KIDS & CONTACTS:

A Lesson Plan

• Prepare for the Coming Myopia Epidemic, p.12
• Control Myopia with Multifocals, p.16
• Embrace Ortho-K — for Both Myopes and Astigmats, pp. 22, 26
• Engage With Adolescent Patients, p.30
• Tackle Even the Toughest Cases, pp.8, 34
The first contact lens specifically designed for your patients’ digital life and everyday living._

9 out of 10
digital device users* agreed that Biofinity Energys™ contact lenses made their eyes feel good1.

8 out of 10
digital device users* agreed that Biofinity Energys™ contact lenses made their eyes feel less tired1.

Biofinity Energys™ contact lenses help with eye tiredness and dryness commonly associated with digital device use. Considering 90 percent of U.S. adults use digital devices more than two hours per day2, the opportunity to upgrade your patients is significant. Biofinity Energys™ contact lenses feature a revolutionary Digital Zone Optics™ lens design and Aquaform® Technology.

Energize your practice—prescribe the patent-pending contact lens innovation made for today’s digital lifestyle.

Visit coopervision.com, or talk to your CooperVision® representative for details.

Biofinity Energys™
Welcome to the new comfort zone_
Myopia on the Move
Steady growth in the prevalence of this deceptively simple condition will expose half the world’s population to visual impairment. Here’s what to expect and what we should do.
By Monica Jong, PhD, BOptom, Padmaja Sankaridurg, PhD, BOptom, Timothy R. Fricke, BOptom, MSc, Thomas John Naduvilath, PhD, Serge Resnikoff, MD, PhD, and Kovin Naidoo, OD, PhD

CE — Fitting Multifocal Contact Lenses for Myopia Control
These practice pearls aid in myopia management, including avoiding onset and slowing progression in patients of all ages.
By Padmaja Sankaridurg, PhD, BOptom

10 Tips From an Orthokeratology Expert
Don’t let misconceptions stop you from using this treatment modality that can provide a huge benefit to patients with myopia.
By Cary M. Herzberg, OD

Reshaping Ortho-K
Toric Lenses can expand myopia management to include patients with astigmatism.
By Daddi Fadel, DOptom

Keys to a Pediatric Soft Lens Fitting
From infancy to adolescence, contact lenses prove a viable and beneficial treatment option for a range of conditions.
By Erin C. Jenewein, OD, MS, and Kriti Bhagat, OD
Evidence Supports Long-term Efficacy of Collagen Crosslinking

Corneal collagen cross-linking (CXL) may be effective in managing keratoconus for longer than two years, according to a recent study in the journal Cornea. A possible reversal of CXL effects after four years was also discovered.

The study followed 377 eyes in pediatric patients ages eight to 18, all of whom had progressive keratoconus and underwent CXL. Of the eyes tracked, 194 had follow-ups more than two years post-treatment, the results of which show a significant improvement in mean spectacle-corrected distance visual acuity (CDVA), a reduction in mean topographic astigmatism, flattening of keratometry (Kmax) and corneal thinning of 31.1 ± 36.0µm.

Despite these promising results, the study also revealed the effects of CXL reversed after four years post-treatment in some eyes. The researchers noted stabilization or flattening of Kmax in 85% of eyes at two years, which dropped to 76% after four years. CDVA improved in 80.1% of eyes at two years, but only in 69.1% at four years. After four years, 24% showed steepening of the cornea and 30.9% showed reduced visual acuity, suggesting possible progression of the disease after four years. Some note that these findings are not statistically significant in the current study, however.

“Confounding factors like thinner corneal pachymetry expected after CXL further make it challenging to diagnose regression at its immediate resurgence,” says Clark Chang, OD, director of the Contact Lens division at the Center for Keratoconus-Cornea and Laser Eye Institute, Teaneck, NJ. “Therefore, it is important to minimize or eliminate extrinsic factors that can exert mechanical strain on the ocular surface, which presumably can destabilize therapeutic effects conferred by CXL.”

Clinicians must remain vigilant in managing ocular comorbidities such as dry eye and atopic or allergic conditions, Dr. Chang says, as well as educate patients about both the risks of long-term regression and the importance of compliance with clinical monitoring to detect the potential need for retreatment. The study also found that 17.1% of eyes in the study presented topographic coupling effects—in which flattening of one meridian is accompanied by steepening of the orthogonal meridian—suggesting a compensatory biomechanical response. “If we can control and maximize such coupling effects, then better visual outcome after CXL may be achieved,” Dr. Chang says. “Thus, it is essential for future investigations to identify patient variables associated with such topographic coupling events, as well as determine clinical characteristics that may better predict the duration of CXL stabilization effects in different patient subgroups.”
2017 MEETINGS

Aspen, CO
February 17-21, 2017
Winter Ophthalmic Conference
(The Former SkiVision)
The Westin Snowmass
Program Chairs: Murray Fingeret, OD
Leo Semes, OD

Charleston, SC
March 24-26, 2017
Charleston Marriott
Program Chair: Paul Karpecki, OD

San Diego, CA
April 20-23, 2017
Joint Meeting: NT&T/OCCRS
San Diego Marriott Del Mar
Program Chair: Paul Karpecki, OD

Orlando, FL
June 8-11, 2017
Disney’s Yacht & Beach Club
Program Chair: Paul Karpecki, OD

Philadelphia, PA
November 3-5, 2017
Loews Philadelphia Hotel
Program Chair: Paul Karpecki, OD

Check Our Website for the Latest Information!

www.reviewofoptometry.com/events
E-mail: reviewmeetings@jobson.com | Call: 866-658-1772

Hands-on Workshops
Up to 18-28 CE Credits

NEW TECHNOLOGIES & TREATMENTS IN EYE CARE
EDUCATIONAL MEETINGS OF CLINICAL EXCELLENCE
Get to Know Your Genes

One day, genetic testing and gene therapy may help patients avoid corneal disease altogether.

