

### How to Shield Patients From Problems



Contact lens wearers are extremely happy... on day 1. From then on, complaints and complications threaten their success and yours. Here's how to ward off worries.

VISUAL COMPLAINTS

NON-COMPLIANCE

RED EYE

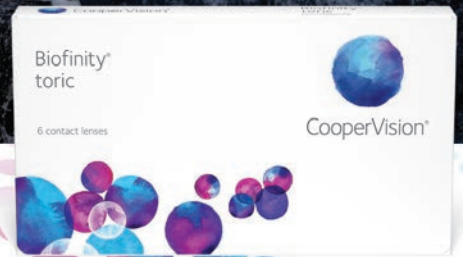
DRY EYE

LENS DISCOMFORT

INFECTIONS

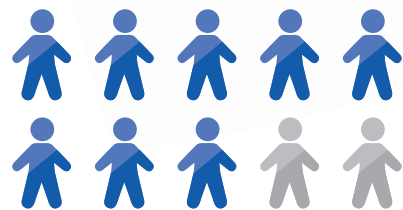
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- Get Daily Disposables on Your Radar, PAGE 14

- How to Refit the Unhappy Multifocal Patient, PAGE 18
- A Systematic Approach to Solving Contact Lens Discomfort, PAGE 22  
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2. The results of an online survey involving patients who wear Biofinity<sup>®</sup> toric contact lenses. January 2018 Biofinity<sup>®</sup> toric wearer online survey. Data on file.  
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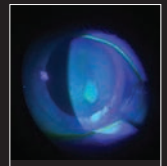
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## IN BRIEF

■ Research dating as far back as four decades **connected damage to the corneal epithelium in diabetes patients with contact lens use**. In addition to mechanical damage, **contact lenses can increase risk for diabetes patients by exposing them to more impactful infections** from bacteria, fungus and yeast, according to the study. The authors of a recent literature review suggest doctors carefully consider the duration of disease, the level of glycemic control, the presence of retinopathy and the diabetic patient's overall health before fitting contact lenses.

Bussan K, Robertson D. Contact lens wear and the diabetic corneal epithelium: a happy or disastrous marriage. *J Diabetes Complications*. 2019;33(1):75-83.

■ A recent study found **an association between iris color and the presence of astigmatism** in a school-based sample of Chinese students. Individuals with darker iris color tended to have a higher likelihood of being astigmatic, and those with the lightest were less likely to be affected. Researchers used eye exam results and measures of iris color to develop their grading system but believe that a more objective method may help achieve more precise, reliable measurements. They also suggest assessing the association in other ethnic groups who have larger variations in iris color such as in Caucasians. **Examining the longitudinal influences could help establish iris color's impact on astigmatism's development.**

Pan C, Ke C, Hu D, et al. Iris colour and astigmatism among Chinese teenagers. *Br J Ophthalmol*. February 11, 2019. [Epub ahead of print].

■ **Penetrating keratoplasty is a reasonable option to improve visual acuity in patients with herpes zoster ophthalmicus**, even though corneal complications present a higher risk for graft failure and other postoperative complications. Comorbid ocular diseases may also limit long-term visual potential, and prophylactic postoperative oral acyclovir did not improve outcomes. Researchers concluded that practitioners should choose surgical candidates conservatively, operate on quiet eyes whenever possible, monitor the patient closely after surgery and assiduously treat postoperative inflammation and ocular surface problems.

Tanaka TS, Hood CT, Krieger MF, et al. Long-term outcomes of penetrating keratoplasty for corneal complications of herpes zoster ophthalmicus. *Br J Ophthalmol*. February 7, 2019. [Epub ahead of print].

## ROCK Inhibitors Impress

**T**o aid in the repopulation of the human corneal endothelium and promote corneal endothelial proliferation, notably for Fuchs' dystrophy (FD) patients, researchers have developed novel therapies using rho-kinase (ROCK) inhibitors. Two studies have demonstrated their effect on FD patients and cataract development.

## IMPROVED RESULTS

Topical use of the ROCK inhibitor ripasudil (Glanatec) for two months after lamellar surgery to remove Descemet's membrane without performing endothelial keratoplasty, called Descemet's stripping only (DSO), can help FD patients achieve recovered 20/40 vision.<sup>1</sup>

The study enrolled 18 patients and assigned nine to a DSO group and nine to DSO-plus-medication group. The latter were prescribed ripasudil 0.4% QID for two months. All participants were followed monthly for the first six months and then at nine and 12 months post-op.

The use of topical ripasudil led to more rapid visual recovery, at 4.6 weeks compared with 6.5 weeks for the observation group. Researchers also noticed the ROCK inhibitor group had higher central endothelial cell density (ECD) at 12 months and less loss of peripheral ECD.

While ripasudil is commercially available in Japan for glaucoma, it remains an investigational drug in the United States. The researchers also do not know how long the corneas will remain clear with this treatment, and the small sample size limits their ability to recommend its broad use among all FD patients.

Future treatments will require a personalized approach and will depend on the clinical presentation.

Patients with Fuchs' who are currently asymptomatic will be treated with observation, whereas patients with a peripheral ECD greater than 1,000cells/mm<sup>2</sup> may be treated with DSO and topical ripasudil.

"DSO with topical ripasudil may be the treatment of choice early in the disease process, reserving Descemet membrane endothelial keratoplasty (DMEK) for patient who present with more advanced disease states," the authors wrote in the study.<sup>1</sup> "DSO with topical rho-kinase inhibitors may decrease the cost of visual rehabilitation for both individual patient and society as a whole."

## SHADE FROM UV DAMAGE

A new study from Japan has shown that the topical application of a specific ROCK inhibitor, presently designated Y-27632, can reduce ultraviolet radiation type B (UVR-B)-induced cataracts.<sup>2</sup> The cataracts are formed when the UVR-B exposure causes TGF-2 signaling in the lens epithelial cells. The topical ROCK inhibitor, researchers believe, blocks the signal.

Using human lens epithelium (HLE)-B3 cells *in vitro* and using mice with UVR-B-induced cataracts *in vivo*, the investigators found that the responsible transforming growth factor could be successfully suppressed in a dose-dependent manner by topical treatment with the ROCK-inhibiting drop.<sup>2</sup>

1. Macsai MS, Shiloach M. Use of topical rho kinase inhibitors in the treatment of fuchs dystrophy after descemet stripping only. *Cornea*. February 1, 2019. [Epub ahead of print].

2. Imaizumi T, Kurosaka D, Tanaka U, et al. Topical administration of a ROCK inhibitor prevents anterior subcapsular cataract induced by UV-B irradiation. *Exp Eye Res*. 2019;181(4):145-9.

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# Lens Therapy for Patients

**T**wo recent studies have proven new contact lenses to be effective therapeutically:

## POST-LASIK BANDAGE

Bandage contact lenses (BCL) may help reduce pain and result in a less intense wound healing response following femtosecond laser *in situ* keratomileusis (FS-LASIK), according to a study in the *Journal of Ophthalmology*.<sup>1</sup>

“Patients felt less discomfort in eyes treated with a BCL after FS-LASIK than in control eyes. Some BCL-treated eyes also had a less intense wound healing response at the flap margins,” the study reads.<sup>1</sup>

The prospective randomized trial included 41 patients (82 eyes) with myopia and/or myopic astigmatism. After FS-LASIK surgery, patients were fitted with a BCL in one eye but not in the contralateral eye. The BCL was left in place overnight and removed the next morning.

Postoperative pain and photophobia were milder in the BCL eyes, but patients felt more foreign-body sensation in the eye with a BCL. Researchers also reported no significant difference in tearing score.

At six months post-op, in regards to the fibrotic healing response of the flap margin, BCL eyes showed a markedly narrower and smoother peripheral circumferential band, with a less spiculated edge and lower reflectivity.

BCLs may merit consideration as a treatment option after FS-LASIK for special patients, researchers concluded.<sup>1</sup>

## KERATOCONUS SAFETY

A mid-size option between corneal gas permeable and traditional scleral lenses—corneoscleral contact lenses

(CScL)—may be a healthy and safe alternative for keratoconus patients, a new study claims.<sup>2</sup>

Spanish researchers analyzed the changes in corneal biomechanical parameters of keratoconic eyes with and without intracorneal ring segment (ICRS) implants after one year of CScL wear.

The study included 74 eyes of 74 patients and divided them into three groups: healthy subjects (29 eyes), keratoconic patients fitted with CScL (20 eyes with ICRS implants), and keratoconic subjects not fitted with the implants (25 eyes).

They found the corneal hysteresis and corneal resistance factor were lower in keratoconic corneas than in healthy ones. Additionally, keratoconic eyes with ICRS implants had lower corneal hysteresis, central corneal thickness and endothelial cell count values.

After one year of CScL wear, no statistically significant differences in corneal biomechanical parameters were reported in any of the groups, although slight differences (0.13–0.27mm Hg) were found.

“These lenses seem to be safe and healthy and are a reasonable alternative option for keratoconus management,” the researchers wrote in the study.<sup>2</sup> **RCCL**

1. Zhao LQ, Li LM, Liu J, et al. Bandage contact lens application reduces fibrotic wound healing of flap margins after FS-LASIK: a prospective randomized clinical trial. *J Ophthalmol*. January 20, 2019. [Epub ahead of print].

2. Porcar E, Montalt JC, E España-Gregori, et al. Impact of corneoscleral contact lens usage on corneal biomechanical parameters in keratoconic eyes. *Eye & Contact Lens*. February 4, 2019. [Epub ahead of print].

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# By Any Genes Necessary

Determining possible genetic predispositions could help improve contact lens safety.

Overall, the safety of wearing contact lenses is stellar. Fortunately, sight-threatening corneal infections are exceedingly rare. But when microbial keratitis does occur, any loss in vision is catastrophic. Microbial keratitis has remained a somewhat unsolved problem for many years. The incidence of corneal infection in contact lens wearers has not changed significantly since first reported in 1989 (one out of 500 extended wear users and one out of 2,500 daily wear users).<sup>1</sup> Despite large advances in lens materials, care products and attention drawn to modifiable risk factors, the number of infections reported has remained static.

Still, there is some good news. Daily disposable lenses, when worn as intended as single-use devices, are now considered safer than wearing gas permeable lenses.<sup>2</sup> When infections do happen in daily disposable lens users, they tend to have a lower rate of environmental causes (i.e., *Pseudomonas aeruginosa*), are more likely to have an endogenous cause and are less likely to have culture-positive results. Infections related to endogenous (or lid pathogen) sources tend to generally be less severe and resolve faster than those from environmental sources.

## A FRONTIER WITH PROMISE

Beyond manufacturers providing new materials and accoutrement, identifying modifiable risks and screening appropriately, the next frontier will likely be identifying genes and looking for any genetic predisposition that contributes to

the pathophysiology of corneal disease. Identifying those most susceptible and knowing who might experience a more severe response might be a new realistic approach to reducing infection rates. Researchers at Case Western Reserve University and University Hospitals of Cleveland have recently been funded to study exactly that.

Published works have associated genetic variants in different cytokine genes and one beta-defensin gene, *DEFB1*, with susceptibility and severity to microbial keratitis in contact lens users.<sup>3</sup> Cytokines are small proteins released by cells that have a specific effect on the interactions and communications between cells.<sup>4</sup> This remains a focused area of investigation when it comes to identifying important steps in any pathophysiology process.

Researchers have looked closely at single nucleotide polymorphisms and recruitment strategies associated with contact lens related keratitis. Pro-inflammatory IL-6 cytokine deficiencies are associated with more severe disease states with a three to six times worse outcome; so, IL-6 may play a protective role against microbial keratitis.<sup>3</sup> Variants in cytokine genes, in addition to IL-6, define one's inherent inflammatory profile, which may help determine susceptibility and severity of response to corneal infection. An altered immune system surely plays a significant role in the pathophysiology of any disease process.

The cornea does have inherent protection; however, when things go wrong, a cascade of catastrophic events occur that can lead to bacterial adherence and infection.

The eye has a normal community of flora expected to confer some resistance to infection. Yet, the bacterial flora in contact lens wearers has been shown to differ significantly from those who don't wear lenses. This may provide insight into the microbiome's possible role in increasing the risk for infection.<sup>5</sup>

How do we go about managing or mitigating this conspiracy between the epithelium when injured and microbial contamination that results in a devastating event in contact lens wearers? Genetic susceptibility testing and proper patient communication may just provide the answer.

Innovations in lens material, lens designs, care products and strategies to minimize infection and reduce overnight wear have not reduced the rate of corneal infection to a desirable level. Knowing ahead of time a patient's genetic predisposition may add immensely to our ability to alter the course of this dreaded complication. Contact lens safety is satisfactory, but there are areas that need improvement. Perhaps this new area of investigation may someday help us pick who might be most susceptible to infection and drive the rate of corneal infection to a desirable level. [RCLL](#)

1. Poggio EC, Glynn RJ, Schein OD, et al. The incidence of ulcerative keratitis among users of daily-wear and extended wear soft contact lenses. *N Engl J Med*. 1989;321:779-83.

2. Stapleton F: Glenn Fry Award Lecture. American Academy of Optometry; San Antonio, November 9, 2018.

3. Shin H, Price K, Albert L, et al. Changes in the eye microbiota associated with contact lens wearing. *mBio*. 2016;7(3):198.

4. Carnt NA, Willcox MD, Hau S, et al. Immune defense single nucleotide polymorphisms and recruitment associated with contact lens keratitis. *Ophthalmol*. 2012;119:1997-2002.

5. Zhang JM, An J. Cytokines, inflammation and pain. *Int Anesthesiol Clin*. 2007;45(2):27-37.

# Finding the Perfect Alignment

Understand the invaluable technology that can make lens fitting more efficient.

**L**ens comfort often dictates whether a patient will continue with contact lens wear or drop out. Practitioners struggle with the concept of discomfort because the cause is usually multifactorial. If we ask a patient whether they want to wear a soft lens or a hard gas permeable (GP) lens, most say a soft lens. More often than not, patients associate lens comfort with lens material. However, we know that initial lens awareness and discomfort is heavily attributed to lens diameter and edge alignment, *not* lens material. Numerous factors, such as ocular surface disease, allergies and poor lens wettability, can also contribute to discomfort.

A comfortable initial lens fit is crucial to overcoming a patient's apprehension with scleral lenses and keeping them happy in the modality long-term. New technologies can help clinicians better assess ocular shape and lens fit, providing patients the optimal all-day comfort they need.

## SCLERAL SHAPE

When designing the landing zone, pay close attention to the patient's scleral shape using diagnostic lenses, scleral mapping tools and impression molds.

For the average eye, the ocular surface beyond the cornea is asymmetrical in nature.<sup>1</sup> The sclera, similarly to the cornea, may present steep and flat meridians even though corneal and scleral toricity are not associated.<sup>2</sup> Based on studies evaluating the shape of the average eye, the nasal portion typically is flatter compared with

the rest of the eye.<sup>1</sup> Today, many practitioners use asymmetrical lens designs for the majority of their patients to compensate for irregular scleral shape.<sup>2</sup>

Asymmetrical back surface scleral lenses, such as toric- or quadrant-specific lenses, can eliminate many complications that can lead

to discomfort, such as lens decentration, bubble formation and excessive tear exchange that can cause debris inflow.<sup>2</sup>

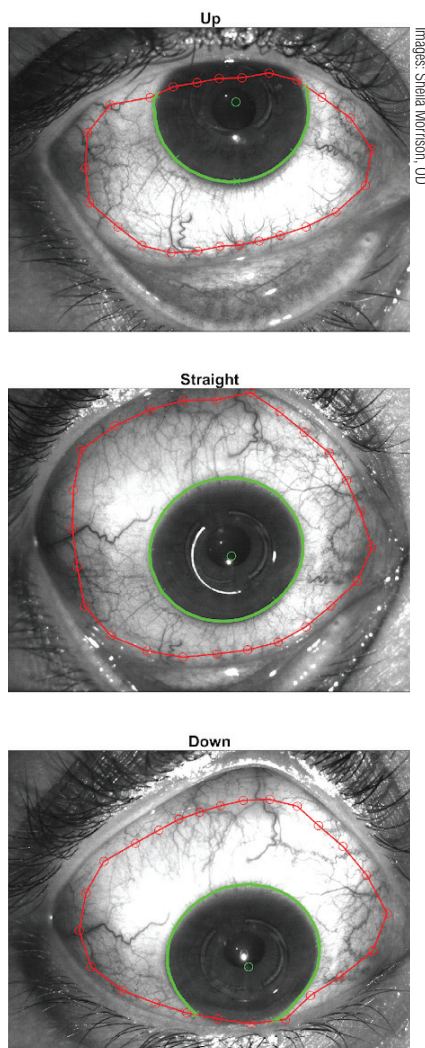
Determining the appropriate amount of central clearance and back surface toricity from diagnostic slit lamp findings is a skill that comes with experience and assistance from consultation. But using objective data from mapping tools, such as a scleral topographer, to design a scleral lens may be a more straightforward approach that can minimize the need for additional troubleshooting.

