situations and disease entities in our practices. At various times and with varying frequencies, all my glaucoma patients will complete a series of testing and imaging, including the obvious data points—IOP, visual fields, OCT and gonioscopy. They will also eventually undergo fundus photography, HRT-3 imaging (Heidelberg Engineering) of the optic nerves, anterior segment OCT and ultrasound biomicroscopy. That's a lot of data, and certainly too much to obtain over a few visits, let alone on the initial presentation.

Compounding the issue of figuring out an appropriate testing schedule is the fact that certain items are not covered by insurance when performed on the same day as other items. For example, Medicare will not pay for OCT and fundus photography in the same sitting (for the same disease). Regardless, patient care and well-being trumps coding and reimbursement issues, so if OCT and imaging need to be done on the same day, then so be it.

Keep insurance coverage in mind when deciding which tests are needed right away and which can wait. To a large extent, this depends on the patient and how advanced their disease is, how controlled their IOPs are and other clinical signals. We also need to be mindful of juggling multiple patients and managing office flow, as there will inevitably be other patients in the clinic at the same time and we can't get bogged down with one at the expense of three others.

Patient Management

An adjustment to the patient's spectacle prescription should improve her sight, so I updated her prescription to get new glasses. The bigger issue at hand is her advanced glaucoma. This is how I prioritized her initial testing:

- Pachymetry to get a sense of her IOPs and progression risk
- Photography in the form of multimodal laser imaging to see (and record) what's happening in the neuroretinal rim, macula and RNFL
- IOPs to get a feel for how tenuous her IOP situation is, knowing full well that when I saw her in the afternoon, her IOPs were probably higher earlier in the day
- Slit lamp examination of the posterior pole to get an idea of how things look *in vivo*

Her next visit will include:

- IOPs to document her diurnal fluctuations
- Standard automated perimetry 24-2 visual field thresholds to assess the extent of vision loss
- OCT and HRT-3 imaging of the optic nerves and OCT imaging of the macula to quantify the glaucomatous damage
- Gonioscopy to evaluate the nuances of her angles and the positions of the iStents OS

At the completion of the second visit, I should have a reasonable set of data points that I can use to set and start working toward a target pressure for the patient.

There is a lot to take into consideration when juggling different conditions and patients, especially the first time around. Luckily, the more cases we see, the easier it will become to prioritize testing. ■

I was only seeing light flashes early on, but light

FLASHES

when you've not seen anything for so many years—it was wonderful

—Keith H, retinal prosthesis recipient

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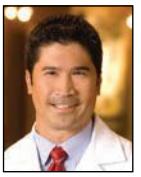


Stop the Drop?

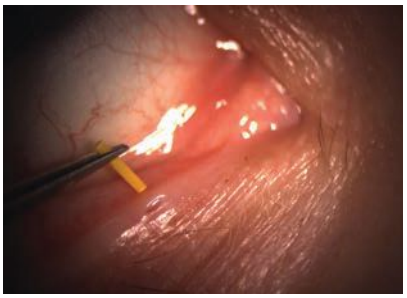
Newer drug delivery options give us more control over the post-op care experience for cataract patients. **By Derek N. Cunningham, OD, and Walter O. Whitley, OD, MBA**

With over four million cataract procedures performed each year, optometrists must be ready to provide the necessary perioperative care. From the initial diagnosis to the post-op care, we communicate with patients and work with surgeons to ensure everyone is on the same page and moving toward the most desirable outcome.

Ocular Drug Delivery

One of the most difficult aspects of any ophthalmic procedure is choosing the drops that patients take pre- and post-op. There are numerous factors to take into consideration, including name brand vs. generic, dosage and the option of intracameral injections. Although efficacy and safety are among the most important, we must also consider the five Cs: *corneal* toxicity, *cost*, *convenience*, *confusion* and *compliance*. If any one becomes too cumbersome, many patients will not use their medication as prescribed. To address these concerns, several companies have presented new approaches to ocular drug delivery for surgery:

Dextenza. In November 2018, Ocular Therapeutix introduced the first therapeutic intracanalicular insert. It delivers 0.4mg of dexamethasone to treat pain and inflammation following ocular surgery. One preservative-free hydrogel insert can relieve postsurgical side effects for up to 30 days. Following treatment, Dextenza resorbs and exits the nasolacrimal system without the need for removal.