Research suggests there are nearly 500 different eye-related diseases, with more than 800 ocular and periocular manifestations of systemic disease. Hundreds of genes, if mutated, can cause disease isolated to the eye. Fortunately, genetic testing can aid health care providers in managing inherited diseases. Specifically, genetic testing is beneficial for (1) a confirmational diagnosis, (2) newborn screening, (3) carrier screening and (4) forensic testing.

Exciting new frontiers are providing measures for pharmacogenomics, whole genome and whole exome sequencing, and even tumor analysis. The latter, for example, looks at genetic alterations that drive tumor growth and the genetics that help predict therapeutic response.

Identification of susceptibility loci has helped researchers better understand the complex pathophysiology of several ocular and neurologic diseases.

**CLINICAL APPLICATIONS**

Many recent findings in eye care are a result of genetic testing, and some are applicable to therapy today:
- Though controversial, research suggests there may be a different response to the AREDS formula based on specific genotypes, and testing for the genotype for which zinc supplementation may be pro-inflammatory in patients with macular degeneration could impact therapy.
- For the cornea, genetic testing is now available to identify Avellino’s corneal dystrophy.
  - The Asper Biotech test screens for 333 mutations in 13 genes for corneal dystrophy.
- Researchers have been investigating gene therapy to improve the quality of donor tissue for corneal grafts, which might decrease the risk of graft failure and rejection.

**THERAPY ADVANCES**

The key is to target therapy with testing prior to gene expression. Gene augmentation—treatment for deficient genes—is easier than gene knock-out therapy (blocking a gene causing a detrimental effect). For example, gene augmentation therapy is now possible for Leber’s congenital amaurosis when a RPE65 deficiency is found.

Using nanoparticles as vectors for delivering DNA is an exciting advancement. For example, researchers recently used lentiviral-mediated genetic modification of cultured endothelial cells to deliver genes to the endothelium. Creating new viral vectors with directed evolution is the key to timely adoption. Researchers can now create viruses in the lab to maximize their diversity and can promote the evolution of viruses, through an artificial selection process, that have the traits researchers need.

**KEEP PATIENTS INFORMED**

As helpful as genetic testing can be, it can raise both social and ethical issues, and clinicians must be careful to discuss the value and limitations of genetic testing with patients. When ordering tests, it is the clinician’s duty to educate patients on the likelihood that they have a particular disease, the spectrum of disease possibilities (from mild to severe), recurrence rates, chance of passing the condition to offspring, possible treatments and reproductive alternatives.

The ramifications of knowing that you have the genes for a particular disease without a current treatment can be traumatic. Fortunately, patients are protected by the Genetic Nondiscrimination Act, which does not allow health care insurers or employers to discriminate based on genetic predisposition or pre-existing conditions.

The last two decades have seen an explosion of research in genomics, with rapidly expanding genetic medicine. Gene therapy specific to the cornea and anterior segment is a particularly exciting frontier, considering corneal disease is responsible for a significant amount of blindness worldwide. Ocular gene testing and therapy research is robust with a high priority in funding and should prove fruitful in the very near future.

---

Combating Online Contact Lens Sales

We must stand together to protect healthy vision and responsible enterprise.

Optometrists are fielding attacks from all sides—not simply on our profession, but actions that could ultimately fracture the doctor-patient relationship and potentially put our patients’ health at risk. Online contact lens retailers are primary and long-time aggressors who use deceptive practices, underhanded loopholes and, sometimes, blatantly illegal tactics to line their pockets and build their bottom lines.

Like other physicians, eye doctors take an oath and hold ourselves to the highest standards to protect our patients’ health. The oath guides the way we practice and compels us to advise patients of all their options to restore, maintain or enhance vision, as well as eye and overall health. We do this within a competitive marketplace bound by laws and regulations, which are constantly evolving as care advances.

**LEGISLATIVE LANDSCAPE**

Unfortunately, the full picture of the 2016 contact lens legislative and regulatory landscape made it clear online contact lens retailers are using misinformation and subterfuge to divert attention away from their unscrupulous business practices and gain advantage in the marketplace.

The American Optometric Association (AOA), doctors of optometry and the patients we serve are gaining ground in the fight against these abusive and illegal practices. We’ve exposed deceptive tactics—such as 1-800-Contacts’ improper use of pre-checked order forms to obtain copies of customer contact lens prescriptions. This is further evidenced by the Federal government’s suit against 1-800-Contacts for alleged activities that “had the purpose, capacity, tendency and likely effect of restraining competition unreasonably and injuring consumers.”