## SCLERAL PROFILERS

Scleral topographers image both the depth and shape of the cornea and sclera. Information regarding the shape of the eye beyond the cornea is valuable in determining whether toricity is needed in the scleral landing zone. Oftentimes, clinicians underestimate the amount of sagittal depth or toricity needed for the landing zone, resulting in additional follow-ups to make adjustments and an increase in chair time costs.

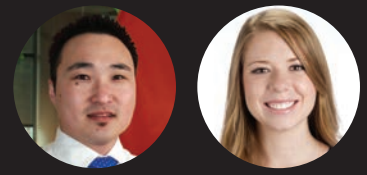
These instruments may increase the rate of fitting success by providing a better understanding of the shape of the eye and eliminating some guesswork involved with diagnostic lens fittings. They may also help clinicians troubleshoot difficult-to-fit patients, minimize the amount of follow-ups and provide greater efficiency in the lens fitting process.

Currently, three scleral mapping instruments on the market measure the topography of the eye beyond the limbus and create scleral



**Fig. 1. The sMap3D uses three images in multiple gaze directions to create a single image of the ocular surface.**





lenses empirically: the sMap3D (Precision Ocular Metrology), the Pentacam Cornea Scleral Profile (CSP, Oculus) and the Eye Surface Profiler (ESP, Eaglet Eye).

### SMAP3D

The sMap3D is a fluorescence-based structured light topographer with a range of more than 22mm and 360° scleral coverage. The sMap3D captures three images in multiple gaze directions that are then stitched together to create a single image of the ocular surface (*Figure 1*).

The topographer provides many software features, such as simulated fluorescein 3D images to predict how the lens is vaulting over the cornea and how it will align with the scleral surface. Practitioners can use various maps to define sagittal height at any chord and visualize the ocular surface compared with an overlying scleral lens.

After imaging, the clinician can apply a scleral lens to determine the over-refraction. Once the clinician has added all the necessary parameters, the software designs a customized scleral lens that takes into account the amount of scleral toricity necessary and integrates it into the landing curves, if needed. The software designs the best-fit lens based upon the Europa scleral lens (Visionary Optics) to determine initial lens parameters.

### PENTACAM CSP

This tool measures up to 18mm of the ocular surface as well as the sagittal height for scleral

lens fitting for both the cornea and sclera. This streamlines the first trial lens selection of sagittal depth based on measured corneal elevation. Each scan provides anterior segment and scleral topography analysis. The instrument takes five scans with 50 images each in primary gaze for a total of 250 Scheimpflug images. The resulting scan is a tear film-independent measurement. Therefore, it does not require fluorescein.

If a practitioner obtains a poor quality image or inadequate surface area, they can repeat an individual portion of the imaging without repeating the entire process. The goal is to measure as close to 18mm of the ocular surface as possible. Because the CSP software is not lens specific, clinicians can use a variety of lens designs. Another unique aspect to the CSP software is the ability to design a lens using external fitting software, such as Wave (Bausch + Lomb).

### ESP

This device is a fluorescence-based topographer that captures a single image of the cornea and sclera in primary gaze. Each scan provides more than 350,000 measurement points across a 20mm diameter area with a resolution of 2 $\mu$ m of the cornea, 10 $\mu$ m of the sclera and 0.1D of refractive error. Corneal and scleral curvature data is translated into height maps that are then used to select a lens from the software.<sup>3</sup>

The ESP software contains more than 30 lens designs, including

corneal GPs, sclerals, hybrids, ortho-K and specialty soft lenses. The instrument generates the initial lens diameter based on corneal size, as well as the recommended initial lens sagittal value and amount of toricity in the scleral landing zone for optimal fit.<sup>3</sup> The toricity in the landing zone is derived from both scleral shape and total sagittal value of each of the major meridians of the eye, allowing for precise landing in each meridian.<sup>3</sup>

Clinicians can place the suggested diagnostic lens on the eye, perform an over-refraction and finalize the initial lens order. Also, the ESP software can detect physiological changes related to contact lens wear through its different tangential maps. This is beneficial to monitor for subclinical corneal changes such as corneal edema or corneal warpage.

Despite the technological advancements clinicians have access to with scleral topographers, the information is only as valuable as the accuracy of the image acquired. If a patient has severe dry eye, then data collection may not be optimal. Ultimately, mapping devices in conjunction with diagnostic lens observations can help provide ideal landing zones leading to increased wear time and improved overall comfort. **RCCL**

1. van der Worp E. A Guide to Scleral Lens Fitting, Version 2.0 [monograph online]. Forest Grove, OR: Pacific University; 2015.

2. Jedlicka J, Johns LK, Byrnes SP. Scleral contact lens fitting guide. *Contact Lens Spectrum*. 2010;25:30-6.

3. Barnett, M. Utilize scleral profilers for scleral lens selection. *Contact Lens Spectrum*. 2017;25:30-6.

# FOUR Contact Lens Complications TO COMBAT

Any one of these could cause significant visual problems, so do your best to be proactive to prevent further damage.

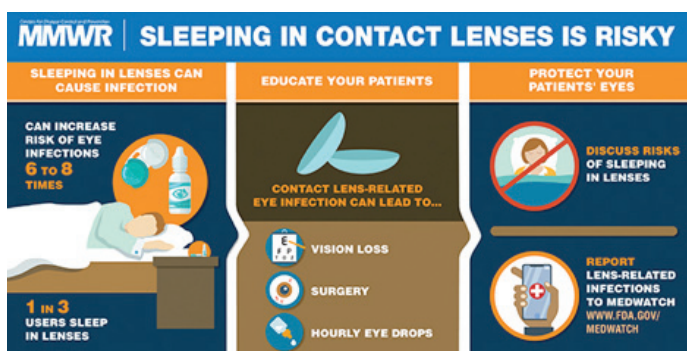
By Melissa Barnett, OD

Contact lenses can be a safe and effective form of vision correction when properly worn, treated and maintained.<sup>1</sup> When not cared for appropriately, however, lenses could present several problems that we should attempt to avoid whenever possible. Be on the lookout for and know how to address these top four contact lens complications in your patients.

## ONLINE SALES

More so now than ever, practitioners and patients alike are dealing with an outside threat: online contact lens vendors. These sellers cannot sell unverified lenses, alter lens prescriptions or fill lens prescriptions unless they are accurate and have not expired. Doing so is illegal. There are many illegal contact lens sellers in the United States, including those who sell decorative or colored lenses.

A recent online survey of 22 optometrists outlined the consequences of purchasing decorative



Sleeping in contact lenses can cause eye infections.<sup>13</sup>

lenses through unauthorized vendors.<sup>2</sup> Patient complications from obtaining these lenses both legally and illegally were reported by 77% of respondents.<sup>2</sup> Half of those who had negative responses did not receive proper care and handling instructions and were unaware that these instructions even existed, rendering them inept in maintaining proper lens wear and warding off unwanted effects.<sup>2</sup> If you suspect any illegal contact lens sales or observe any adverse events from unverified contact lenses, report these activities immediately by emailing [stopillegalcls@aoa.org](mailto:stopillegalcls@aoa.org) and contacting MedWatch, the FDA Safety Information and Adverse Event Reporting Program ([www.fda.gov/medwatch](http://www.fda.gov/medwatch)),

to prevent further consequences.

According to Jeffrey Sonsino, OD, “we are at a time of unprecedented disruption in the industry.” Online-based vendors are discouraging the doctor-patient relationship, downplaying the importance of

thorough eye examinations and contact lens fittings and taking advantage of unsuspecting lens wearers to make a profit at the expense of buyers’ ocular and systemic health. This makes it more important than ever to explain to patients that contact lenses are medical devices that require a valid lens prescription and a

## ABOUT THE AUTHOR



Dr. Barnett is a principal optometrist at the University of California Davis Eye Center in Sacramento, CA, and the past president of the Scleral Lens Education Society. 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.

comprehensive eye examination. A multitude of systemic conditions, such as diabetes, hypertension and melanoma, can be caught with an eye examination to lower the risk of further visual impairment.

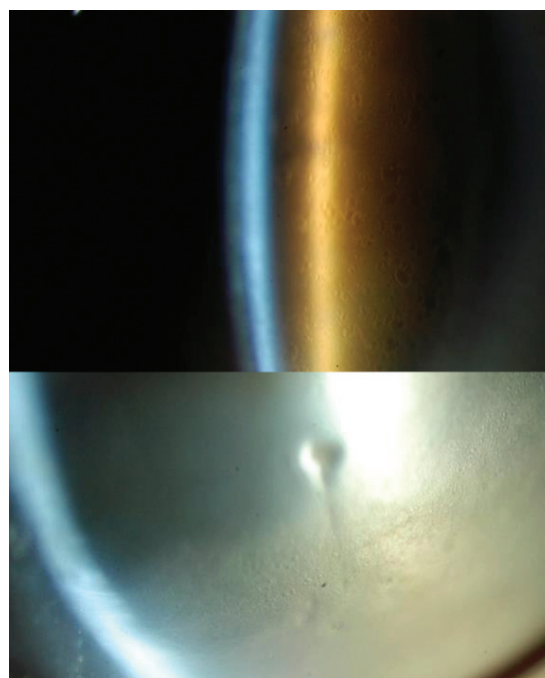
### LENS DISCOMFORT

Beyond providing good vision and comfort, well-fit contact lenses can promote retention and prevent dropout. Contact lens dropout, due to a complication like lens discomfort, is a prevalent issue and remains around 15% to 20%, even with new lens materials.<sup>3-9</sup>

A study sought to determine if the meibomian gland and tear film characteristics were affected by soft contact lens wear and possibly contributing to lens discomfort.<sup>10</sup> The researchers found that, in symptomatic contact lens wearers, grades of foam at meibomian gland orifices, expressibility, quality of secretions, tear evaporation rates with or without contact lens wear, tear break-up times and tear lipid layer thicknesses were all significantly associated

with symptoms of discomfort.<sup>10</sup> They noted that there were significant correlations between upper eyelid wiper epitheliopathy, meibomian gland acini reflectivity and tear meniscus height and comfort scores in both symptomatic and asymptomatic contact lens wearers.<sup>10</sup>

Another study evaluated the relationship between lid wiper epitheliopathy and ocular surface signs and symptoms.<sup>11</sup> Lid wiper epitheliopathy width was associated with greater symptoms in contact lens wearers, decreased tear film stability, lid anatomy and lid-parallel conjunctival folds.<sup>11</sup> The team found more *Demodex* mites in the upper eyelids of symptomatic lens wearers and attributed discomfort symptoms



**Microcystic corneal edema appeared in two cases of post-penetrating keratoplasty and after eight hours of scleral lens wear.**

Photo: Karen Carrasquillo, OD, PhD

### BRIDGING THE AGE GAP

Contact lenses should not only be considered for older demographics. They are an excellent option for children as long as these young patients can practice good hygiene and are motivated to take care of their contact lenses.

A study found that myopic children who chose to wear contact lenses after five years of using glasses had higher self-esteem compared with those who chose to remain in glasses.<sup>24</sup> The authors suggest that self-esteem may influence the decision to wear contact lenses.<sup>24</sup>

A 2016 population-based survey looked into contact lens wear, care behaviors, risk factors and demographics in different aged populations in the United States.<sup>13</sup> Eighty-five percent of the estimated 3.6 million adolescents wearing contact lenses reported at least one behavior that put them at risk for a lens-related eye infection, compared with 81% of young adults and 88% of older adults.<sup>13</sup> The authors concluded that encouraging adolescents to adopt healthy contact lens wear and care behavior earlier on may help them maintain these good habits into young adulthood when the frequency of risk behaviors associated with contact lenses increases.<sup>13</sup>

in these patients to morphological irregularities of the meibomian glands and alterations to tear film secretions that affect tear evaporative dynamics.<sup>11</sup> Clinically, this highlights the importance of evaluating the ocular surface in contact lens wearers.

### EYE INFECTIONS

While convenient, contact lens use also puts wearers at greater risk for lens-related eye infections, particularly when they do not wear and care for their lenses appropriately.<sup>12</sup> Many behaviors increase the risk of developing a lens-related corneal infection, one of the biggest and most commonly reported being sleeping in lenses.<sup>13</sup> Approximately one third of adolescent and adult contact wearers report that they sleep in their lenses.<sup>13</sup> Regardless of lens material and replacement frequency, sleeping in contact lenses is a significant risk factor and increas-

## FOUR CONTACT LENS COMPLICATIONS TO COMBAT

es the risk for lens-related eye infections six- to eight-fold.<sup>14-16</sup> These eye infections can cause vision loss, require eye drop usage and may even lead to surgeries like corneal transplantation.

Microbial keratitis (MK), a sight-threatening condition that rapidly progresses, is the most serious corneal complication associated with wearing contact lenses.<sup>17</sup> *Pseudomonas* causes MK in more than half of cases.<sup>18</sup> *Acanthamoeba* keratitis should also be included in the differential, particularly if there is any water exposure, if pain exceeds the clinical appearance or if the patient is not responding to antibiotics. Although MK only affects a small proportion of contact lens wearers (four per 10,000 annually), the large population of individuals who wear contact lenses and the serious threat of vision loss make it a much larger issue to combat.<sup>19</sup>



**Any age demographic can use contact lenses as long as patients are following the proper care and handling instructions.**

A study investigating contact lens water exposure found that both soft and gas permeable lens wearers regularly expose their lenses to water and are unaware of the potential consequences of these risky behaviors.<sup>20</sup> It is imperative to educate contact lens

wearers on proper lens hygiene and the dangers of not taking proper care and handling instructions seriously. Tips for safe contact lens wear include washing and drying hands prior to lens handling, not using tap water to clean lenses, not rinsing lens cases in tap water, replacing lens cases monthly, not swimming and showering with lenses, avoiding eye rubbing when wearing lenses and replacing lens solutions daily.<sup>21,22</sup>

surface disease, scleral lenses may not always be the most ideal choice.

Specular microscopy provides helpful information about the corneal endothelium and can help reveal any contraindications for scleral lens wear. Specifically, knowing endothelial cell counts can be especially useful in managing patients with corneal transplants. Patients with reduced endothelial cell counts and endothelial disease may be at higher risk for developing corneal edema and are not ideal candidates for scleral lenses. Pre-existing corneal edema prior to scleral lens wear and microcystic corneal edema with scleral lens wear are also concerns when considering scleral lenses. Evaluate the cornea prior to commencing a scleral lens fitting to determine if the patient has any underlying pathologies that may predispose the cornea to develop edema with scleral lens wear.

Prior to the initial scleral lens fitting, specular microscopy can also detect and quantify polymegethism (cell size variability) and pleomorphism (cell shape variation). Potential contraindications to scleral lens wear include epithelial basement membrane dystrophy, guttata, Fuchs' corneal dystrophy, corneal edema and other corneal dystrophies. If a scleral lens is the only choice for patients who may not be the best candidates, options include reducing scleral lens wear time, adding channels or fenestrations and altering the scleral lens fit to make it looser.<sup>23</sup>

There is an ongoing debate between researchers and scleral lens practitioners over whether scleral lenses elevate intraocular pressure (IOP) and impact glaucoma.