Dextenza has a reported 30 days' duration of efficacy.

In each of three trials, a higher proportion of Dextenza patients were pain-free on post-op day eight vs. controls.[1] On post-op day 14, two of the studies observed a higher proportion of Dextenza patients with a statistically significant absence of anterior chamber cells.[1]

Dexycu. Approved by the FDA in February 2018, this single intraocular dose of 0.005mL of dexamethasone 9% is administered in the posterior chamber to treat post-op inflammation. Although steroid injections have been used off-label in dropless cataract surgery, EyePoint Pharmaceuticals' Dexycu is the first drug to have this on-label indication.

A trial reported the percentage of Dexycu patients with anterior chamber cell clearing on post-op day eight was 20% in the placebo group and 57% and 60% in the 342µg and 517µg Dexycu groups, respectively.[2] The percentage of participants who received rescue medication of ocular steroids or NSAIDs was significantly lower in the treatment groups.[2]

Compounded medications. A few compounding pharmacies (Imprimis Rx and Ocular Science) have entered the ophthalmic market to help address issues of the five Cs. Drugs are compounded into either intracameral injections or combination drops. For example, we use gatifloxacin-bromfenac-prednisolone QID for two weeks before switching to bromfenac-prednisolone QID for three weeks. Other practices use the dropless formulation of intracameral injections of dexamethasone and moxifloxacin at the end of surgery.

These medications are not FDA-approved for this specific indication and have not gone through large randomized studies or regulated quality control measures. However, they have been used for a long time in an off-label manner to address issues with on-label medications. Speaking from decades of experience with various compounded medications, we advise that you must be prepared for varying levels of both efficacy and adverse events.

It's exciting to have so many new medication options available for ophthalmic surgery, but be mindful to take the full clinical picture into account when selecting which is best for your patient. Only time will tell where these newer options fit in and what optimal outcomes they may be capable of delivering. ■

For a video of this procedure, visit www.reviewofoptometry.com or scan the QR code.

1. Dextenza. www.dextenza.com/wp-content/uploads/DEXTENZA-Full-Prescribing-Information.pdf. July 7, 2020.
2. Dexycu. dexycu.com/downloads/DEXYCU%20Prescribing%20Information_6-11-20.pdf. July 7, 2020.



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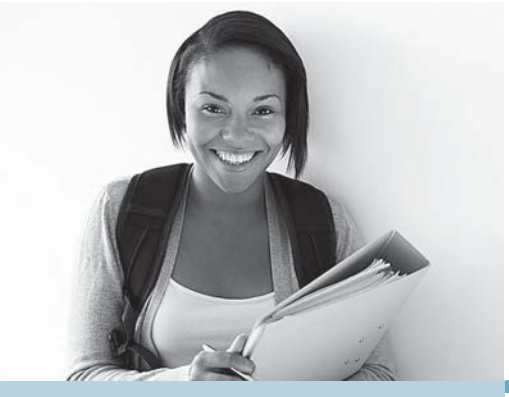

About Rick

Rick Bay served as the publisher of The *Review* Group for more than 20 years.

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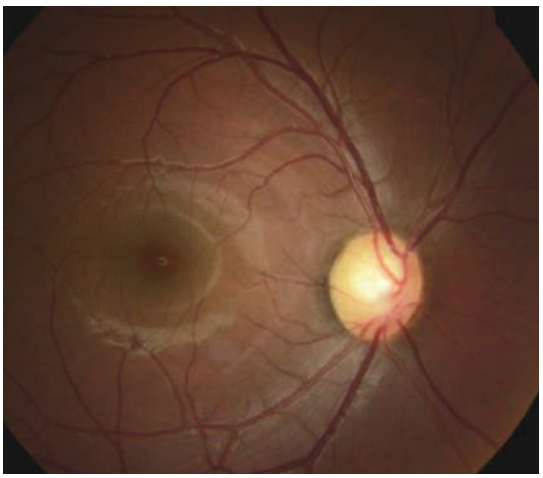
When to Treat Ocular Hypertension

Consider many factors, but don't rely on any one measurement alone before you make your move. **By Joseph W. Sowka, OD**

A 27-year-old male presented to the clinic after being referred for management of his markedly elevated intraocular pressure (IOP). His past ocular history was significant for ocular trauma to his left eye that left him with poor vision. He had never been diagnosed with glaucoma before.