But along with wins, there are sometimes setbacks, and the Federal Trade Commission’s (FTC) recent proposed rule is just that.

The AOA vigorously objects to the FTC’s misguided proposal, which adds new prescription requirements to the Contact Lens Rule. The proposal makes clear that the agency is hearing from those who question whether doctors of optometry are following the law and does not take the illegal practices of some retailers into account.

With the active involvement of our member doctors, state optometric associations, concerned physicians, as well as public health and consumer protection organizations, we are making the case for changes that will not stop until our concerns are clearly understood by agency officials. This will not be a quick or easy process, but one the AOA will see through to the end.

**A UNITED FRONT**

We need the involvement and activism of all of our colleagues to get this proposal changed. The FTC asked for public comments and is now considering the issue further.

Moreover, we need to hold internet sellers accountable, and the AOA and state optometric associations are leading the effort by aggressively building support for the bipartisan Contact Lens Consumer Health Protection Act. The bill calls for bolstering patient safety requirements, increasing accountability for internet contact lens sales and reinforcing the distinction that contact lenses are medical devices and should be treated that way—all of which the FTC should support.

The health and safety of the patients we serve is at the heart of this matter, and the AOA, along with member ODs, our paraoptometric colleagues and optometric students, will continue to fight for patient safety. For every doctor of optometry in America, the surest way to fight back against internet sellers and the harm they cause patients is to support the AOA and your state optometric association.

Our past advocacy efforts show that optometry is stronger when we all work together, and we ask every doctor to join in the fight with the AOA to uphold patient safety against online contact lens retailers and their profit-driven business practices.


**ABOUT THE AUTHOR**

Dr. Thau is president of the American Optometric Association (AOA). She was elected to the AOA Board of Trustees in 2007 and president in July 2016. Dr. Thau also serves as chair of the AOA’s Executive and Agenda Committees and is a member of the Personnel Committee. She serves as liaison trustee for the American Academy of Optometry (AAO) and the College of Optometrists in Vision Development (COVD).
The Right Lens for a Corneal Scar

It’s not easy fitting a five-year-old with a specialty lens to correct irregular astigmatism.

Children younger than seven who need a specialty contact lens fitting can be some of the most challenging patients we encounter. Kids are vulnerable to amblyopia, which makes the stakes even higher. The need for specialty lenses at a young age can occur for a variety of reasons, such as aphakia, high refractive error, anisometropia, iris defects, irregular astigmatism from corneal scarring or keratoconus. Let’s discuss a challenging case in which a child with irregular astigmatism from a corneal scar needed a specialty contact lens.

**CASE REPORT**

A five-year-old female presented for a contact lens evaluation to correct irregular astigmatism from a corneal scar. Her pediatric ophthalmologist referred her for a unilateral contact lens fit over an eye that had a corneal dermoid removed at age three. She was currently managed with glasses and was patched two hours per day with good compliance. Medical history was positive for Goldenhar syndrome and negative for systemic medications. She exhibited no other ocular history and neither did her family. Presenting best-corrected visual acuity (VA) was 20/20 OD, 20/50 OS. Her current spectacle Rx was -0.50+0.50 x168 OS; +3.00+3.75x070.

Pupils were round and reactive to light, with no relative afferent pupillary defect in either eye. Extraocular movements were full OU. A slit lamp exam demonstrated that the lids were clear, the conjunctiva white and quiet, the iris and lenses clear, and the anterior chamber deep and quiet OU. Exam of the corneal surface revealed a clear right cornea and an elevated 2.7mm horizontal inferior temporal scar on her left cornea—no staining or vessels OU. Manifest refraction OD was plano VA 20/20, OS was +4.25+5.50x075 VA 20/30-. Corneal topography revealed a flat cornea with steepening at the corneal scar (Figure 1). Sim K measured 46.17/40.62 OS and 5.62D of astigmatism.

**DIAGNOSTIC FITTING**

Although we started with a scleral lens due to the irregularity of the periphery, insertion was unsuccessful. The patient was very reactive and could not fixate her eyes so that the lens could be inserted without a bubble inside the lens. After several attempts, I decided to try a corneal gas permeable (GP) lens instead. I chose a large diameter intra-limbal GP design (GBL, Concise) as the diagnostic lens. This lens also features a reverse geometry design in the mid periphery, which would allow it to clear the steep elevation in the mid periphery without adding too much clearance over the central cornea. I first tried a 45.00D (7.50) lens based off the average of the steeper curvature readings over the scar. The lens was slightly flat over the cornea, there was 1+ punctate staining over the corneal scar. I decided to piggy-back the GP with a soft lens.

With the lens removed to evaluate the cornea, there was 1+ punctate staining over the corneal scar. Modifying the GP would unlikely achieve better results, as opening the periphery to increase movement and increasing the vault over the scar would likely still result in the lens migrating towards the steep elevation of the scar. I decided to piggy-back the GP with a soft lens.