### SCLERAL CONTRAINDICATIONS

While innovative in their corrective abilities for corneal irregularities and their indications for ocular

Image: CDC

**CONTACT LENSES ARE LIKE UNDERWEAR**  
DON'T OVER-WEAR. AVOID THAT SKETCHY PAIR. CARRY A SPARE.

Not caring for your underwear can lead to nasty smells, but not caring for your contacts can lead to nasty eye infections.

- 1 DON'T OVER-WEAR**  
Replace your contacts as often as your eye doctor tells you, and don't sleep in them (unless your eye doctor says otherwise).  
*TIP: Clean your case with solution daily, and get a new case at least every three months.*
- 2 AVOID THAT SKETCHY PAIR**  
If a contact comes out and you can't disinfect it with fresh solution (never water or spit) right away, throw it out. Don't buy contacts from costume shops or anywhere that doesn't require a prescription.  
*TIP: Use out contacts before showering, swimming, or hot tubbing.*
- 3 CARRY A SPARE PAIR (OF GLASSES)**  
If you need to take out your contacts for an unexpected late night or trip to the pool, or if a contact comes out, have a pair of glasses as a backup.

**COVER YOUR BUTT TAKE CARE OF YOUR EYES**

U.S. Department of Health and Human Services  
Centers for Disease Control and Prevention  
www.cdc.gov/contactlenses

**Healthy contact lens habits go a long way in creating a comfortable, uneventful experience for wearers.**

# 2019 MEETINGS

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Unfortunately, there is no direct and consistent way to accurately measure IOP on the cornea while wearing scleral lenses, and significant limitations exist associated with the tonometers researchers use to obtain these measurements. That being said, practitioners should exercise caution when fitting scleral lenses on patients who may be susceptible to or suffering from glaucoma.

It's hard to imagine a world in which contact lenses don't exist. They are often crucial for patients in need of vision correction. We as primary eye care providers can do many things to improve the overall wearing experience, including discouraging illegal online sales, promoting contact lens comfort, combating eye infections and choosing the optimal contact lenses for our patients based on their individual characteristics. **RCCL**

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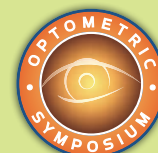
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# GET DAILY DISPOSABLES On Your Radar

These lenses come with many benefits, but we need to make sure we're doing our best to shed light on what they are.

By Andrew Fischer, OD, Mile Brujic, OD, and David Kading, OD

**W**hen a patient is in our chair expressing an interest in contact lenses, what drives our recommendation decisions? The always-evolving nature of lenses can make weighing our options an overwhelming and tedious process, but our patients rely on our expertise as health care professionals to help select the best lens for them.

We've reached a consensus with our colleagues that daily disposable contact lenses produce the healthiest ocular results. In our practices, daily disposable wearers tend to be more compliant and have lower incidences of microbial keratitis, contact lens-associated red eye, corneal infiltrates and contact lens-related dryness. Further, these users have almost no incidence of solution toxicity or solution-related adverse responses. Most eye care providers agree that the daily disposable modality is optimal, so why don't our prescribing habits reflect this belief, and why does the United States lag behind many other countries in daily disposable prescribing rates?

## CONSIDER GLOBAL PRESCRIBING HABITS

Over the past 10 years, there has been a consistent increase in the

percentage of daily disposable fits and refits. In the United States in 2008, daily disposables only made up 11% of soft lens fits while monthly and one-week/two-week modalities accounted for 40% each.<sup>1</sup> In 2018, however, daily disposable lenses increased more than trifold to 35% of soft lens fits, one-week/two-week lenses decreased to 21% and monthly lenses moved up to 41%.<sup>2</sup> Internationally, the story is the same for the most part: daily disposable contact lenses accounted for 18% of new soft lens fits in 2008 and increased to 32% this past year.<sup>3,4</sup> There are a few countries that have fully embraced the daily disposable modality and stand out among the rest: Japan at 57%, Australia at 64%, Norway at 63% and Denmark and Finland each at 71% of daily disposable lenses as new soft fits.

Without being immersed in the health care industries of the countries excelling in daily disposable prescribing, it is difficult to determine how and why they are able to prescribe these lenses at a much higher rate. These countries are generally regarded as some of the more health-conscious countries, so perhaps it is this mindset that drives patients to prioritize the safest and healthiest lenses

available, which happen to be daily disposables.

We believe there are a few contributory factors in the industry that have driven this upward trend in daily disposable lenses over the last decade. In the early 2000s,

## ABOUT THE AUTHORS



Dr. Fischer is currently completing his residency at Specialty Eye in Kirkland, WA, where he specializes in ocular surface disease and specialty contact lenses. He graduated from the Indiana University School of Optometry in 2018.



Dr. Brujic is a 2002 graduate of the New England College of Optometry. He is a partner of Premier Vision Group, a three-location optometric practice in Northwest Ohio. He is active at all levels of organized optometry and practices full-scope optometry with an emphasis on ocular disease management of the anterior segment and specialty contact lenses. He is on the editorial board for a number of optometric publications, has published over 300 articles and has given over 1,500 lectures, both nationally and internationally, on contemporary topics in eye care.



Dr. Kading has a three-location specialty practice in Seattle, WA. He lectures internationally and has written hundreds of papers. He co-owns Optometric Insights with Dr. Brujic.



**A sample of the daily disposables we use in our offices.**

contact lens solutions were heavily marketed. Around 2008 or 2009, we noticed that representatives from solution manufacturers were visiting our offices less frequently. At that same time, our industry partners were rolling out daily disposable lenses and putting more time and effort into producing and promoting these products. As parameters expand, materials and proprietary hydrating compounds evolve, and ease-of-fitting improves, the daily disposable market is gaining all the tools it needs to take off.

### PRESCRIBING SHORTCOMINGS

Recently, a colleague started a thread on social media asking why doctors don't prescribe daily disposable lenses. The most common responses included unavailable parameters, increased cost to the patient and nonexistent or improper education.

#### *Parameter Constraints*

Spherical daily disposable lenses span an incredible range and are available from +8.00D to -12.00D. Toric lenses have around-the-clock axes available up to -1.75D

of cylinder and many options in -2.25D of cylinder. For presbyopic patients, multifocal daily disposables are available from +6.00D to -9.00D. Soon, toric lenses in -2.75D of cylinder and toric multifocals will be available, further expanding the patient populations we can fit. With such a wide array of lens options, we can easily find daily disposable lenses to correct a vast majority of our patients. That being said, for patients who are highly hyperopic or myopic, or who have oblique astigmatism, daily disposable lens parameters may be difficult to find, and another modality may best suit them.

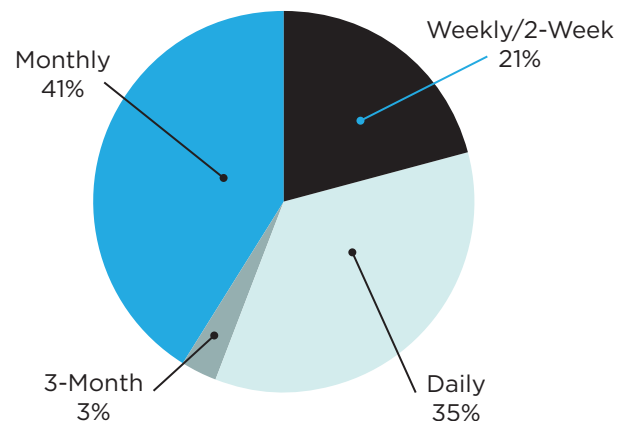
#### *Price*

##### *Constraints*

It's not a secret that practitioners don't exactly enjoy talking about pricing with patients, no matter the service or product. We all inherently keep our finances private, and discuss-

ing money can make many of us uncomfortable. Pricing concerns are a very common hurdle in transitioning a patient into daily disposable lenses. It is easy for our patients to check contact lens prices online and see that daily disposable lenses are more expensive than reusable lenses. Additionally, because daily disposable wearers tend to be more compliant and wear their lenses for their designated use of one day, they are more likely to need a new supply sooner.

When it comes time to have the conversation about daily disposable pricing with your patients, always be sure to highlight the outstanding rebates that are available after ordering a year's supply. Many manufacturers offer rebates of \$200, which could significantly change a patient's willingness to try daily disposables. Additionally, because multipurpose cleaning solutions are not needed with these lenses, patients are able to save a few hundred dollars each year. After outlining rebates and savings, the price of daily disposables becomes much more comparable with that of other modalities. It also helps to break down the price into a daily cost, after the rebate is applied. When comparing the daily cost of daily disposables with



**The distribution of soft lens fits in the United States in 2018.<sup>2</sup>**

## GET DAILY DISPOSABLES ON YOUR RADAR

a patient's daily Starbucks intake or gasoline usage, \$1.25 per day sounds much less intimidating.

### Education Constraints

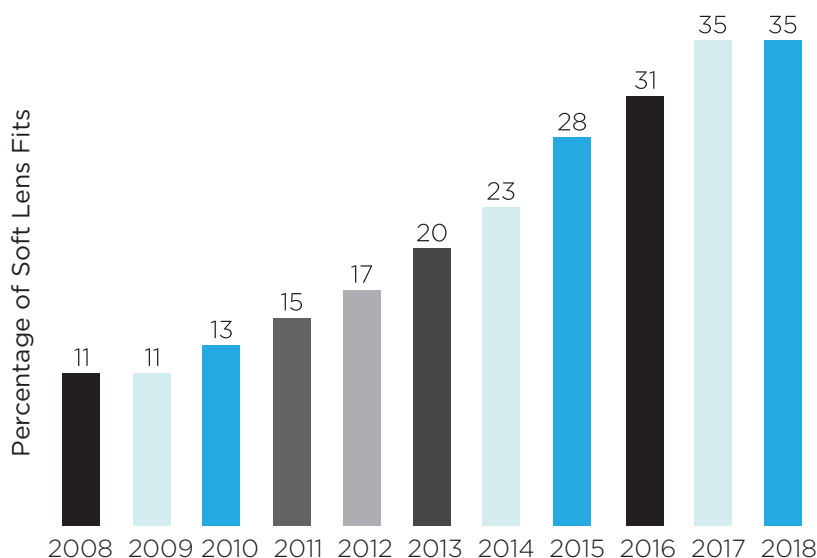
Some lens fitters simply forget to discuss daily disposables with their patients. Keep in mind that this “forgetfulness” puts patients at a disadvantage, as it is important to make sure they're informed about the latest technologies and options available. Keeping patients in the loop speaks volumes to them. Not only does it provide them with more options to optimize their health care, but it also serves to show that you are in tune with the shifting field and want to ensure they are as well.

Practitioners may also forget to ask the “right questions” to determine how a patient's current lenses are truly affecting them. Important questions to ask include:

- Do your eyes feel dry, especially toward the end of the day?
- Do your eyes feel itchy after wearing your lenses?
- Do your lenses become more uncomfortable the longer you wear them?
- How often do you replace your lenses?
- How often do you sleep in your lenses?
- How do you clean and store your lenses?
- If you could change anything about your lenses, what would it be?

Asking these open-ended questions gives patients an outlet to express feedback and provides practitioners with more detailed and honest information regarding shortcomings that prevent patients from having a more enjoyable lens experience. This exchange may be the perfect point to lead into a discussion about other lens options, including daily disposables.

### Upward Trend of Daily Disposables



Source: refs. 1, 2, 5-13.

### MOVE DAILY DISPOSABLES INTO THE SPOTLIGHT

By adopting an aggressive approach in each of our clinics, we have been able to fit 93% of our contact lens patients into daily disposable lenses through effective education on the reduced risk, ease of use and competitive pricing of this modality. Unless parameters are not available, the first (and only) modality we recommend is a daily disposable. We do this because it is our job to prescribe what is best for our patients, not to give them a choice of options that may not be as effective or low-risk.

Remember that, as healthcare providers, our top priority is to care for the long-term ocular health of our patients; therefore, it is vital that we prescribe the lens that we feel will be the most optimal for meeting that goal. That being said, not all daily disposable lenses are the same and work the same for everyone. This doesn't change the fact that they should be on every contact lens patient's radar.

Daily disposables have changed the way we practice. There is no reason US eye care providers can't excel in prescribing them at the same rate our Danish and Finnish counterparts do. If your daily disposable fits aligns more closely with the US average, challenge yourself to increase it by 10% each quarter. Be prepared to discuss why dailies are your first choice, how they are healthier than reusable modalities and what benefits patients could experience with them. [RCLL](#)

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# HOW TO REFIT *the Unhappy*

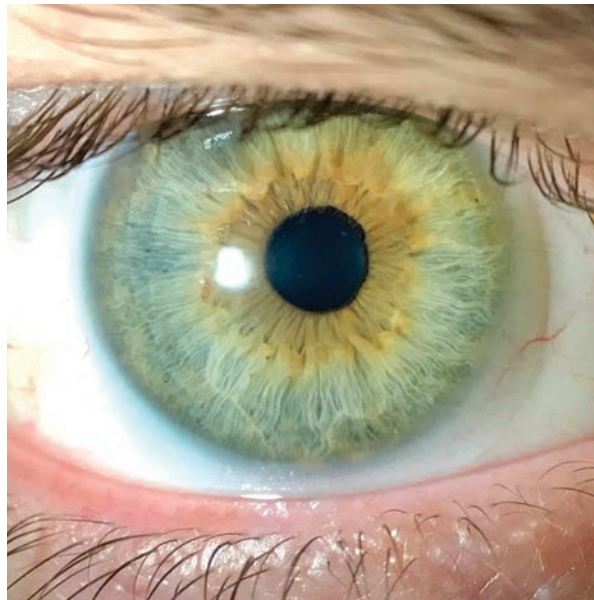
By Alex Nixon, OD, MS, and Erin Rueff, OD, PhD

If you work with multifocal contact lenses, you also deal with unhappy, frustrated patients. At times you may also feel unhappy and frustrated yourself. Vision and comfort issues can make multifocal fitting complex and, too often, unsuccessful. However, a successful multifocal fit doesn't have to be a rarity. Changing how you communicate and re-structuring how you troubleshoot can flip your failures into successes. Here we discuss strategies for identifying dissatisfied patients, improving communication regarding lens wear and optimizing lens performance.

## ROOM FOR IMPROVEMENT

Contact lens wearers are not always forthcoming about problems. When asked about their comfort or quality of vision, they may shrug and remark that they are doing "fine." This short, nondescript answer is unhelpful and means you need to do more digging to get the real picture. In addition to the typical, "When and how long do you wear your lenses?" question, some others you can ask to help uncover room for improvement include:

- Why don't you wear your contact lenses every day?
- Would you like to wear your



**With today's advances, soft multifocal lenses present many benefits to patients, and it's worth the extra time it takes to fit them successfully.**

contact lenses longer each day?

- At what time do your contact lenses begin to feel uncomfortable?
- How is your vision when driving or looking far away?
- How well can you see your phone and computer?
- How often do you use reading glasses over your contact lenses?
- What do you wish you could see better with your contact lenses?

These questions may help you realize that even if your patient's current contact lenses are "fine," their pattern of contact lens wear may highlight deficiencies. For example, limiting contact lens use to

only evenings or weekends generally indicates a problem with vision or comfort that limits contact lens wear in the workplace.

Patients with specific multifocal complaints such as distance blur, glare or inadequate near vision may be disappointed in the performance of the lenses. While having appropriate expectations is important, avoid trying to immediately lower the patient's expectations after a disappointing initial experience. This can leave the patient feeling as if they invested in a process that will yield meager results. Instead, reinforce your understand-

ing of the patient's limitations with their current contact lens brand and prescription, then highlight your plan to assess their vision and find opportunities for improvement. Your ability to win over

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# Multifocal Patient

These tips can help you turn a negative experience into a positive one.

dissatisfied patients correlates with the enthusiasm and confidence you convey in your ability to address their issues.