His best-corrected acuities were 20/20 OD and 20/400 OS due to a traumatic macular scar, choroidal rupture and fibrotic parapapillary traction. His anterior chamber angles were gonioscopically open to the ciliary body OU, without abnormalities. He had large optic discs with a cup-to-disc ratio of 0.7/0.7 with smooth and regular neuroretinal rims and no focal damage, parapapillary atrophy, disc hemorrhages or retinal nerve fiber layer (RNFL) defects.

His central corneal thicknesses were 557µm OD and 560µm OS. Optical coherence tomography (OCT) showed a normal RNFL in the right eye and abnormal measurements in the left, due to maculopathy. Threshold perimetry was normal OD and unreliable OS. Except for pre-existing traumatic maculopathy, he had no abnormalities or damage attributable to glaucoma. His IOPs, however, were quite remarkable at 51mm Hg OD and 55mm Hg OS. He was subsequently diagnosed with an extreme degree of ocular hypertension (OHTN). Clearly, the patient was not the prototypical ocular hypertension case.



This fundus photo shows our 27-year-old patient's right eye. He has a large, healthy optic nerve despite an intraocular pressure of 51mm Hg.

Risk of Progression

OHTN—classically thought of as IOP above a statistically normal level of 21mm Hg in the absence of glaucomatous damage to the optic disc, retinal nerve fiber layer (RNFL) or visual field—is one of the most common clinical entities encountered. While diagnosis can be straightforward, management is more challenging, especially when other variables come into play. Patient age, comorbidities, level of IOP and other factors make this common condition a sometimes-complicated management issue.

Historically, OHTN was seen as a relatively benign condition that could predispose patients to the development of primary open-angle glaucoma (POAG). However, no scientific assessment of the probability of converting to POAG existed and doctors had no data on the whether it was useful to prophylactically lower IOP. Anecdotally, clinicians who had extensive clinical experience with glaucoma and OHTN patients generally felt that, without treatment, approximately 10% of OHTN patients would develop glaucoma, but that was just a rule of thumb. Researchers had no consensus on how best to manage OHTN. Some doctors chose to merely observe while others treated.

Then, in 2002, the Ocular Hypertension Treatment Study (OHTS) was published. The main focus of that research was to determine if reducing IOP delayed or prevented the development of glaucoma in eyes with OHTN.[1] What the investigators found was that, prophylactically lowering IOP in eyes with OHTN reduced the risk of progression over the initial five years of the study.

At 60 months, the cumulative probability of developing POAG was 4.4% among the prophylactically medicated subjects, while it was 9.5% in the observation group.[1] That nicely validated our previous rule of thumb that approximately 10% of OHTN patients convert to glaucoma. Although IOP reduction imparted about a 60% reduced risk

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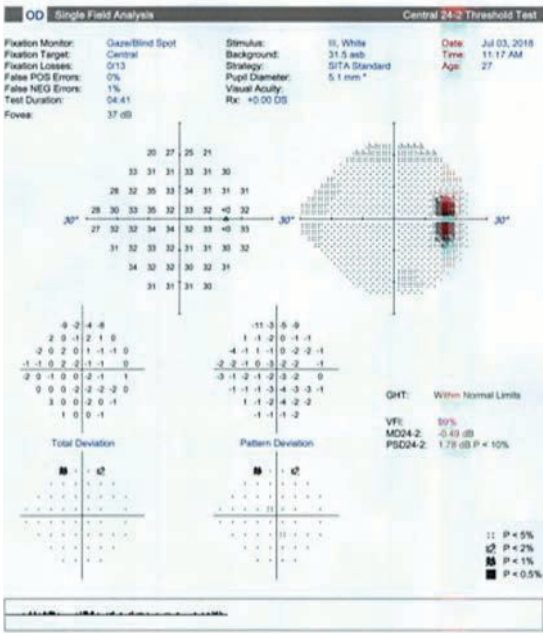
of conversion to glaucoma, the study results did not imply that all patients with borderline or elevated IOP should receive medication, but that clinicians should consider initiating treatment for individuals with OHTN who are at moderate or high risk for developing POAG.[1]

Subsequent analysis of that data attempted to identify patients who would be a greater risk of converting to glaucoma. It found that older baseline age, larger vertical and horizontal cup-disc ratio, greater visual field pattern standard deviation values, and greater IOP levels were good predictors for the onset of POAG in the OHTS.[2] The research also shows lower central corneal thickness (CCT) is a powerful POAG predictor.[2]

A European study of OHTN found similar results and the pooled data from these two studies have led to the development of risk calculators to estimate the five-year risk of developing POAG and are useful for clinicians and patients in guiding management plans.[2-4] Most experienced glaucoma clinicians recommend treatment when the calculated risk of glaucoma conversion exceeds 15% for longer than five years.