I used a +3.00 Air Optix Night & Day (Alcon) to create a buffer between GP and eye. I chose a higher plus lens to aid in shifting the steep

**DISPENSING**

The patient presented with her mother with no new complaints and I inserted the lens (Figure 2). The lens exhibited light one-third touch inferotemporally with pooling over the rest of the cornea. The peripheral edge was wide with good overall centration of the lens and movement with blink. VA measured 20/25 with the GP in place OD. The patient’s mother was instructed on care, insertion and removal, and advised to build wearing time, starting at two hours a day with the goal of eight to 10 hours a day.

**FOLLOW-UP #1**

One week later, the patient presented with complaints that the lens hurt after a few hours of wear, and she was unable to wear it more than three hours per day. Some redness, but no discharge, was observed. Presenting VA was 20/25 OD with the contact lens. No over-refraction was measured. Fluorescein was instilled, and I observed that the lens had adhered to the cornea, exhibiting little movement and was centered temporally over the scar. With the lens removed to evaluate the cornea, there was 1+ punctate staining over the corneal scar. Modifying the GP would unlikely achieve better results, as opening the periphery to increase movement and increasing the vault over the scar

First lens: Base curve 7.38, power: +3.25, diameter:11.2, P1:0.4/9, P2:0.4/10.5, P3:0.4/12.
area centrally so the lens would decenter less. On slit lamp exam, the GP moved well over the soft lens. VA was 20/30. Over-refraction of the combined system (-0.50) would be added to the GP if the patient did well. I prescribed Polytrim (polymyxin B/trimethoprim, Allergan) for a few days to prevent infection and advised her to start lens wear after finishing the antibiotic course. Mom was again trained on insertion and removal and instructed to have her daughter wear the lens no more than four hours per day as long as the lens is comfortable.

FOLLOW-UP #2
The patient presented the next week. Though lens tolerance was much improved, she didn’t think she could wear it more than four hours per day, as she needed frequent lubrication with artificial tears. On slit lamp exam and instillation of fluorescein, the lens was again decentering temporally with little movement. When the lens was removed, no staining was observed. Other than the scar, the cornea was clear.

Because any GP would most likely shift towards the elevation, we discussed using a scleral lens again and I performed an in-office evaluation, during which the patient was very cooperative. I used a Europa (Visionary Optics) fitting set and chose a 45.00D/16.0 diameter lens as the first diagnostic lens simply because it was in the middle of the set. Upon insertion, the child noted an immediate improvement in comfort. Slit lamp exam revealed excessive clearance of about 450µm. When I tried a 42D lens, it exhibited about 200µm of central clearance on initial evaluation, which was ideal. The lens landed outside the limbus and centered well. The periphery appeared tight, exhibiting slight conjunctival vessel compression. Given the child’s positive initial reaction, I ordered a 42.50/46.25/16.0 diameter, 1 flat periphery lens to be dispensed the next week. The base curve was slightly steepened to compensate for the change in the sagittal depth with a 1 flat periphery.

SCLERAL LENS DISPENSE
At the second lens dispense a week later, the patient hadn’t been wearing any lenses for the past week.
The scleral lens cleared the central cornea by about 200μm. The fluorescein extended from limbus to limbus and the lens landed on the conjunctiva without impinging on the sclera. VA was 20/25 OS. Mom was trained on insertion, removal and care. The patient was instructed to return the following week.

**FOLLOW-UP #3**

One week later, the patient said she was able to wear the lens for 10 hours a day without any complaint (Figure 3). Uncorrected VA measured 20/20 OD and 20/25 OS. No over-refraction was noted over the left lens. The lens was finalized and the patient was asked to return in six months for a follow-up.

**DISCUSSION**

Several studies show that vision rehabilitation of irregular astigmatism or high refractive error with contact lenses is more effective than spectacles.1-4 GP’s are able to correct irregular astigmatism as well as eliminate the aniseikonia from unequal prescriptions when the irregularity is unilateral.5,6 For children, the high oxygen material of the lenses combined with involving the parents in the care lowers the risk for contact lens complications.7

Younger than seven are often too young to understand what needs to be done, but old enough to be traumatized by an aggressive approach, which may give them a negative association with the lens.

Using a soft approach is ideal, and you should always tell the child what you are doing and why. If you can, show them that you and their parents wear contact lenses. If a child is particularly resistant to anything being inserted in the eye, send them home with artificial tears or even a soft contact lens to practice. This will help acclimate the child to the task, as with this patient.

The process of fitting a contact lens can vary from child to child. With younger or less cooperative children, GP diagnostic lenses of known base curves and their fluorescein patterns can help determine corneal curvature.

To fit a corneal scar, the fluorescein pattern of an GP should exhibit two-thirds pooling and one-third light touch over the entire cornea. The lens should center well and move adequately to provide tear exchange for optimal corneal health. In cases where GPs fail, sclerals can be effective, as they are tolerated well in the pediatric population.10,11 The lens can often compensate for GP issues such as ocular surface disease, decentration or intolerance.12

**EDUCATION IS ESSENTIAL**

Despite vision improvement for most children, studies indicate a contact lens dropout rate as high as 36.8% in patients with unilateral irregular astigmatism.11 To help avoid this, clinicians should ensure parent buy-in and educate them on why the contact lens is necessary. They also need to understand the risk of amblyopia and why a contact lens is preferable to a spectacle correction.