## THE RIGHT DESIGN

First, make sure you are fitting based on an updated refraction. Many presbyopes experience a hyperopic shift due to decreasing index of refraction in the lens, exacerbating their presbyopic symptoms. Use the most plus or least minus prescription to maintain clear distance vision while maximizing the benefits of the multifocal. Patients with astigmatism who have “gotten by” with spherical contact lenses in pre-presbyopic years may not be able to tolerate the combined astigmatic blur and multifocal aberrations.

For most spherical multifocal designs, up to 1.00D of astigmatism can be tolerated. Patients with higher refractive error powers often tolerate uncorrected astigmatism better. Consider toric multifocals for patients with higher amounts of astigmatism. Finally, emmetropic and low-hyperopic presbyopes are likely experiencing vision problems for the first time—an alarming revelation to these patients. Acknowledging these from the start will lead to a more optimal result.

Consider an alternate method of vision correction if your patient has a tropia and lacks stereopsis. Multifocal contact lenses are de-

signed to supplement one another to offer the wearer a range of clear vision without the need for reading glasses. When a tropia exists, the vision system cannot summate the images as intended and the multifocal performance lags. These patients are better candidates for monovision or may need to use distance correction with reading glasses for optimal performance.

While many of the modern soft contact lens designs employ center near optics, both visual performance and lens preference can still vary from person to person. Contact lens decentration, pupil size variability, or the natural aberrations of the eye you are working with can have real impacts on vision performance. If, even after adaptation and optimization, the vision quality provided by the contact lens remains inadequate, consider trying a different multifocal design altogether.

## VISION QUALITY

Appropriately assessing vision in office will allow you to isolate areas of visual satisfaction and send your patient home with lenses that optimize vision at all distances. An effective vision assessment includes binocular high contrast visual acuity at distance and near, with over-refraction at distance only. If their histo-

ry or entering visual acuity shows room for improvement, consider including monocular visual acuity at distance and near, which can help identify the cause of reduced visual acuity. For example, if visual acuity is reduced at distance but good at near, the eye is likely under-minused. Reduced visual acuity at both distance and near could be due to uncorrected astigmatism or an over-minused prescription. While these trends don't help quantify a needed change, when considered along with the over-refraction, they provide rationale for implementing a lens change.

Interpreting and addressing patients' symptoms can be challenging, but it's even more complex



Conditions such as allergic conjunctivitis can hinder success and must be addressed to ensure patient comfort and continued multifocal lens wear.

## HOW TO REFIT THE UNHAPPY MULTIFOCAL PATIENT

if you aren't speaking to your patients clearly. Optometry has specific definitions for distance, intermediate and near as they relate to working distances, but patients don't adopt this same jargon. To minimize unintended context when discussing visual performance, encourage patients to focus on specific tasks or activities they are struggling with and encourage them to bring samples or identify similarly sized text in-office. If they are having difficulty seeing on the job, have them describe and simulate the setup of their workplace. Understanding the patient's needs helps you make the best recommendations for material or parameter modifications.

If the patient reports distance vision problems, consider the results of the distance over-refraction. You should always implement a plus-powered distance over-refraction because this improves the entire range of vision in multifocal lenses. A minus-powered over-refraction, which will reduce multifocal effectiveness, should be demonstrated binocularly at distance and near before making a change.

In some cases, only part of the minus-powered over-refraction is implemented to maintain the patient's range of near vision. If distance vision problems are reported with a plano over-refraction, rule out limitations by uncor-

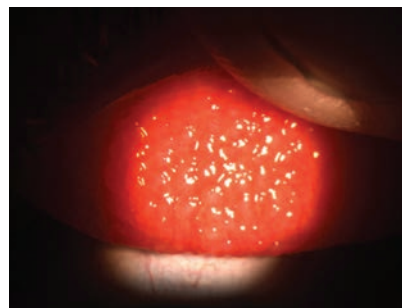
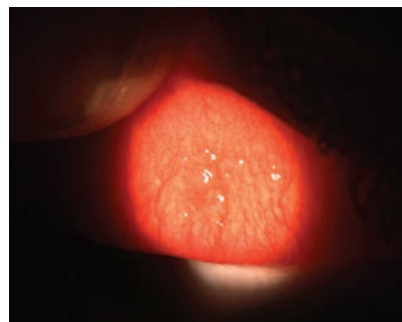
rected astigmatism and then refer to the fitting guide to determine the appropriate change.

If the patient reports near vision problems, the ideal scenario is that the patient accepts plus in the distance over-refraction. If they do not accept plus, the fitting guide will recommend the next changes, which could include increasing the add power or adding plus power to the non-dominant eye.

Prescription or lens material changes should be driven by the patient's subjective level of satisfaction, not visual acuity, especially when considering near vision. If you or your patient get caught up in specific acuity goals, lens changes may be made that improve acuity but do not positively impact the patient's quality of life. Using point print sizes for near vision testing can help avoid fixation on achieving 20/20 vision and thus maintain focus on the patient's visual goals.

If you don't have the trial lenses you need, consider ordering them. Steps as small as 0.25D can have a significant effect on range of vision in multifocal lenses. When discussing the changes with the patient, reinforce your understanding of the patient's visual needs and concerns, then highlight how you have addressed their needs.

Before departing, review challenges the patient may experience and highlight the feedback you

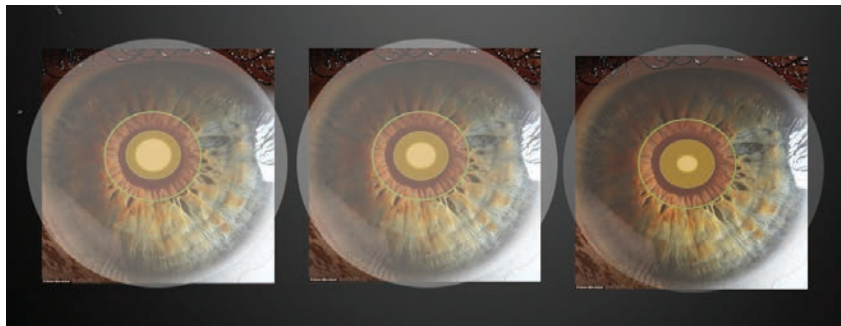


**Patients with mild (above) or severe contact lens papillary conjunctivitis will have textured, inflamed eyelids, which can cause discomfort and keep them out of contact lens wear.**

would like to receive at follow-up. The patient must know that multifocals often will not perform as well with fine print or dim lighting. Suggest a pair of low-powered (e.g., +1.25) readers for spot usage and extra lighting in their work area, if possible. The patient should be coached to keep track of activities that are challenging in the lenses. While complete freedom from readers may not be achievable, knowing what tasks are challenging will help you better understand the context of any vision issues.

### THE OCULAR SURFACE

Clear vision at all distances isn't worth much if your patient is uncomfortable in their contact lenses. As with any contact lens modality, multifocal wearers may experience comfort issues. It may be easy to suggest an artificial tear and hope for the best, but lubrication alone is not a lasting solution for your patients' comfort issues. A recent



**The patient's pupil size can affect the lens performance, so varying the multifocal zone sizes, seen here, based on this measure can help.**

study reported that subjects using artificial tears wore their lenses less and were more likely to drop out of contact lens wear.<sup>1</sup> Lubricant drops can offer short-term relief, but they require frequent dosing and may treat symptoms that could be better addressed with other interventions such as modifications to the contact lens material, care solution or replacement frequency.

Throughout the fitting process, make sure dry eye, meibomian gland dysfunction and allergic issues are addressed. Implementing appropriate lid hygiene, for instance, can improve the lipid tear layer, reducing tear evaporation and improving comfort. Allergic conjunctivitis and contact lens papillary conjunctivitis can lead to textured, inflamed eyelids with symptoms of itch, dryness and discomfort. Everting eyelids and

evaluating the health and texture of the palpebral conjunctiva may help you isolate causes of discomfort and eliminate them early.

Using daily disposable multifocal modalities can help you manage and avoid many discomfort issues. Introducing a clean material that is free of allergens and deposits will allow for maximum comfort and vision quality. Daily disposables also eliminate the need for solution, avoiding any hypersensitivity reaction with a care solution. In the past, daily disposable multifocal lenses were rare and prohibitively expensive. But today's contact lens market has expanded to include more daily disposable multifocals at a variety of price points. In addition, many reusable multifocal designs are available in a daily disposable design, so you should aim to fit the majority of your multifo-

cal wearers in daily disposables to optimize comfort.

Compared with other fitting processes, successful multifocal fittings require a unique, highly communicative approach. Keeping patients involved in the fitting process by addressing their concerns early, educating them on how the lenses work and acknowledging negative symptoms will maintain their confidence in the process. Focus on subjective patient responses instead of objective visual benchmarks to achieve the patient's specific visual goals. Next time you encounter an unhappy multifocal wearer, consider these tips and enjoy a smoother troubleshooting experience. [RCC](#)

1. Pucker AD, Ng SM, Nichols JJ. Over the counter (OTC) artificial tear drops for dry eye syndrome. Cochrane Database Syst Rev. 2016;2:CD009729.

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# A Systematic Approach to Solving Contact Lens Discomfort

Comfort may be the number one factor in achieving a successful, long-lasting contact lens fit. Take a stepwise approach when comfort can't be found.

By Christopher Kuc, OD

**H**ow can a patient who has been wearing an outdated lens for decades and using generic multipurpose solution have no complaints while another patient wearing the latest in daily disposable technology borders on miserable?

When selecting an appropriate lens, the biggest obstacle for any clinician to overcome is contact lens discomfort (CLD). Surveys show this is the predominant complication for upwards of 20% of patients who drop out of contact lens wear.<sup>1,2</sup> Indeed, as many as 50% of patients who stop wearing contacts cite CLD as their primary reason for throwing in the towel, and this dropout rate is a limiting factor in growing a contact lens practice.<sup>2,3</sup>

This article explains recent findings related to CLD and provides a stepwise approach to troubleshooting CLD in our patients.

## DEFINING AND IDENTIFYING THE PROBLEM

In 2013, a group of experts known as the Tear Film & Ocular Surface Society (TFOS) published a comprehensive report on CLD. The TFOS workshop defined CLD as:

“A condition characterized by episodic or persistent adverse ocular sensations related to lens wear, either with or without visual

disturbance, resulting from reduced compatibility between the contact lens and the ocular environment, which can lead to decreased wearing time and discontinuation of contact lens wear.”<sup>4</sup>

Because we want to avoid decreased wearing time and discontinuation of contact lens wear in our patients, we need to seriously address CLD.

But detecting the early symptoms of CLD can be challenging. The prevalence of discomfort and dryness revealed in contact lens surveys demonstrates that most patients will not voice their symptoms during an exam unless the clinician takes a proactive approach.

## ELICITING SYMPTOMS

One method for eliciting a patient's symptoms is questionnaires. Implementation of a questionnaire can seem daunting, but in many cases could help grow a dry eye and contact lens practice. Commonly used validated questionnaires are the Ocular Surface Disease Index (OSDI) or the Contact Lens Dry Eye Questionnaire (CLDEQ).<sup>5</sup> A shorter version of the CLDEQ, known as the CLDEQ-8, accurately reflects changes in patient symptoms in a simpler format.<sup>5</sup>

Taking a more thorough history can also yield symptoms that a

patient may not normally discuss. Ask all contact lens patients direct questions, such as:

- Does your vision change throughout the day?
- Do your eyes become tired in the afternoon?
- Have your eyes ever become red while wearing contacts?
- How long do you use a computer or screen each day?
- Are you using lubricating drops?
- How many hours per day do you wear your contacts? Overnight?
- Can you describe how your contacts feel throughout the day?

Using at least one open-ended question to elicit symptoms is important. If you rely on technical staff for workups, then consider using a standard checklist to elicit history in your contact lens patients.

A good tie-in to history taking is to use flow charts to help categorize contact lens discomfort. This requires little paperwork, and you

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gather the information simply by learning the correct questions to ask and collecting scores based on responses. One such flow chart is the Berkeley Dry Eye Flow Chart (DEFC). Research has shown a strong correlation between DEFC and leading contact lens questionnaires such as OSDI.<sup>6</sup>

## INFLUENCES IN CLD

Collecting a detailed history gives us information about non-modifiable and modifiable influences in contact lens discomfort.

Non-modifiable factors such as increased age and female sex, for instance, play a role in contact lens discomfort risk. Also, a history of underlying allergies, autoimmune disease and underlying disease such as polycystic ovarian syndrome have all been tied to CLD.<sup>7</sup>

Modifiable factors, in turn, can be evaluated and managed based on information gathered in a patient's medical history. For example, the use of oral contraceptives and over-the-counter pain medications have been tied to contact lens discomfort. Modifiable environmental considerations that affect CLD include humidity, airflow and changes in blink rate with prolonged screen time.<sup>7,8</sup>

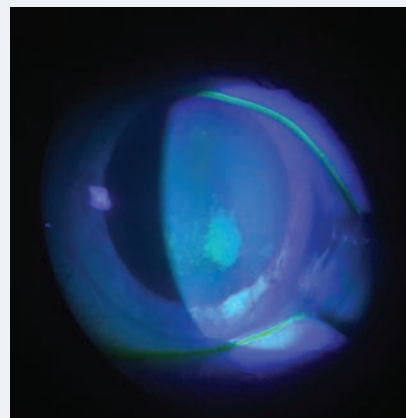
Gathering this pertinent informa-

tion should be the starting point of an investigation into contact lens discomfort.

## LENS CHARACTERISTICS

Once you've identified a patient with CLD and you've determined patient considerations based on history, a systematic approach to isolating other contributors is important. The contact lens itself is where most practitioners would begin their focus. With the resurgence of silicone hydrogel (SiHy) lenses and benefits of increased Dk, many doctors still believe that more oxygen equals more comfort.

However, studies with good controls have not shown superior comfort with SiHy and have revealed the difficulty in finding what contributes to CLD, including lens properties, design and modality.<sup>9</sup> The modulus of the lens, which is also closely tied to Dk, affects the rigidity or flexibility of a lens because it's directly tied to water content. The higher the silicone content, the more challenging it is to incorporate greater water content, and the lens modulus becomes higher/stiffer. Intuitively, a stiff modulus would seem like a logical reason for an uncomfortable lens, but this too has not been verified in studies.<sup>10</sup>



**Fig. 1. Staining associated with preservative uptake and release. Corneal staining should be evaluated during a contact lens exam with consideration given to underlying mechanisms.**

Surprisingly, the TFOS workshop also found no direct correlation in CLD to deposits, dehydration and tear exchange.<sup>11</sup>

What are some modifiable contact lens properties that do have a direct correlation to CLD?

The fit of the lens is important. A lens that moves less and closely conforms to the bulbar conjunctiva tends to be more comfortable.<sup>12</sup> This may also tie closely to lens edge profile and thickness. A thinner lens edge provides better comfort, possibly because it causes less disruption of the surrounding conjunctiva.<sup>13</sup>

**Release Date:** March 15, 2019  
**Expiration Date:** March 15, 2022  
**Estimated time to complete activity:** 1 hour

**Jointly provided by Postgraduate Institute for Medicine and RGVCE**



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

- Define the characteristics and implications of contact lens discomfort.
- Take a thorough history of the patient's problem and general health status.
- Describe the modifiable and non-modifiable patient factors, as well as the ocular and external environmental factors, that may contribute to contact lens discomfort.
- Use a stepwise intervention strategy to attempt to ameliorate contact lens discomfort and to prevent decreased or discontinued contact lens wear.

**Target Audience:** This activity is intended for optometrists engaged in the care of patients with contact lens discomfort.

**Accreditation Statement:** In support of improving patient care, this activity has been planned and implemented by the Postgraduate

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**Faculty/Editorial Board:** Christopher Kuc, OD, Chester County Eye Care Associates in West Chester, PA.