After a median of 7.5 years without treatment, the original OHTS observation group received medication for a median of 5.5 years to determine any problems from delaying treatment. At a median follow-up of 13 years, researchers saw little absolute benefit of early treatment in individuals with OHTN at low risk of developing POAG.[5,6] Clinicians need to consider the patient's age, health status, life expectancy and personal preferences when making treatment decisions.[5,6]



Ocular hypertension patients usually have visual fields with normal sensitivity and variability only slightly higher than in normal subjects.

Balancing Parameters

While we have learned a great deal from OHTS, the information provides only general guidelines and leaves many questions unanswered. Thanks to this research, clinicians now have risk calculators that can help assess the five-year risk of conversion from OHTN to POAG readily available online.[7,8]

However, these risk calculators must be used accurately. They are only useful for patients with OHTN (and not pre-existing glaucoma) within a specific IOP range (22mm Hg to 32mm Hg). The calculators have not been validated in patients younger than 30 years or older than 80 years. Secondary conditions causing IOP elevation, such as pigment dispersion, exfoliation or uveitis are not part of the assessment. Furthermore, accurate data in terms of several IOP measurements, CCT and visual field parameters need to be entered, which can be time consuming. Deviating from these parameters makes the calculated risk dubious at best.

Practitioners often wonder about a "magic number"— an IOP measurement above which treatment should always be initiated. No such concept has any scientific validity. Most experienced glaucoma practitioners have differing opinions and trying to standardize treatment in this manner independent of CCT, age, optic disc appearance, systemic health and numerous other factors oversimplifies OHTN and may put patients at risk of under- or overtreatment.

For those who demand a "magic number," look to the design of OHTS.[9] Eligibility required that IOP be less than 32mm Hg. Patients with IOP at or above 32mm Hg were excluded, not for any scientific reason, but likely due to the designers' discomfort at possibly randomizing eyes with this IOP level to observation. Hence, for those who demand an absolute number, OHTS indicated 32mm Hg to be the peak.[9]

Targeting Treatment

Old wisdom suggests that doctors should treat elevated IOP if for no other reason than to prevent a retinal vascular occlusion (RVO). This practice goes against much of what we learned from the OHTS regarding lowering IOP in ocular hypertensive eyes to prevent glaucoma formation. Do we really want to lower IOP in every ocular hypertensive eye due to fear of RVO?

The most definitive answer to the question of prophylaxis against RVO comes from a subsequent publication from OHTS. In this subanalysis, researchers noted that 26 RVOs occurred in 23 participants (15 in the observation

group and eight in the medication group).[10] They saw that the 10-year cumulative incidence of RVO was 2.1% in the observation group with untreated ocular hypertension and 1.4% in the medication group.[10] Although the incidence of RVO was higher in the observation group than the medication group, this difference was not statistically significant.[10]

Based upon this evidence, we cannot justify recommending that ocular hypertension be treated to protect against RVO. In fact, the 10-year incidence of RVO in ocular hypertensive eyes is actually low.[10] RVO often occurs concurrent with OHTN and POAG because they are comorbidities affecting elderly patients with vascular diseases. I have encountered many patients with IOP ranging from 50mm Hg to greater than 70mm Hg at time of diagnosis and not once saw a concurrent RVO in any eye. In patients for whom I have seen POAG and RVO concurrently, they have almost been exclusively in eyes with well-treated IOP levels. As such, I don't consider the fear of RVO in my OHTN decision-making.