Additionally, the process of acclimating a child to lens wear can be emotionally taxing on the parents, and they need to be reassured they are not hurting their child. Spending time on this conversation is essential to the child’s visual success.

**For children with irregular astigmatism or high refractive error, vision rehabilitation should begin right away to prevent amblyopia. This case emphasizes the importance of using your full arsenal of contact lens options to address the different needs of each child.**

---

7. Shaughnessy MP, Ellis FJ, Jeffrey AR, Szocika L. Rigid gas permeable contact lenses are a safe and effective means of treating refractive abnormalities in the pediatric population. CLAO J. 2001;27:195-201.
Your job is about more than providing good patient care. To succeed, you have to navigate changing healthcare policies, keep up with the latest clinical advancements, manage your staff and run a successful business. Zero in on the topics impacting every aspect of your practice and career at SECO 2017, the largest conference in the world for optometric professionals and staff, and let us bring it all into sharp focus for you.

REGISTER NOW!
Visit www.seco2017.com for more information and start planning today.
The general public has traditionally considered myopia a simple refractive condition correctable by spectacles and contact lenses with limited impact on permanent visual impairment. This is not the case, however; myopia is increasingly associated with a heightened risk of permanent vision impairment, as evidenced by reports of myopic macular degeneration as a frequent cause of vision impairment and blindness in Asia and Western nations.1,4

Myopia already affects a massive proportion of the population in Asia.1 For example, Taiwan has rates of myopia of up to 84% in school children, and 97% of 19-year-old South Korean male military conscripts are myopic.2,3 Myopia is also becoming a problem beyond East Asia, with the United States reporting increases in prevalence from 25% to 42% between 1972 and 2002, and high myopia, in particular, increasing eightfold from 0.2% to 1.6% in those older than 30 over the same period.4 In Australia, where myopia levels are generally considered to be low, the Sydney Adult Vascular and Eye Study recently reported that almost 30% of 17-year-olds are myopic.5

Although individual studies provide essential information on the prevalence of myopia, they are difficult to generalize, as they cover specific ages, groups or places. For effective planning, policymaking and interventions regarding myopia, we must organize and understand the data to predict trends and estimate future prevalence.

**THE GLOBAL PREVALENCE**

A study by the Brien Holden Vision Institute (BHVI), published in *Ophthalmology* in 2016, reported a meta-analysis of the global prevalence data on myopia and high myopia since 1995.6 Using the PubMed (National Library of Medicine) database to review the literature, this study highlights the condition’s prevalence across the 21 regions of global burden of disease (GBD), which are countries grouped together based on their geographic location and socioeconomic status (http://ghdx.healthdata.org/countries). Evidence of varying prevalence over time enabled our research team to create functions to predict the future prevalence of myopia and high myopia from 2000 through 2050 by decade. (see, “How BHVI Estimated Prevalence Rates Through 2050.”)

The model indicated the global prevalence of myopia affected almost 23% of the population in 2000. More importantly, it predicted that amount would grow to 50% of the world’s population by 2050 (Figure 1). Nearly 1.5 billion people were affected in 2000, and by 2050 this is expected to increase to almost five billion.6

High myopia is also set to rise from an initially low prevalence of almost 3% in 2000 to close to 10% in 2050. This equates to 163 million people in 2000, and by 2050 almost one billion people will be potentially at risk of developing permanent vision impairment and blindness associated with high myopia.6

Approaching 2050, the difference in prevalence rates between Asia and the rest of the world start to decrease, with many regions reaching a prevalence of more than 30%, presumably due to increasing urbanization and socioeconomic development. For example, in 2010, the high-income Asia-Pacific nations had a prevalence of 48.8%, while Eastern Europe and North Africa and the Middle East had prevalences of 25% and 14.2%, respectively.
But by 2050, the research suggests, the gap will close, with Eastern Europe reaching a prevalence rate of 50.4%, North Africa and the Middle East jumping to 52.2% and high-income East Asia moving up less significantly to 66.4% (Figure 2).6

WHY THE INCREASE?
The projected increases in myopia and high myopia are largely considered to be driven by environmental factors and lifestyle changes, such as reduced time outdoors and increased near-based activities.1 Genetic predisposition is also a factor, but it cannot explain the rapid changes in prevalence seen in such a short timespan.7

Research suggests the high-pressure educational systems children are subjected to at very young ages in countries such as Singapore, Korea, Taiwan and China may be a major contributing lifestyle factor.1 Excessive use of electronic devices could also play a role.3

Other factors thought to be involved in myopia development and progression include light levels and specific wavelengths, time outdoors, vitamin D and peripheral defocus in the corrected and uncorrected myopic eye, stimulating axial elongation.8 Different light levels, different wavelengths and duration of light have been shown to affect axial elongation in animal studies, but are yet to be tested in humans.8 Trials conducted in Taiwan and China indicate time outdoors reduces risk of developing myopia, with less myopia progression seen in summer vs. winter months.9,10 The role of vitamin D in myopia is unclear; some reports suggest it is linked with myopia, while others have found no association.11,12 Investigators also found diet was not associated with myopia in a group of healthy children in Singapore.13

The BHVI study results show that, in the year 2000, the majority of myopia was occurring in those younger than 40, reflecting the major change in lifestyle in children and young people over the last two decades, especially in Asia.6 Due to urbanization and development, similar lifestyle factors will likely spread to other parts of the world that are still developing.