**Credit Statement:** This course is COPE approved for 1 hour of CE credit. Course ID is **61134-CL**. Check with your local state licensing board to see if this counts toward your CE requirement for relicensure.

### Disclosure Statements:

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## A SYSTEMATIC APPROACH TO SOLVING CONTACT LENS DISCOMFORT

A more recent area of interest is lubricity and friction. Studies indicate these may significantly impact comfort, and the combined properties of a lens may individually affect a lens's coefficient of friction.<sup>14</sup>

Other properties the TFOS identified as contributing to improved CLD are shorter frequency of replacement and lower water content.<sup>11</sup> Overwear of contact lenses, including overnight or prolonged daily wear hours, has been difficult to study but has long been tied to contact lens discomfort and should be addressed with your patients. Discuss the importance of adhering to the manufacturer-recommended replacement schedule and duration of daily wear time.<sup>15,16</sup>

### CONTACT LENS SOLUTIONS

Although the current eye care landscape has seen huge growth in the daily disposable market, understanding the ingredients in solutions—and how certain lens-solution combinations have been shown to contribute to CLD—is incumbent upon all optometrists who fit daily wear contacts. Because the various components in multipurpose solutions include biocides, surfactants, wetting agents, chelating agents and buffering agents, studying which ele-

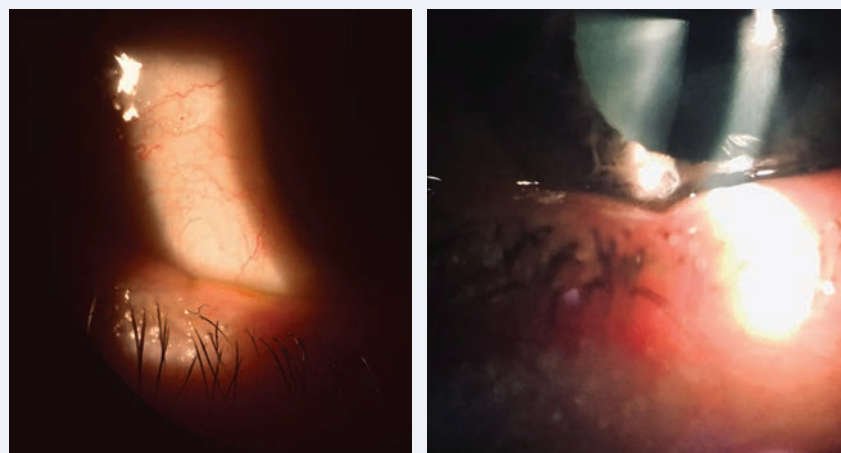
ments affect contact lens discomfort has been challenging.

A good starting point for differentiating these products is understanding that the active ingredient in contact lens solutions is the biocide or preservative. Polyhexamethylene biguanide (PHMB), polyquaternium-1 (Polyquad), alexidine dihydrochloride, and hydrogen peroxide are common biocides used in contemporary solutions.

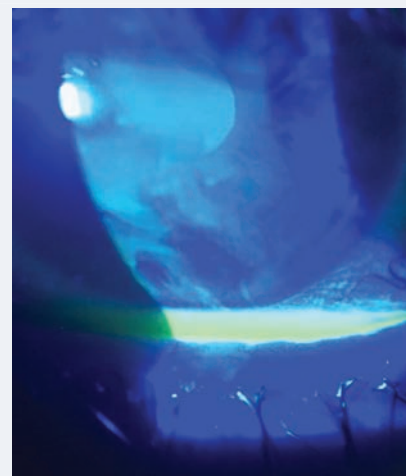
Preservative uptake and release have been extensively investigated and found to be associated with increased corneal staining (*Figure 1*).<sup>17,18</sup> Although many studies showed PHMB is a greater concern for this phenomenon, the related corneal staining wasn't closely correlated to CLD. Nevertheless, one way to minimize corneal staining is to use caution when mixing groups II, IV and silicone hydrogel materials with older PHMB.<sup>19,20</sup>

Meanwhile, hydrogen peroxide systems are often touted as providing superior comfort, and at least one smaller study has shown improved comfort and extended wearing times.<sup>21</sup>

Among newer generation solutions (including hydrogen peroxide), one component tied directly to better comfort is the wetting agent.<sup>22,23</sup>



**Fig. 2. Lid notching indicating MGD is easily overlooked and can be a clue to underlying deficient lipid tear film layer.**



**Fig. 3. Reduction in tear break-up time is easily assessed and has direct correlation to CLD.**

This supports the idea that increased lubricity or decreased friction may add to comfort and should be considered when recommending solutions for silicone hydrogel lenses.

Proper use of any system, including case care, should be reviewed at each visit, as compliance is tied to keratitis and corneal staining.<sup>24</sup> Recommending new solutions designed to match new lenses makes sense based on these findings and should be considered when discomfort occurs.

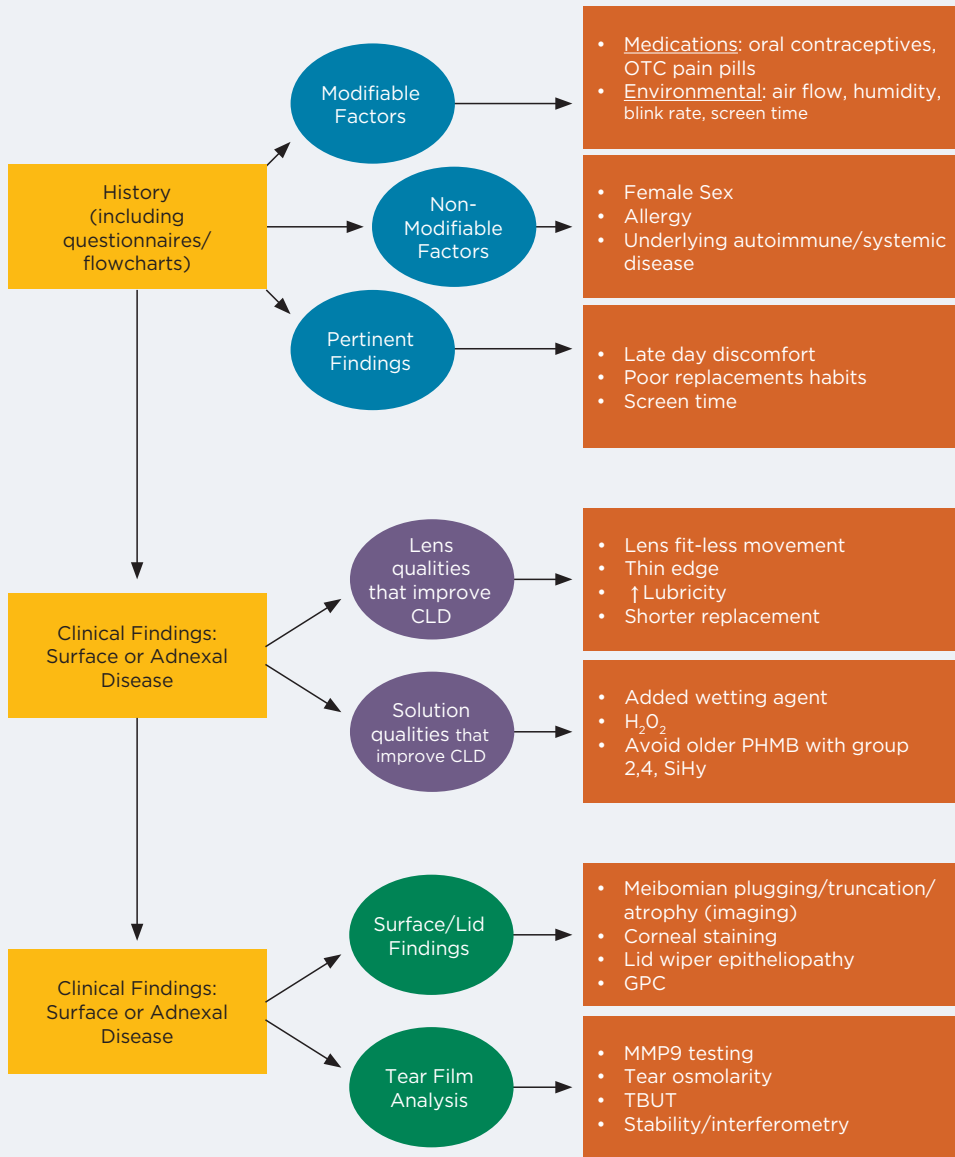
### PREEXISTING OCULAR CONDITIONS

If the ocular surface has underlying disease, even the latest contact lens or solution may not lead to better comfort. A thorough slit lamp exam of any patient who is currently wearing or considering contacts should give insight into existing ocular pathology that may contribute to contact lens discomfort.

For instance, meibomian gland dysfunction (MGD) and CLD are closely tied.<sup>25,26</sup> More than 20% of patients who have pre-existing evaporative dry eye do not know they have MGD.<sup>27</sup> A careful examination of these glands—including eversion of the lower lid, transillumination



## TREATING CLD SYSTEMATICALLY



and expression of meibum—is easy to do and can help identify MGD in CLD (Figure 2). Meibography is becoming more common in optometric practice and can help screen contact lens wearers with underlying lid disease and gland atrophy. Once you’ve identified MGD, initiate traditional therapies such as hot compresses (with improved microwaveable eye masks that incorporate silica beads to promote moisture) or in-office heat therapy such as LipiFlow (Johnson &

Johnson Vision), MiBo Thermoflo (Mibo Medical), or iLux (Alcon).

Tear film quality should also be assessed clinically. In 2017, TFOS released the DEWS II report, which again identified inflammation as playing a central role in dry eye.<sup>28</sup> We know that contact lens wear can induce inflammation, but it has been more difficult to affix CLD to inflammation.<sup>29,30</sup> One recent study has shown upregulation of IL-17A in tear film analysis of patients with contact lens discomfort.<sup>31</sup>

Identifying underlying inflammation should be a top priority when addressing CLD, and methods for measuring this include tear film osmolarity (TearLab) and InflammDry (Quidel).

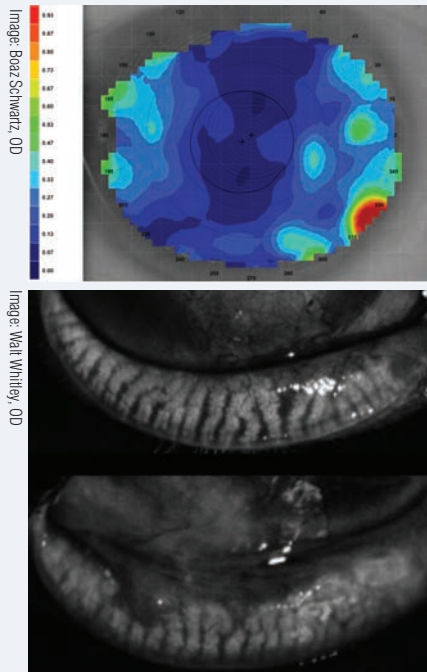
Also, consider adding topical steroids, cyclosporines or other anti-inflammatory agents as a possible solution to CLD if switching contacts and solutions have failed.

Tear break-up time (TBUT) is an important indicator of dry eye, which in normal eyes should be greater than 10 seconds, and can be assessed simply with fluorescein (Figure 3). In an eye wearing a contact lens, this time could be regularly diminished to eight seconds and even lower if CLD is present.<sup>32</sup> In-office tear film testing, such as tear film stability (Medmont topographer/Oculus Keratograph) and tear film interferometry (LipiView II, Johnson & Johnson Vision), can be incorporated and is closely tied with MGD discussed earlier (Figure

4).<sup>33,34</sup> In confounding cases, consider use of all vital dyes (lissamine green and rose bengal), as one may reveal nuanced staining patterns where another may not, such as in conjunctival staining.

Inserting silicone punctal plugs has also been demonstrated to improve CLD and can certainly be considered after first treating underlying surface inflammation, even though this avenue is traditionally used for dry eye therapy.<sup>35</sup>

To enhance tear film stability,



**Fig. 4.** Above, dynamic tear film stability analysis with cooler colors representing uniform, denser tear layer and hot colors representing thinning and poor consistency, may shed light on CLD related to poor tear film quality. Below, meibography showing healthy glands above and glands with truncation and close to 50% loss inferiorly.

direct the patient to use a good preservative-free surface lubricant (or one that is approved for contact lens use) before and after contact lens insertion.<sup>36</sup>

In addition, absence of sufficient surface lubrication and the presence of underlying inflammation may contribute to the development of lid wiper epitheliopathy, which is also tied to CLD.<sup>24</sup> This abnormality to the lid margin can be identified easily with lissamine green and should also be considered in the presence of an abnormal tear film along with meibomian gland and tear film evaluation.<sup>37</sup>

**I**n summary, CLD is an often overlooked, multifaceted condition associated with contact lens wear. Understanding its impact should

encourage a practitioner to assess each contact lens patient carefully. A typical exam should consist of a thorough history (including a questionnaire when possible), evaluation of fit and proper use of solutions, consideration of lens material characteristics and biomicroscopy to detect underlying surface or adnexal disease. Implementing the knowledge available regarding CLD and taking a systematic approach to manage these patients will undoubtedly help your patients while helping your contact lens practice. **CCCL**

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**CE TEST ~ MARCH/APRIL 2019**

1. In patient surveys, what is the most commonly cited reason for discontinuing or dropping out of contact lens wear?
  - a. Vision.
  - b. Cost.
  - c. Comfort.
  - d. Doctor's poor chairside manner.
2. What percentage of contact lens wearers will drop out of contact lens wear at some point?
  - a. 15% to 30%.
  - b. 30% to 45%.
  - c. 45% to 60%.
  - d. 60% to 75%.
3. The current TFOS definition of contact lens discomfort (CLD) includes:
  - a. A tight-fitting lens.
  - b. Excessively increased wearing time.
  - c. Adverse ocular sensations.
  - d. Low oxygen permeability.
4. Which line of questioning may result in obtaining more information about a patient's contact lens comfort?
  - a. "How long do you wear your contact lenses each day?"
  - b. "How often do you replace your contact lenses?"
  - c. "What type of contact lens solution do you use?"
  - d. "Can you describe how your contact lenses feel at the end of the day?"
5. Reasonable methods for detecting symptoms of CLD in a contact lens practice include all of the following **except**:
  - a. A thorough initial history.
  - b. Administering a dry eye or contact lens specific questionnaire.
  - c. Flow charts.
  - d. Ignoring non-modifiable factors.
6. What is an example of a modifiable patient factor that may improve contact lens comfort?
  - a. Female sex.
  - b. Airflow at a work station.
  - c. Underlying history of allergy.
  - d. Age.
7. Which contact lens characteristic has been directly tied to improved CLD:
  - a. HEMA lens material.
  - b. Shorter replacement modality.
  - c. Stiff modulus.
  - d. Lens deposits.
8. Which solution characteristic has been shown to help improve the comfort of a contact lens:
  - a. Any solution with PHMB as a preservative.
  - b. Preservative uptake and release phenomenon.
  - c. Newer wetting agents.
  - d. The pH of the system.
9. When evaluating the tear film, which finding points to a patient with CLD?
  - a. Decreased tear film break-up time.
  - b. Positive InflammaDry Test.
  - c. Staining with vital dye along the palpebral conjunctiva at the lid margin.
  - d. All of the above.
10. All of the following would be an appropriate therapy/ modification used to improve CLD **except**?
  - a. In-office lid heat therapy administration.
  - b. Topical anti-inflammatory treatment.
  - c. Refit into a new contact lens material or switch solutions.
  - d. Removal of silicone punctal plugs.

**EXAMINATION ANSWER SHEET**

**A Systematic Approach to Solving Contact Lens Discomfort**

Valid for credit through March 15, 2022

**Online:** This exam can also be taken online at [www.reviewsce.com](http://www.reviewsce.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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**Payment:** Remit \$20 with this exam. Make check payable to: Jobson Healthcare Information, LLC.