In the patient described here, very little guidance from controlled studies helps dictate his management. His young age and markedly elevated IOP exceeded ranges from any study on OHTN. Despite IOP in the 50s, his optics discs, RNFL and visual field were still normal. After a discussion of the risks, benefits and the unusual nature of his condition, he was prescribed a topical prostaglandin analog which lowered his IOP to 20mm Hg OD and 18mm Hg OS and he is currently being followed at appropriate intervals. ■

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Diagnostic **Quiz**

It's Not Your Imagination

She said she recently started "seeing spots" and losing vision. We soon learned why.

By Andrew S. Gurwood, OD

History

A 65-year-old woman presented to the ophthalmology department as an emergency consultation with a chief complaint of recently noticed vision changes "next to her nose" with new floating spots. She was a poor historian, not recalling any ocular or systemic illnesses, and confessed she had not been to a medical or eye doctor "in years." She reported no ocular or systemic histories, took no medications and denied allergies of any kind.

Diagnostic Data

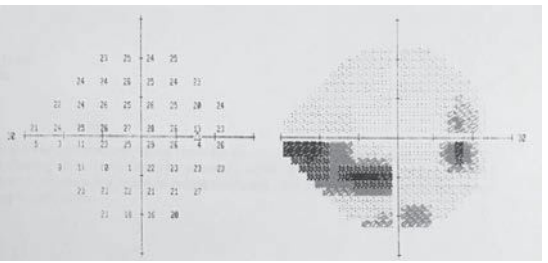
Her best entering acuities were 20/30 uncorrected at distance and 20/30 at near with use of a reading spectacle. There was an afferent defect OD; however, color vision was intact with no red desaturation and no brightness comparison loss.

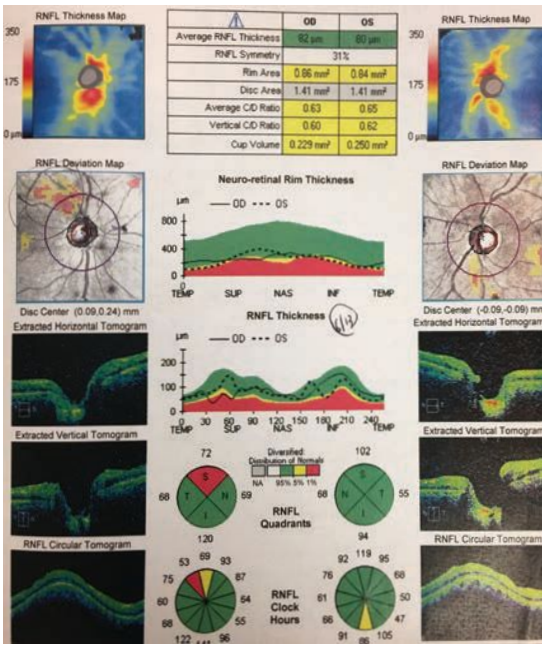
The facial Amsler grid uncovered general constriction without any pathognomonic neurological symmetry, OD>OS. Extraocular motilities were intact. Refraction was negligible and her near acuity improved when her reading addition was increased to +2.50 DS.

Biomicroscopic exam of the anterior segment found normal structures with no evidence of iritis, rubeosis, exfoliation, pigment dispersion or gross trauma. Intraocular pressures measured 18 OU with Goldmann applanation.

The patient had gonioscopy completed OU to rule out evidence of previous trauma (angle recession), pseudo or true exfoliation syndrome, pigment dispersion, synechial closure or evidence of plateau iris and both nerves were photodocumented.

OCT was completed to gather information regarding optic nerve fiber layer analysis and macular vulnerability zone thickness. Additional history questions included presence of sleep apnea, unusual routine such as yoga, contact sports or gymnastics and whether there was ever an episode of blunt trauma or blood loss.





Automated perimetry yielded the field results above. Below are RNFL scans OS and OD.