IMPLICATIONS
As a consequence of the rising prevalence of myopia, there will be substantial demand for increased eye care resources for refractive services, such as spectacles and contact lenses, in correcting the refractive error and treating myopia progression. In addition, there will be a need for managing and preventing high myopia–related ocular complications.

Uncorrected refractive error is already the primary cause of distance vision impairment globally, affecting 108 million people.14 It is also the second most common cause of global blindness.15 The economic burden of uncorrected distance refractive error was estimated to be $202 billion annually, of which myopia was the main cause.16 As a consequence of rising myopia levels, the prevalence of uncorrected refractive error and the associated burden will increase. High myopia also increases the risk of potentially sight-threatening conditions such as glaucoma, myopic macular degeneration, cataracts and retinal detachment.17 One billion people are predicted to be highly myopic by 2050, and the number of people with vision loss resulting from high myopia is predicted to increase sevenfold from 2000 to 2050.6 Based on these projections, myopia is set to become a leading cause of blindness worldwide.

NEXT STEPS: MANAGEMENT
Many unanswered questions remain. To intervene at the appropriate stage, we need to better understand the risk factors associated with myopia onset and progression—such as ethnicity, lifestyle and parental myopia. It is important to regularly monitor population trends and characteristics to identify risk factors and adjust behaviors and management accordingly to limit
the burden of rising myopia. For example, myopia has traditionally been treated with single vision spectacles and contact lenses, but now we know there are other options.

Research has made considerable headway in identifying optical interventions that might aid in preventing the onset and progression of myopia. Optical interventions provide myopic defocus—bringing the image in front of the retina to slow axial elongation.18 The myopic eye tends to have relative peripheral hyperopia, and these interventions address this key risk factor. These strategies include bifocal spectacles, multifocal soft contact lenses and ortho-k—in combination with behavioral strategies such as reduced near work and more time outdoors, and pharmacological agents such as low-dose atropine. All these methods can help reduce the number of people with myopia progression.19

There is still much debate about when to start myopia control, what treatments should be used on whom and at what age. Optical treatments such as bifocal spectacles and multifocal soft contact lenses can be used full time as soon as a child is becoming myopic, and ortho-k is a good option if the child is a suitable candidate in terms of refractive error and their ability to perform extended wear. Concerning efficacy, the average slowing of myopia achieved across the bifocal spectacles, ortho-k and multifocal soft contact lenses are comparable, ranging from 35% to 50%.20-22 The choice often depends on the patient’s lifestyle and the rate of slowed progression achieved.

Low-dose atropine (0.01%) is commonly prescribed for myopia progression in places such as Hong Kong, Taiwan and Singapore, and, more recently, in some Western nations, one drop daily before sleep. Research shows the use of
pharmacologic treatments such as low-dose atropine for myopia is safe in those as young as six, with the longest study being five years. The mechanism by which low-dose atropine works to slow myopia remains unclear, but it significantly slows the change in the spherical equivalent by 60% after two years, although this is not seen in a change in the axial length. Some caution is still required, as the effects of chronic treatment with low-dose atropine are unknown, including the overall level of myopia control when combining behavioral, optical and pharmacologic treatments. Although consensus surrounding myopia management has not yet been achieved, it is critical to successfully address the issue of myopia. The Brien Holden Vision Institute hopes to further foster the movement towards consensus through collaboration with researchers, clinicians and health bodies using our experience in advocacy in areas such as uncorrected refractive error. More research is required to fully understand the mechanisms of myopia development and progression and identify those at risk of developing high myopia. Public health advocates will also need to develop wellness promotion strategies and provide resources such as clinical guidelines to respond to this significant public health challenge. Industry can also take a leadership role by working with researchers and clinicians to develop FDA-approved myopia treatments that will have a positive impact.

Overall, the world is becoming more myopic—a trend that has significant financial and societal implications. More importantly, high levels of myopia pose a threat to sight that reduces quality of life and exposes those affected to greater health risks. Evidence suggests myopia can be managed better by reducing the risk of the eye becoming more myopic with a number of lifestyle, optical and pharmaceutical interventions. The BHVI will be releasing the first online myopia management education program for optometrists in March 2017. Please go to www.brienholdenvisioninstitute.org for details.

How BHVI Estimated Myopia Rates Through 2050

- Selected 145 relevant studies from a pool of 4,288 PubMed articles, representing 2.1 million individuals with myopia.
- Combined myopia prevalence data with world population data and stratified data into age cohorts in five-year increments.
- Defined myopia as spherical equivalent ≤ -0.50D and high myopia as spherical equivalent ≤ -5.00D.*
- Grouped countries by GBD region for applicability to other epidemiological studies. (Results were extrapolated for GBD regions lacking myopia data).
- Performed meta-analysis of prevalence data, combined with myopia change over time, to project prevalence rates for each decade from 2000 to 2050.