**Credit:** This lesson is approved for 1 hour of CE credit. Course ID is 61134-CL.

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**Answers to CE exam:**

1. (A) (B) (C) (D)
2. (A) (B) (C) (D)
3. (A) (B) (C) (D)
4. (A) (B) (C) (D)
5. (A) (B) (C) (D)
6. (A) (B) (C) (D)
7. (A) (B) (C) (D)
8. (A) (B) (C) (D)
9. (A) (B) (C) (D)
10. (A) (B) (C) (D)

**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

11. Define the characteristics and implications of contact lens discomfort. (1) (2) (3) (4) (5)
12. Take a thorough history of the patient's problem and general health status. (1) (2) (3) (4) (5)
13. Describe the modifiable and non-modifiable patient factors, as well as the ocular and external environmental factors, that may contribute to contact lens discomfort. (1) (2) (3) (4) (5)
14. Use a stepwise intervention strategy to attempt to ameliorate contact lens discomfort and to prevent decreased or discontinued contact lens wear. (1) (2) (3) (4) (5)
18. Based upon your participation in this activity, do you intend to change your practice behavior? (choose only one of the following options)
  - (A) I do plan to implement changes in my practice based on the information presented.
  - (B) My current practice has been reinforced by the information presented.
  - (C) I need more information before I will change my practice.
19. 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) \_\_\_\_\_
20. If you plan to change your practice behavior, what type of changes do you plan to implement? (check all that apply)
 

(A) Apply latest guidelines	(B) Change in pharmaceutical therapy	(C) Choice of treatment/management approach
(D) Change in current practice referral	(E) Change in non-pharmaceutical therapy	(F) Change in differential diagnostics
(G) Change in diagnostic testing	(H) Other, please specify: _____	
21. How confident are you that you will be able to make your intended changes?
  - (A) very confident
  - (B) somewhat confident
  - (C) unsure
  - (D) not confident
22. Which of the following do you anticipate will be the primary barrier to implementing these changes?
  - (A) Formulary restrictions
  - (B) Time constraints
  - (C) System constraints
  - (D) Insurance/financial issues
  - (E) Lack of interprofessional team support
  - (F) Treatment related adverse events
  - (G) Patient adherence/compliance
  - (H) Other, please specify: \_\_\_\_\_

**Rate the quality of the material provided:**

- 1=Strongly disagree  
2=Somewhat disagree  
3=Neutral  
4=Somewhat Agree  
5=Strongly agree

15. The content was evidence-based. (1) (2) (3) (4) (5)
16. The content was balanced and free of bias. (1) (2) (3) (4) (5)
17. The presentation was clear and effective. (1) (2) (3) (4) (5)

23. Additional comments on this course: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

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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 fraudulent or improper means.*

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# NAVIGATING THE CROSSLINKING POSSIBILITIES

Future modifications to the standard protocol already in use abroad may soon make their way stateside.

By Mark De Leon, Associate Editor

Corneal collagen cross-linking (CXL) is the only minimally invasive surgical procedure to halt keratoconus progression, and is often considered the gold standard.<sup>1</sup> While the Dresden protocol, known as “epi-off,” was FDA-approved for clinical use in the United States in 2016, the treatment option’s history traces back to the early 2000s. Today, a variety of newer protocols are under development with the hopes of reducing complications or improving outcomes from the standard epithelium-off protocol. The growing sense of intrigue has led to several US clinical trials investigating the alternative protocols already in use in other countries, as well as a spread of off-label uses.

## RELIABILITY WITH DRESDEN

The Dresden protocol remains limited in scope, and only uses riboflavin solutions and an ultraviolet (UV) light system designed by Avedro. The current technique involves removing the epithelium and applying riboflavin solution (0.1% riboflavin in 20% dextran solution) to the de-epithelialized cornea 30 minutes before irradiating it with

UVA at a wavelength of 370nm and power of 3mW/cm<sup>2</sup> or 5.4J/cm<sup>2</sup> for another 30 minutes.<sup>2</sup> The riboflavin solution is applied to an 8mm area of the central cornea every three to five minutes during the irradiation process. The epithelial removal prior to CXL treatment addresses the epithelium’s shielding effect and ensures adequate penetration of riboflavin to the corneal stroma, while the riboflavin facilitates absorption of UVA and prevents UVA damage to the endothelium.<sup>3-5</sup>

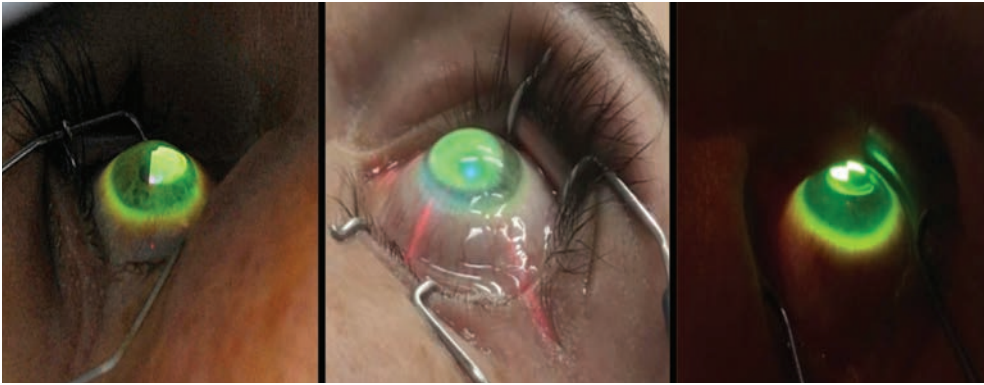
Philadelphia’s Clark Chang, OD, of Wills Eye Hospital and TLC Vision, understands that the epi-off CXL procedure stands as the tried-and-true method. “It currently has a sufficient amount of scientific data behind it,” Dr. Chang says. “The efficacy of the procedure has been largely proven with good outcomes, and we continue to provide that treatment protocol in my practice to most of the patients coming in that seek crosslinking care.”

Cecelia Koetting, OD, of Virginia Eye Consultants, also believes that patients are seeing the benefits of the current protocol, even though payers might not cover it. “We have noticed some of our kera-

toconus patients have continued improvement in their visual acuity and corneal flattening well after one year from treatment,” Dr. Koetting says.

Still, the protocol’s reputation of complications precedes it. “The dextran-diluted riboflavin appears to cause significant dehydration, thus more occurrence of scars, melting, possible infection and delayed re-epithelialization,” explains A. John Kanellopoulos, MD, a clinical professor of ophthalmology at New York University Medical School and medical director of the Laservision Eye Institute in Athens, Greece.

S. Barry Eiden, OD, president and medical director at North Suburban Vision Consultants, Ltd., and president and co-founder of the International Keratoconus Academy (IKA), has seen patients who have undergone epi-off CXL experience significant discomfort for several days post-op associated with the epithelium removal, as well as slow recovery of vision, visual fluctuations over the initial weeks and months and a significant delay in the ability to wear contact lenses.



**CXL can stop progression of keratoconus and can also help to preserve vision.**

But patients can have great success following the epi-off protocol, as long as they are fully informed of the postoperative course, says Dr. Chang. “We do tell patients about the visual fluctuation that is present within the first three to six months, and that they can typically resume contact lens wear or fitting at about one month post-operatively,” Dr. Chang notes.

### **GAINING SPEED**

In an attempt to improve the visual and topographical outcomes of the standard CXL protocol and to minimize the time-related discomfort and endothelial-related side effects, researchers are investigating various modifications, such as a protocol known as accelerated CXL.<sup>1</sup> This method uses shorter UVA exposure times of three, five or 10 minutes with higher energy levels of 30, 18 or 9mW/cm<sup>2</sup>—all of which provide a cumulative irradiation dose of 5.4J/cm<sup>2</sup>.<sup>1</sup>

“In addition to comfort and convenience, researchers have theorized that the shorter exposure time may reduce the rate of complications such as corneal thinning, haze, infection and melting,” explains Dr. Eiden.

The main advantage of the accelerated protocol in comparison with conventional CXL is the reduced treatment time. Theoretically, the

infection risk might also be reduced since the de-epithelialized cornea is exposed for a shorter period of time.<sup>6</sup>

Although some contradictory clinical and laboratory results exist, many studies suggest accelerated CXL procedure as an effective method to stabilize the progression of keratoconus both in adults and in children.<sup>1</sup>

One study from the Sunderland Eye Infirmary in Great Britain found that the accelerated CXL protocol safely halted keratoconus progression over a 24-month period. The researchers observed that eyes with corrected distance visual acuity (CDVA) greater than or equal to 0.3logMAR significantly improved from 43 preoperatively to 50 (96.2%) eyes. They noted no adverse effects, as all cases of mild post-CXL corneal haze were transient and resolved by six months post-op after a course of topical steroids. The study proposes that early administration of CXL for progressive keratoconus leads to good long-term visual outcomes.<sup>7</sup>

More recently, pulsed-light accelerated crosslinking with eight minutes of UVA exposure at 30mW/cm<sup>2</sup> with an energy dose of 7.2J/cm<sup>2</sup> was introduced as an effective mode of treating keratoconus.<sup>8</sup> A clinical study with a one-year follow-up found that the

functional outcome of the pulsed-light accelerated CXL was better than the continuous-light accelerated CXL with the ability to penetrate deeper into the corneal stroma.<sup>9,10</sup>

Using a higher peripheral intensity profile allowed UV light to penetrate deeper into the pe-

riphery of the cornea during the accelerated procedure, increasing tissue crosslinking.<sup>11</sup> While clinical studies indicate that accelerated CXL is successful in stabilizing keratoconus, several investigators have noted differences in the appearance and depth of the corneal stromal demarcation line that occurs when CXL is performed at different irradiances.<sup>12</sup> Because surgical protocols for accelerated CXL are significantly different than the current one, researchers are unable to effectively compare the two.

### **STICK WITH THE EPITHELIUM**

The clinical drawbacks of standard crosslinking—such as post-op pain, prolonged visual recovery due to the large epithelial defect and the inability to perform conventional CXL on thin corneas due to the risk of endothelial damage—has encouraged clinicians to look for a method of crosslinking without epithelial debridement.<sup>1</sup> For transepithelial (epi-on) crosslinking, the corneal epithelium is left intact prior for the CXL treatment. One study notes that transepithelial CXL can be used as an effective treatment option for keratoconic patients with thin corneas.<sup>1</sup>

“Epi-on crosslinking has a number of potential advantages over epi-off, including a superior safety profile, faster recovery of vision



## NAVIGATING THE CROSSLINKING POSSIBILITIES

and visual stability,” Dr. Eiden says, who uses the epi-on procedure in his practice. “It provides far less discomfort and the ability to return to normal life activities and contact lens wear in a much shorter period of time.”

Research demonstrates that preserving the epithelial layer conserves corneal morphology and makes the procedure more comfortable for patients.<sup>1</sup> Performing CXL with an intact epithelium can reduce the risk of infective keratitis, improve patient comfort, reduce stromal haze and minimize intraoperative corneal thinning, likely due to less tissue damage and reduced wound healing reaction.<sup>13</sup>

However, epi-on CXL might affect corneal sensitivity to a lesser degree than the standard protocol. Riboflavin—a high molecular weight, hydrophilic molecule—may not penetrate the intact epithelium as well.<sup>14</sup> An intact epithelium might also diminish oxygen diffusion into the stroma, further weakening the crosslinking effect.<sup>15</sup>

Currently, Avedro is recruiting practitioners for a Phase III study on the efficacy of the epi-on protocol, with a primary completion date of June 2020.<sup>16</sup>

While patient comfort is important to the treatment’s eventual adoption, its efficacy is even more crucial, and researchers continue to study whether epi-on is as effective as the standard protocol. Dr. Eiden thinks that might be a tall order. “The volume of evidence-based data supporting the efficacy of epi-off CXL exceeds that for epi-on CXL; however, over the years greater support

for epi-on CXL efficacy has come to light,” Dr. Eiden says.

“Despite clinical debates regarding long-term efficacies of epithelium-on protocols, this area will continue to fascinate physicians within the United States,” says Dr. Chang. “Recent research effort to refine transepithelial protocols will result in better treatment standardization and reduce questions about its long-term efficacy.”

### STAYING CURRENT

Other investigations are underway to explore the use of iontophoresis to help address some of the shortcomings of the epi-on protocol. This technique uses a low-voltage electrical current to increase the penetration of riboflavin deeper into the corneal layers during epi-on CXL. The iontophoresis method (I-CXL) of riboflavin loading typically takes only five minutes—far better than the 30 minutes necessary for the Dresden protocol.<sup>1</sup> A study investigating human corneas following I-CXL and conventional CXL methods suggested that I-CXL induced less tissue damage and provided better stromal remodeling compared with conventional CXL treatment.<sup>1</sup>

Iontophoresis may provide other advantages as well. Studies show a significant improvement in contrast sensitivity in patients

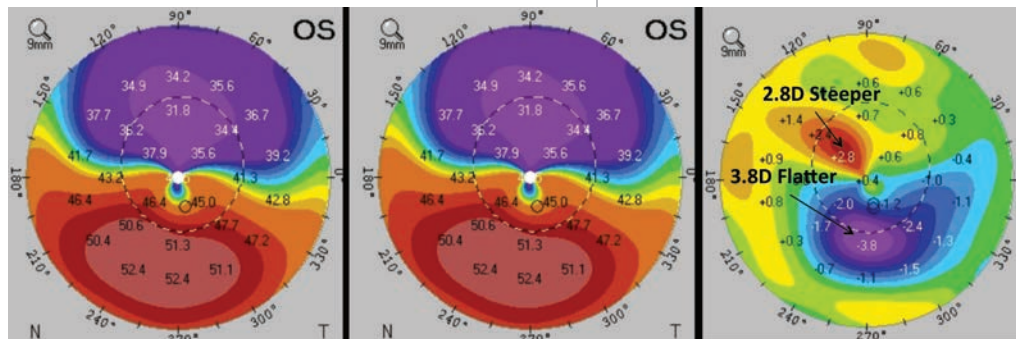
who underwent I-CXL compared with those who had conventional CXL.<sup>17,18</sup> This may be due to the epithelial debridement and wound healing in standard CXL, according to the researchers. Also, early investigations suggest a reduction in postoperative pain and incidence of infective keratitis due to its transepithelial nature. However, long-term follow-ups are needed to establish its efficacy.<sup>19</sup>

### REAPING REFRACTIVE BENEFITS

“Once the efficacy question has been answered, then how do we maximize the refractive benefit from crosslinking?” Dr. Chang asks. While most keratoconus patients will continue to require contact lenses, these new CXL protocols may help to improve their vision when they aren’t wearing corrective lenses.

According to Dr. Kanellopoulos, refractive crosslinking involves the use of customized, variable-pattern, variable-fluence crosslinking to address refractive error based on topography. “This includes the concept of treating corneal irregularity with a higher refractive correction than standard crosslinking,” he says.

Dr. Kanellopoulos and his team have been working on a new CXL protocol that uses a customized pattern and variable fluences to



This patient underwent epi-on CXL. Comparing the pre-op (left) and post-op (middle) corneal thickness reveals significant changes in corneal parameters in the difference map (right).

Images: William Trattler, MD, International Keratoconus Academy





Photos: Avedo, International Keratoconus Academy



**Epi-on/accelerated/oxygen-enhanced CXL remains investigational, but it might be common in the future.**

investigate PiXL's ability to improve vision without compromising corneal biomechanical integrity.<sup>20</sup> Researchers are also testing the efficacy of oxygen goggle use during the epi-on procedure to help boost the oxygen supply and, thus, treatment efficacy.<sup>21</sup>

deliver different energy cross-linking to enhance crosslinking's refractive effect—known as the Athens protocol. According to Dr. Kanellopoulos, refractive crosslinking has been a buzzword outside the United States since he began his work on it in 2013. The Athens protocol offers the ability not only to halt keratoconus and ectasia evolution but also to have a more significant refractive rehabilitation for these patients.