Your Diagnosis

Does the case presented require any additional tests, history or information? What would be your diagnosis? What is the patient's likely prognosis? To find out, please visit www.reviewofoptometry.com. ■

Retina Quiz Answers *(from page 76)*—Q1: a, Q2: b, Q3: d, Q4: e, Q5: a

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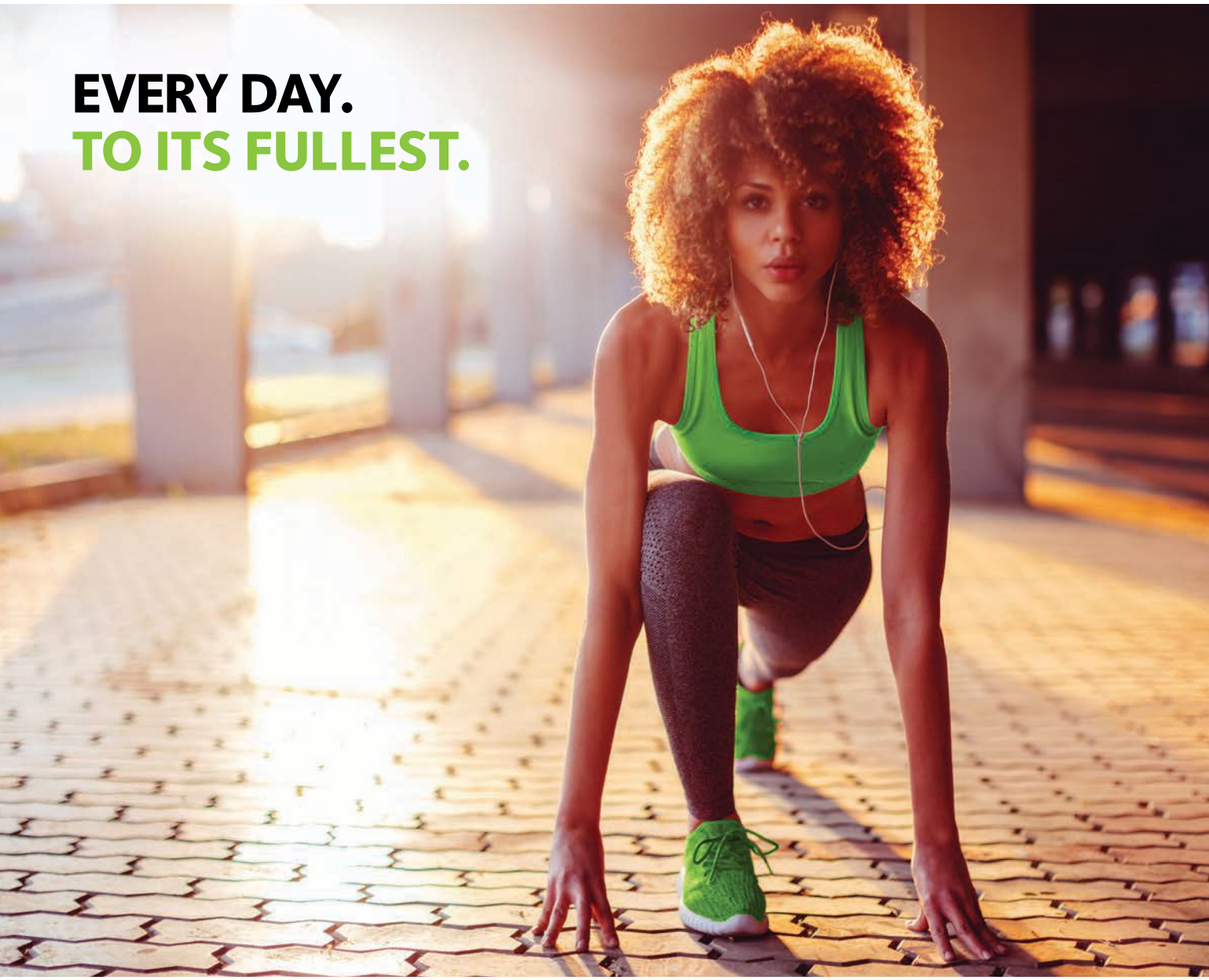

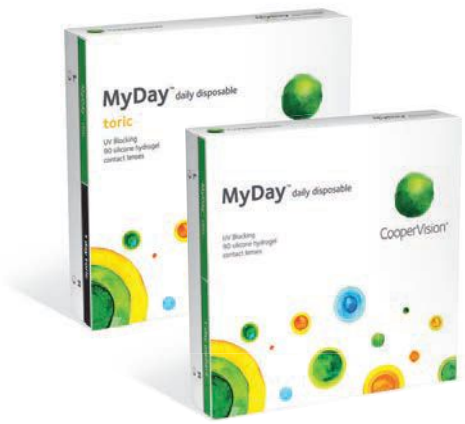

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