*Spherical equivalent ≤ -0.50D, the most commonly used myopia definition, is beyond the refraction measurement error and captures children at the start of their progression. Spherical equivalent ≤ -5.00D for high myopia identifies people at higher risk of pathologic myopia and, if uncorrected, causes vision impairment equivalent to the World Health Organization’s blindness definition.


Want to learn more?
Access the freely available study at: www.sciencedirect.com/science/article/pii/S016164201600257
Myopia affected approximately one and a half billion people in 2010, and that number is expected to rise to nearly five billion by 2050.1 It is the single most significant cause of distance vision impairment, and high myopia (i.e., worse than -5.00D) is associated with a number of sight-threatening complications such as myopic macular degeneration, retinal detachment, cataract and glaucoma.2,4 This significant burden highlights the need for strategies and solutions to reduce the risk of onset and slow the progression in those already affected by myopia.

STRATEGIES FOR CONTROL
Myopia is a complex trait influenced by a number of environmental and genetic factors, and the mechanisms underlying onset and progression are not fully understood. Although there is a great deal to learn about the mechanisms of myopia and why individuals respond differently to different stimuli and treatments, some behavioral, pharmaceutical and optical strategies already show promise in clinical trials in combating myopia—many of which can be incorporated into current day practice.5,26

Prevention is obviously the most effective strategy to reduce the burden of myopia. Several randomized clinical trials suggest a lifestyle intervention with more time spent outdoors reducing the risk of onset.5,6 However, because this involves education and behavioral modification in the years prior to the onset of myopia, comprehensive community-based programs that involve parents, caregivers, teachers, governmental and non-governmental organizations and eye care practitioners (ECPs) must be implemented for this approach to be effective. Despite the crucial role ECPs play in educating parents and communities, their role is limited by the fact that first contact with a practitioner usually comes after the onset of symptoms and signs.

Once a patient is diagnosed with myopia, the ECP becomes the central care provider and is integral to evaluating the risk of further progression. ECPs now have many options for correcting distance vision impairment and slowing its progression. These options include more time spent outdoors, atropine therapy (including low-dose atropine 0.01%), spectacles (progressives, peripheral defocus management and executive bifocals), contact lenses that impose myopic defocus across sections of the retina, and orthokeratology.5,26

Of these various interventions, contact lenses fare well in terms of the risk-benefit ratio compared with other interventions for myopia control. For example, atropine has greater efficacy rates but an increased risk of side effects compared with contact lenses; in addition, myopia rebounds once treatment is stopped.7,8 Clinical trials and case studies show specially designed contact lenses slow myopia progression from 25% to 72% compared with spectacles.8-21

Contact lenses used for myopia control can be either bifocal or multifocal soft contact lenses, as well as the rigid contact lens designs used in orthokeratology. Investigators have proposed

ABOUT THE AUTHOR
Prof. Sankaridurg is the program leader for the Myopia Program at the Brien Holden Vision Institute. She was awarded her BOpt degree from the Elite School of Optometry, Chennai, India, in 1989, her PhD in 1999 from the University of New South Wales, Australia, and her MIP in 2012 from University of Technology, Australia. After working for a number of years at the L.V. Prasad Eye Institute, India, as the chief of Contact Lens Services, she took a position at the Brien Holden Vision Institute and the Vision Cooperative Research Centre. She was appointed a conjoint professor at the School of Optometry and Vision Science, University of New South Wales, Australia, in 2016. She has been actively researching myopia for approximately 13 years. She is also involved in postgraduate supervision and manages the institute’s intellectual property portfolio. She has more than 50 articles in peer reviewed journals, is a co-inventor on nine patents/applications, has authored several book chapters and has delivered many podium presentations including keynote lectures.
several mechanisms to explain their myopia control effect, including: (1) contact lenses correct or reduce accommodative lag, which is considered a stimulus for eye elongation; (2) they reduce the peripheral retinal defocus, which is considered to increase the risk of eye elongation by shifting the image closer to the retina; and (3) the lenses impose myopic defocus across areas of the retina, which is considered to inhibit eye growth.16-21,25,26

These practice pearls can help you better understand the use of soft contact lenses for myopia control and how to incorporate them into your practice. Currently, no products are on the market specifically for use in myopia control; thus, this discussion is based on clinical trial data on the use of multifocal contact lenses for myopia control.

WHERE TO BEGIN
All individuals presenting with myopia should be assessed for risk of progression based on age, ethnicity, family history of myopia and past history of progression. The ocular examination should include a cycloplegic assessment of the refractive error. A non-cycloplegic refraction often results in a more myopic refraction, and the difference is greatest in younger children and those with low myopic, emmetropic and hyperopic refractive errors.27

Because of this, ECPs should note that a patient without myopia could be classified incorrectly as having myopia; likewise, the magnitude of myopia could be found to be higher than it actually is in a patient with myopia.

ECPs can decide to fit contact lenses based on an assessment of the risk profile or at the request of the patient or, in the case of a child, the caregiver. When fitting contact lenses for myopia control, clinicians should take into consideration the minimum age at which contact lenses can be fitted, contact lens design for myopia control, tests to perform, the wear and care schedule, managing visual performance and follow-up intervals.
Let’s take a look at these considerations in more detail:

FITTING AGE

Studies show children as young as eight can successfully manage lens insertion, removal and care.17-21,25,28,29 Other clinical studies found children achieved the required duration of lens wear (including full-time lens wear), and the reported duration of lens wear was comparable with that seen in adult contact lens wearers.30 Evidence shows no increased risk of complications associated with lens wear in children compared with adults.30,31 While it is common practice to teach both the child and the parent, the ECP should ensure the child can independently manage all aspects of lens wear before prescribing them.