This protocol combines cross-linking and a partial topography-guided photorefractive keratectomy (PRK), using 6mW for 15 minutes with the treatment and soak. The combined treatment lasts for about 22 minutes in total instead of more than an hour. Those following the protocol now use saline-diluted riboflavin instead of dextran-diluted riboflavin, which causes less corneal dehydration and less epithelial damage, according to Dr. Kanellopoulos.

"This treatment has been in use for the last decade now and has been in use by many clinicians globally, even if it is not labeled as Athens protocol," Dr. Kanellopoulos says. "The combination of the partial customized ablation with higher fluence CXL appears to not only stabilize ectasia but dramatically improve visual rehabilitation in these patients.

Thus, combining it with refractive crosslinking can offer an even more enhanced effect with less tissue removal."

Another refractive crosslinking method, photorefractive intrastromal corneal collagen crosslinking (PiXL), applies high-energy UV light to specific areas of the cornea to modify refractive error. PiXL uses riboflavin of a significantly higher concentration than what is used in the Dresden protocol. In addition to its application as a method to address normal refractive errors, PiXL potentially can provide specific improvement in cases of irregular topography such as with keratoconus, according to Dr. Eiden. Customizing the energy application to specific areas of the cornea can reduce irregularity and improve visual performance, he said.

"If shown to be safe and effective, PiXL for the treatment of irregular corneas could be an exciting addition to our armamentarium," Dr. Eiden says. "Without a doubt, any of our patients who have already suffered significant disease and corneal irregularity would welcome the opportunity to have their severity of disease reduced by a safe and effective treatment method."

Clinical trials are currently underway in the United States to

### LINGERING QUESTIONS

One major drawback of the current CXL procedure isn't directly involved with the protocol; rather, it is the lack of a standardized analysis of corneal biomechanics following the procedure. As it stands, only limited studies exist on the ultra-structural alterations of the crosslinked cornea, with a majority of studies focusing on the biomechanical properties following conventional CXL treatment.<sup>1</sup> A detailed investigation into the fine morphological changes that occur following CXL is needed to further understand and evaluate the long-term effects of CXL.

Accurate corneal biomechanical measurements in the clinical environment remains a challenge today, as most practitioners make treatment decisions based on topographic and tomographic data.<sup>22</sup> Corneal tomographers only provide morphologic information on curvature and elevation that can be used to assess disease severity and localization. Currently, no widely available clinical diagnostic tool can locate the region of biomechanical weakness in an individual patient. Therefore, abnormalities in the anterior corneal curvature and posterior corneal elevation observed on corneal tomography are used as a proxy to define the cone area.<sup>12</sup>



## NAVIGATING THE CROSSLINKING POSSIBILITIES

“We do not have a measurement of the actual corneal stability in relation to its effect on that individual eye,” Dr. Kanellopoulos points out. “So, we do not know the threshold we should respect and pursue with crosslinking, and then we get different amounts of stabilization with the procedure.” Some eyes have a significant flattening effect due to the crosslinking, while others unfortunately continue on to ectasia, Dr. Kanellopoulos says.

Dr. Kanellopoulos thinks better biomechanical measurements are key elements to first assess which eyes are at risk and how much crosslinking—and what type of CXL procedure—can provide biomechanical stability. “This value would be not only helpful for ectasia cases but for all refractive surgery cases that are based on a corneal procedure,” he says. Dr. Kanellopoulos believes the measurements could “weed out” patients who would be in danger of having ectasia or flag the post-LASIK or post-PRK cases that are in danger of ectasia, thus offering practitioners an ideal crosslinking stabilization option.

While tomography and topography are helpful, any potential biochemical measures will act as an adjunct in the near future, Dr. Chang says. Optometrists won’t stop relying on tomography; instead, future diagnostic tools will provide additional clinical metrics to help measure the need for crosslinking more accurately.

“In the foreseeable future, corneal biomechanical data will not completely replace the need for tomography, but it certainly would be something that can enhance the accuracy of our diagnoses and corneal monitoring,” Dr. Chang says. A better understanding of corneal cell biology prior to surgery could

produce optimized laser ablation profiles and less inflammation, especially in crosslinked corneas, making an already safe and successful procedure produce better outcomes.<sup>23</sup>

Practitioners are also curious about the long-term effects of crosslinking on both the cornea and the disease progression—both of which are key for predicting patient outcomes. “Long-term data of progression of 15 to 20 years could allow for better prediction and anticipation of possible patients who may need to be re-treated or consider alternative treatment,” says Dr. Koetting.

As the discourse continues, many practitioners in the United States will continue to debate whether new crosslinking protocols can effectively handle the common complications of the Dresden protocol and usurp it as the gold standard. Although many short- and long-term studies have evaluated the effectiveness of these various crosslinking treatments, they provide contradictory results.<sup>1</sup> While optometrists have yet to reach a consensus, many continue to follow the ongoing trends outside of the FDA-approved bubble, eagerly awaiting the next development abroad that may provide the best impact on keratoconus progression management. **RCCL**

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# When All Else Fails

Time and topical medications fell short of providing relief for this pyogenic granuloma patient, leaving only one option: surgery.

**A** 46-year-old Hispanic male presented to the clinic with concerns of red bumps on the white part of his right eye that have been growing rapidly since he first noticed them about four weeks ago. He reported that they are generally not painful but are sensitive to the touch, creating an uncomfortable sensation.

## OCULAR HISTORY

The patient had a pterygium removed on the same eye approximately two months prior. When he returned to his surgeon's office upon noticing the bumps, he was told he had cysts that were normal and he was healing well. As the lesions continued to grow, however, the patient sought a second opinion.

The patient was using prednisolone acetate once daily in the right eye as part of his pterygium recovery and had been using timolol maleate 0.5% once daily since roughly a week after his pterygium removal.

## PRELIMINARY TESTING

Entrance testing showed uncorrected visual acuities (VAs) to be 20/50 OD and 20/25 OS, with a pinhole VA of 20/25 OD. The patient's pupillary responses, confrontation fields and extraocular muscle ranges were normal OU. His intraocular pressures were 13mm Hg OD and 12mm Hg OS.

The slit lamp exam of the left eye showed normal structures. The right eye was normal with the exception of the conjunctiva and the cornea. The conjunctiva had two large,

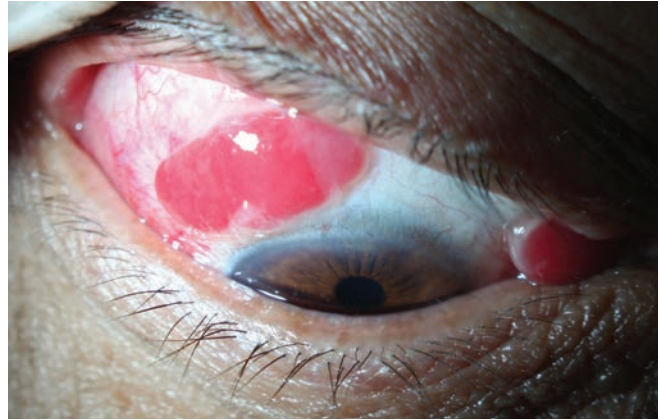
velvety, fleshy masses, one of the nasal bulbar conjunctiva and one of the superior bulbar conjunctiva under the upper lid. These bumps were smooth and highly vascular. Though they both had a placoid,

low-lying appearance, they were attached to the underlying eye wall by a much narrower appendage.

Each of these zones was surrounded by an immediate area of injected conjunctiva, though this was much more intense with the superior lesion and extended well down into the temporal interpalpebral area. Mucus was collecting around the growths but did not appear to be excessive. Other zones of the conjunctiva were white and quiet. The patient's corneal abnormality was limited to nasal fibrosis characteristic of eyes that have undergone pterygium removal.

## THE PROBLEM

The differential diagnoses in this case are relatively small. Vascular tumors of the conjunctiva include Kaposi's sarcoma, papillomatous growths, ocular surface squamous neoplasm (OSSN) and pyogenic granuloma (PG). We can rule out Kaposi's sarcoma because the patient has no known history of immune suppression, a feature



These large, fleshy growths of the superior and nasal bulbar conjunctiva are consistent with PG.

that is closely linked to the growth. His lesion had a smooth, nodular appearance, which, although not definitively uncharacteristic of papillomatous growths or OSSNs, is much more consistent with a PG. Further, while PGs may develop spontaneously, they are often linked to antecedent insult to the conjunctiva. These insults may be incidental traumas but usually follow a surgical disruption of the conjunctiva, which our patient had with his recent pterygium removal.

Modern pterygium surgeries involve taking a conjunctival graft from the superior bulbar conjunctiva and placing it in the bed of the excised pterygium with the help of fibrin adhesive or sutures. This is done to reduce the rate of scleral melt, which occasionally occurs with bare scleral beds, but, more importantly, to reduce the rate of recurrence of the pterygium. The process creates two beds of surgically traumatized conjunctival tissues, the site of the graft harvest (superiorly) and the site of the pterygium



removal (nasally). These zones, not coincidentally, correlated with the locations of our patient's PGs. The surrounding injection was likely due to mechanical irritation of the lid blinking over the lesion and the mucus, a byproduct of that mechanical irritation combined with the disruption of tear flow across the conjunctiva.

### SOLUTIONS

Despite the name, PGs are neither pyogenic (related to infections) nor typically true granulomatous lesions. They are actually made up of immature capillary growths and connective tissues along with variable immune cells.<sup>1</sup> These lesions usually develop as a result of some external insult but may occur *de novo*. Their color and texture are usually consistent with what you would expect of the palpebral conjunctiva. Their size and shape vary, but they are generally smooth and should be on the differential for any patient with an exuberant, red velvety conjunctival mass. As was the case with our patient, the base of these lesions may develop into a colleret.<sup>1</sup>

PGs may occasionally spontaneously involute. When involution does not take place, there are a few less-invasive treatment options available. Corticosteroids are the traditional topical option for PGs, and in a study of post-strabismus surgery patients, 90% of all lesions responded to this modality.<sup>2</sup> A newer treatment option for smaller PGs is ophthalmic timolol maleate 0.5%, which, as a beta blocker, stifles angiogenesis, causes vasoconstriction and leads to apoptosis of the vessel.<sup>3</sup>

Studies generally show good efficacy with BID dosing over three to six weeks.<sup>4</sup> Additionally, timolol is a reasonable, noninvasive treatment for other vascular growths of the conjunctiva, such as hemangiomas.<sup>3</sup> For lesions that do not respond to less-invasive means, removal of the lesion with cautery of the base is standard. Recurrence of the lesion is linked to how quickly the resultant conjunctival defect closes, with those that close more slowly recurring more often.<sup>1</sup>

In our patient's case, he had already failed on corticosteroid therapy and with timolol, given that he was using both while his growths were developing. Since conservative therapy did not prevent the growths or induce regression, we decided to take the surgical course. Due to the patient's recent pterygium surgery, we felt the local surrounding conjunctiva would be fibrosed and our surgeon would be unable to stretch it over any resultant conjunctival defect. Therefore, we had an amniotic membrane sheet on-hand at the time of surgery to help close any open conjunctival defects. The patient was scheduled for surgery and asked to increase his prednisolone from one to four times per day until his surgery two weeks later.

### AFTERMATH

Interestingly, when he presented for surgery, the patient reported the nasal lesion had "fallen out of his eye" earlier in the week. This was accompanied by some bleeding, which had alarmed the patient. It stopped after 20 minutes, so he did not seek help. On exam, the luxation of the lesion appeared to have left a small

zone of conjunctival fibrosis and a subconjunctival hemorrhage but little else. This was probably due to a tourniquet effect of the growth's underlying collarette combined with the constant mechanical pressure applied to it by the lid/blink reflex. We offered to observe the superior lesion, which was still present, in hopes of a similar non-surgical resolution, but the patient wished to proceed with surgery. The growth was removed, and the lesion bled significantly, but this was expected based on its vascular makeup. An amniotic membrane was used to close the conjunctival defect, and the patient healed uneventfully.

**A**ny red, velvety, recently developed conjunctival mass should make a clinician think of PGs. Though these are not the only rapidly growing vascular conjunctival lesions, in my experience they are generally the most common and become markedly more common in circumstances where the conjunctiva has been disrupted. Fortunately, they are benign, and, though they may be alarming to the clinician initially, they often have a good prognosis and respond well to conservative therapy. In cases in which time and topical medications fail to provide relief, surgical removal is usually effective, as in this case. **RCCL**

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# Fitting Outliers: A Guessing Game

A case of megalocornea shows the need for flexibility to adapt to unique circumstances.

Over time, clinicians have realized that corneal diameter, not corneal curvature, is the most influential factor of a patient's sagittal depth.<sup>1</sup> The average horizontal visible iris diameter (HVID) is 11.6mm to 12.0mm, but only 50% of patients fall within this range.<sup>2</sup> This means that the other half of the patient population is wearing contact lenses that do not fit well and are either too large or too small for a patient's eye.

This is where custom soft contact lenses can save the day by providing smaller or larger diameter fits depending on patient needs. These lenses can be a challenge to fit, and clinicians often have to start by making an educated guess about initial lens parameters. But practice makes perfect, and, with each custom lens you fit, you will be able to more accurately gauge what your patient needs. The following case discusses a patient who, despite having megalocornea—a condition in which the corneal diameter is larger than average—is motivated to try contact lenses.

## THE CASE

A 42-year-old male presented with a history of advanced congenital glaucoma. He recently had a Descemet's stripping endothelial keratoplasty (DSEK) in his right eye due to a failing endothelium. In

an attempt to improve his peripheral vision, he was interested in trying contact lenses. When he was a young adult, he wore rigid gas permeable lenses (RGPs) but stopped due to discomfort issues and his inability to adapt to the lenses.

He was using Alphagan P (brimonidine tartrate, Allergan) OU BID as well as Systane eye drops (polyethylene glycol and propylene glycol, Alcon) as needed. He was not taking any oral medications. His health history was unremarkable.

He wore glasses with a prescription of -2.75+1.75x133 OD and -2.50+1.50x030 OS. His presenting visual acuities (VAs) were 20/25 OD and 20/40 OS.

A slit lamp exam revealed clear lids, lashes and conjunctiva and deep and quiet anterior chambers

OU. The right cornea revealed a DSEK, but it was otherwise clear. The left cornea was also clear. The iris was normal, and the lenses exhibited trace nuclear sclerosis OU. An undilated posterior segment evaluation revealed a cup-to-disc ratio of 0.9 OU, with everything else falling within normal limits. The patient's intraocular pressures were 19mm Hg OD and 20mm Hg OS. Topographical imaging showed simulated keratometry (K) readings of 41.81/40.03@125 OD and 41.83/40.24@035 OS and large HVIDs of 14.4mm OD and 14.8mm OS (Figure 1).

## CONTACT LENS EVALUATION

Manifest refraction revealed:

- 2.75+1.75x125 (VA of 20/25) OD
- -3.25+1.75x045 (VA of 20/30-) OS

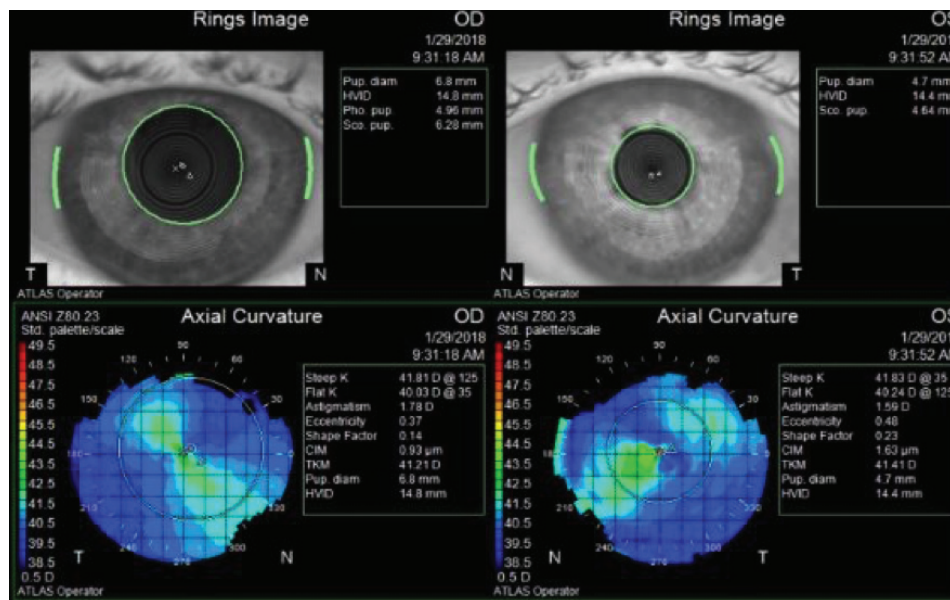


Fig. 1. Imaging reveals this patient's HVIDs fall outside the normal range, at 14.4mm OD and 14.8mm OS, suggesting the need for custom contact lenses.



After I discussed contact lens options with the patient, he was interested in pursuing soft lenses due to his previous experience with RGPs. As an avid mountain biker, he was looking for a lens with better stability.

By adding 3.0mm to the HVID to calculate the lens diameter (i.e., a 12.0mm HVID requires a 15.0mm lens), the patient would need a 17.4mm lens OD and a 17.8mm lens OS. Adding 1.5mm to each side of the lens helps ensure lens stability.<sup>1</sup>

The soft lenses customized by our labs max out at 16.0mm. Kontour makes lenses with large diameters but doesn't produce toric lenses larger than 16.0mm. After discussing options with colleagues, I found I could order toric lenses with large diameters from Visionary Optics.

To design the lenses, I made an educated guess for the base curve (BC), adjusting it due to the increase in arc length associated with the diameter change. For a normal-sized cornea of 11.8mm, a keratometry reading of 40.00/42.00 would require a BC of 8.8. Increasing the arc length would require a steeper lens to compensate for the change in sagittal depth and keep the same cornea fitting relationship. I also rounded up on the diameter to improve the stability of the toric lens.

I chose a steeper BC on the left eye due to its slightly larger corneal diameter. I ordered Methafilcon A soft XP toric lenses with the following parameters:

- 8.4/-1.00-1.75x035/17.5 OD
- 8.1/-1.50-1.75x135/18.0 OS

### CONTACT LENS DISPENSING

A week later, I placed the lenses on the patient's eyes. The right lens covered the cornea, but the scleral coverage was short, and the lens fluted significantly. The left lens also exhibited excessive fluting, although not as severe, but the centration and scleral coverage were both adequate. The left lens was placed on the right eye to assess the fit of a larger diameter and a steeper BC. The lens was centered, had good scleral coverage and showed less severe fluting. An over-refraction was unobtainable because the lenses did not lie flat on the cornea.

I steepened both lenses and ordered a larger right lens in a second set with the following parameters:

- 7.9/-1.00-1.75 x035/18.0 OD
- 7.9/-1.50-1.75 x135/18.0 OS

### REDO CONTACT LENS DISPENSING

The second set of lenses was placed on the patient a week later. Both lenses had good centration, coverage and movement with no fluting OU. The patient's vision was 20/25 OD and 20/30+ OS. His over-refraction was plano OU.

The patient was trained on insertion and removal techniques before he was sent home to try the lenses.

### FOLLOW-UP

The patient presented a week later reporting good comfort and vision with his new lenses, so his prescription was finalized.

### DISCUSSION

When designing custom soft lenses, clinicians should calculate the lens diameters using the HVID

+ 3.0mm formula and add more wiggle room for toric designs to ensure better stabilization. At minimum, clinicians should plan for a 1.5mm overlap on either side of the cornea, with 0.5mm to 1.0mm of movement on primary gaze. The majority of patients with larger corneal diameters require lenses that are large, steep and deep; whereas, most patients with smaller corneas require small, flat and shallow lenses. In this case, because the patient's HVIDs were above average, an educated guess with diagnostic lenses was the only way to find the appropriate fitting relationship between the lens and the patient's cornea.

Also remember to adjust the BC of the lens to steepen larger lenses and flatten smaller lenses. Many topographers can help calculate the sagittal depth of the lens and assist labs in calculating the BC.

Knowing how to properly fit corneas that fall outside of the average HVID of 11.6mm to 12.0mm can add value to your practice and promote patient loyalty. Patients who are not successful with traditional soft lenses and do not have a significant ocular surface disease don't have to walk away from contact lens wear. They will likely benefit from a custom fit, especially if they have a high astigmatism, an oblique axis astigmatism or a desire for more precise multifocal optics. **RCCL**

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# Five Ways to Optimize the Contact Lens Experience

Follow these for more successful visual outcomes and increased patient satisfaction.

**W**ithin the contact lens world, we often focus on the downsides of lenses: the complications and the shortcomings they're associated with. It's time to change that. In this article, we provide the opposite perspective. Although contact lenses are a medical device and, as with any such item, carry a certain level of risk, they are relatively safe when worn appropriately.

Contact lenses offer tremendous opportunities for patients and practitioners. Many patients may not even be aware that they are contact lens candidates. For those who are currently contact lens wearers, there are certainly ways to optimize their chances of success.

Here, we discuss five key factors that are critical to take advantage of when enhancing your patients' contact lens experiences.

## 1. IDENTIFY QUALIFIED CANDIDATES

There are about 41 million contact lens wearers in the United States alone.<sup>1</sup> Although this patient base deserves our continued attention, the more we focus on this demographic, the less we see others who may be in need of our services but don't know it.

Patients who discontinued their lens usage stand to benefit from re-education efforts about newer, more contemporary lens designs and options. Often, patients

who used to wear contacts are interested in wearing them again but have a preconceived notion of what their wearing experience will be like based on their previous wearing experience. Unfortunately, these patients are usually unaware of the continuous advances in contact lens options and technologies that could make their wearing experience more enjoyable and successful. Asking patients who have worn contacts in the past if they are interested in wearing them again is simply not enough. We need to have a proper understanding of the reasons they discontinued lens wear and offer them appropriate education on the technologies that now exist to help overcome previous unmet needs.

One of the biggest reasons patients discontinue lens wear is because of comfort issues.<sup>2</sup> Although altering lens materials and surface properties attempts to counteract this, it is important to examine the ocular surface to identify those with dry eye—the largest cause of discomfort—who may benefit from treatment that would allow more comfortable lens wear down the line.<sup>3</sup>

Another missed opportunity lies with children, who are usually not offered contact lenses as a vision correction option until they are teenagers. We have found that intervening sooner rather than later, appropriately educating patients and parents and ensuring children are responsible and motivated are critical components of initiating

successful lens wear in these young patients. These strategies have given us the chance to achieve a high level of fitting success in children with contact lenses. During an era in which the eye care community is embracing myopia management, the sooner children with progressive myopia are managed with contact lenses, the greater the opportunity to reduce myopia progression over time.

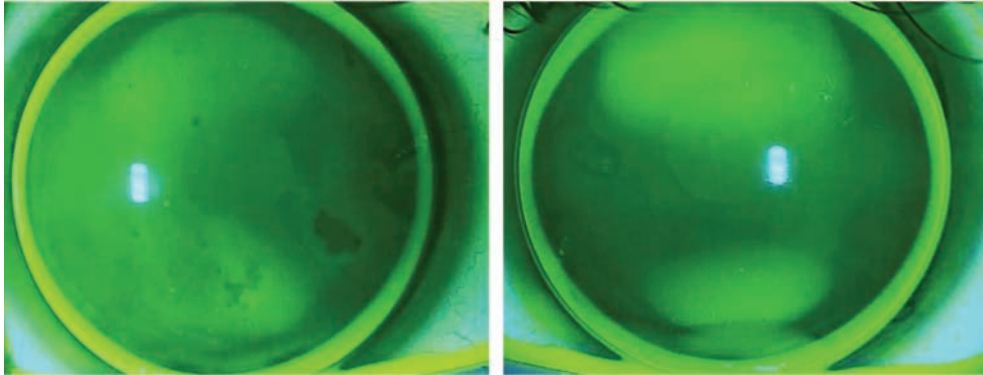
There is one demographic where 100% of the patients require refractive correction, yet the smallest number actually wears—let alone knows they are candidates for—contact lenses: presbyopes. Make sure to raise awareness about and educate them on their options and provide the advantages and disadvantages of each lens route to find the one best suited for each individual patient. Presbyopic patients have several options to choose from, including multifocal lenses, specialty toric multifocal lenses, part-time contact lens wear, distance-only prescriptions and even orthokeratology.

## 2. DISCUSS ALL OPTIONS

When correcting a patient's refractive error, we must consider how responsible and motivated they are to care for their eyes and lenses, their financial restrictions, what designs their prescription is available in and best suited for and how frequently and for what they plan to wear their lenses.

For patients who do not require specialty lenses, daily disposable





**This patient has approximately 3.00D of corneal and refractive with-the-rule astigmatism and wears multifocal gas permeable lenses.**

have contact lenses sent directly to their homes. During months of extreme temperatures and weather, however, patients may not want to risk having their lenses left outside of their homes. In these instances, it may be more advantageous to send the contact lenses to the patient's place of work.

lenses are usually the lenses of choice. They provide the daily benefit of a clean, new lens of advanced material that enhances comfort. In recent years, daily disposable lens manufacturers have been providing options that offer most patients the refractive correction they require, including spherical, toric and multifocal contact lenses.

For patients who do require specialty lenses, small-diameter gas permeable lenses are available with central distance optics that progress to near optics in the periphery of the lens. Scleral lenses are also available in multifocal lens designs.

### 3. ORDER A YEAR'S SUPPLY

Patients are always looking for cost-effective and convenient ways to purchase their lenses. The way to do this is by ordering a year's supply. This provides patients with lenses until their next eye exam and comes with rebates that are only available for those purchasing a long-term supply.

There is always the question of what happens if a patient orders a year's supply of lenses but experiences a change in their prescription before they use up their supply. Our office, similarly to others, gives patients the opportunity to exchange any unused contact lenses with lenses that reflect their updated prescription.

### 4. ORDER CONVENIENT SHIPPING OPTIONS

There are several ways to deliver contact lenses free of charge to the patient. The most convenient is to have them available immediately after your patient's appointment so that they're able to leave with and begin wearing them immediately. Unfortunately, space constraints may limit the amount of contact lenses you can stock in your office. This means you need to be selective about the lenses you stock (if you stock any at all) and only carry the lenses you frequently prescribe.

It is of tremendous benefit, value and convenience to patients to

### 5. CONSIDER THE OVERALL EXPERIENCE

Patients are becoming increasingly more cognizant of advances in technology in all areas of their lives, including in the contact lens sector. As clinicians, we need to make sure we are providing all candidates—new, old and every-one in between—the option of contact lenses, educating them appropriately and doing our job to make theirs easier. In doing so, you will be able to fill an unmet need, provide for underserved populations and offer the best possible contact lens services to your patients, optimizing their experience with your practice and their lenses accordingly. <sup>RCCL</sup>

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# Ring Around the Cornea

Peripheral edema occurring many years post-op, signifying Brown-McLean syndrome, may be initially alarming, but it's nothing to worry about.

**A** 29-year-old bilateral aphake was referred to the University of Iowa for concerns of corneal edema and decompensation. He had pediatric cataracts removed when he was two months old and has a 29-year history of gas permeable contact lens wear.

On presentation, he showed 360 degrees of microcystic edema with a central clear cornea. He denied changes in vision or discomfort.

He suffers from Brown-McLean syndrome, which is visually astonishing but quite clinically benign. This condition usually presents as peripheral corneal edema in patients with long-term aphakia after intracapsular cataract extraction.<sup>1</sup>

Intracapsular cataract surgery, an older technique in which both the lens and capsule are removed, is rarely used today. While once the standard of care, today this type of cataract surgery is reserved for cases where the lens has dislocated secondary to injury or disease. Brown-McLean syndrome may also present after extracapsular cataract extraction and phacoemulsification or pars plana lensectomy and vitrectomy.<sup>1</sup> Rarely, it occurs in eyes that have not had surgery.<sup>1</sup>

The corneal edema starts after a latent period of several years and is seen in the peripheral 2mm to 3mm of the cornea, starting inferiorly and extending circumferentially in severe cases. Guttae are present on the endothelium and may have

punctate brownish pigment. No neovascularization will be present, and the limbus and conjunctiva are unaffected. The central cornea also remains unaffected, and specular or confocal microscopy will show normal endothelial counts and cell morphology.<sup>2</sup>

Most patients are asymptomatic, but some may complain of foreign body sensation or even pain from ruptured bullae. Patients are managed with normal contact lens wear or glasses and symptomatic relief of bullae, as necessary, with hyperosmotic agents. [rcccl](#)

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**References:** **1.** Eiden SB, Davis R, Bergenske P. Prospective study of lotrafilcon B lenses comparing 2 versus 4 weeks of wear for objective and subjective measures of health, comfort, and vision. *Eye Contact Lens.* 2013;39(4):290-294. **2.** Lemp J, Kern J. A comparison of real time and recall comfort assessments. *Optom Vis Sci.* 2016;93:Eabstract 165256. **3.** Merchea M, Mathew J, Mack C. Assessing Satisfaction with Lotrafilcon B Packaged with an EOBO Wetting Agent Combined with EOBO-Based Lens Care Solutions. Poster presented at the Annual Meeting of the American Academy of Optometry, October 11-14, 2017, Chicago, IL. **4.** Nash W, Gabriel M, Mowrey-McKee M. A comparison of various silicone hydrogel lenses; lipid and protein deposition as a result of daily wear. *Optom Vis Sci.* 2010;87:Eabstract 105110. **5.** Nash WL, Gabriel MM. Ex vivo analysis of cholesterol deposition for commercially available silicone hydrogel contact lenses using a fluorometric enzymatic assay. *Eye Contact Lens.* 2014;40(5):277-282. **6.** In vitro study over 16 hours to measure wetting substantivity, Alcon data on file, 2015. **7.** Muya L, Lemp J, Kern JR, Sentell KB, Lane J, Perry SS. Impact of packaging saline wetting agents on wetting substantivity and lubricity. *Invest Ophthalmol Vis Sci* 2016;57:Eabstract 1463.

**Important information for AIR OPTIX<sup>®</sup> plus HydraGlyde<sup>®</sup> (lotrafilcon B):** For daily wear or extended wear up to 6 nights for near/far-sightedness, presbyopia and/or astigmatism. Risk of serious eye problems (i.e. corneal ulcer) is greater for extended wear. In rare cases, loss of vision may result. Side effects like discomfort, mild burning or stinging may occur.



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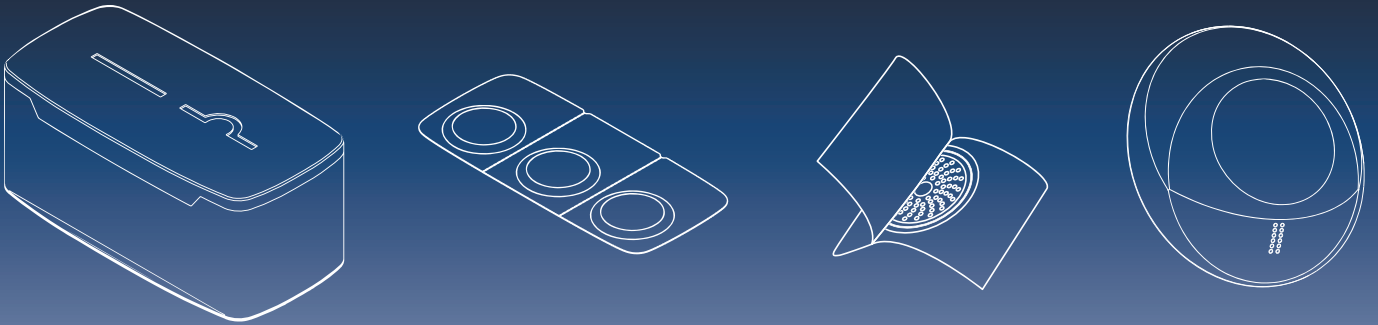
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