In addition to correcting and controlling progression of myopia, studies indicate children and teenagers wearing contact lenses had improved quality of life with respect to appearance and satisfaction with correction.29 However, not all children can successfully wear contact lenses. Conditions such as allergic conjunctivitis have an onset in childhood and, in such instances, contact lens wear may aggravate or increase the risk of flare-up. Clinicians should ask about any previous history of allergic or vernal conjunctivitis, and examinations should include an eversion of the tarsal conjunctiva.

CONTACT LENS DESIGN

Bifocal or multifocal contact lenses have proven effective for myopia control.16-21,25,26

The lens design researchers found effective for myopia control was a center-distance multifocal that had two distinct portions within the optical zone: a central portion that corrected for the distance refractive error and an outer zone that was relatively positively powered compared with the central portion.16-21 The relatively positive power was intended to reduce hyperopic defocus, induce myopic defocus or both across areas of the retina. The tested lenses were experimentally designed with the exception of two trials that used commercially available multifocal soft contact lenses: Acuvue bifocal (center distance, alternating five ring bifocal,
Vistakon) and Proclear multifocal D (Coopervision).\(^{19,21}\) Depending on the lens design, the central distance portion varies in diameter, and the relative positive power is delivered as either concentric rings or as a gradient power rising from the center to the periphery. The dioptic magnitude of the relative positive or plus power—which is fixed for use across the population and not individualized—commonly ranging in power from +1.50D to +2.50D. There is still a dearth of information regarding whether increasing the relative positive power or providing individualized treatment is likely to deliver improved myopia control.

**ASSESSING FIT AND PERFORMANCE**

The initial lens selection should be based on cycloplegic spherical equivalent refractive error and appropriately adjusted for vertex distance. The contact lenses employed in clinical trials were spherical lenses that masked low amounts of astigmatism (commonly <0.75D and based on the spherical component of the refractive error). Clinicians should refer to the manufacturer’s guidelines for lens selection wherever possible.

Patients generally find the first few minutes of lens wear unsettling but tend to adapt quickly. Clinicians should wait to evaluate visual performance until 20 to 30 minutes after lens insertion. To ensure a successful fit, ECPs should examine and optimize the lens centration and movement before addressing visual performance. Issues with lens fit such as decentration or excessive lens movement on the eye may mimic or increase the severity or frequency of symptoms associated with multifocal lens wear such as ghosting, poor contrast and haloes.

Poor visual performance may be related to a number of factors, including: strength of the relative positive power in the optical zone; power profile of the lens (for example, concentric rings of plus power vs. gradient increase in plus power); pupil size; ambient illumination and contrast. A thorough clinical evaluation taking these factors into account may determine if the patient requires a change in lens fit, lens design or simply reassurance that the lens is properly fit. If clinicians perform over-refraction, they should do so using a trial frame rather than a phoropter to minimize errors related to head tilt and movement behind the phoropter.

**WEAR TIME AND REPLACEMENT MODALITY**

Patients should be advised to wear myopia control contact lenses for all waking hours, as improved lens wear compliance results in better outcomes.\(^{18}\) Also, patients should have an up-to-date spectacle prescription for occasions when lens wear may not be feasible. Contact lens wear does not appear to pose an increased risk of

---

**Practice Pearls on Myopia Control:**

1. Your toolkit for myopia management should include myopia control contact lenses.
2. Assess the risk of progression of myopia for a patient and tailor the management based on the risk.
3. A cycloplegic assessment of the refractive error is essential, particularly in children, as non-cycloplegic refractive assessment often results in a more myopic refractive error.
4. Children eight years and older can successfully be fit with contact lenses and can independently manage and care for their lenses. In children, clinicians should examine the anterior segment before prescribing contact lenses, including eversion and examination of the tarsal conjunctiva.
5. Contact lens designs employed for myopia control are multifocal or multifocal-like lenses with a portion of the optical zone devoted to correcting the distance myopic refractive error and the remainder being relatively positive compared with the distance power by an average of +1.50D to +2.50D.
6. Wait 20 to 30 minutes to allow lenses to settle prior to examining lens fit and visual performance. Optimize lens fit prior to measuring visual performance with the lenses.
7. A daily disposable option or a frequent replacement schedule minimizes the risk of complications associated with contact lens wear.
8. When fitting children with contact lenses, ensure the children can independently manage lens insertion and removal, as well as lens care procedures.
complications in children compared with adults. To reduce the risk of complications associated with lens wear, whatever they may be, ECPs should prescribe a regimen that minimizes lens handling and the consequent risk of microbial contamination of the lenses. Education is key, and ECPs should emphasize the risks associated with overnight lens wear such as increased risk of infection and focus on properly training patients in appropriate lens care and handling techniques. A daily wear, disposable or frequent replacement schedule is often the most successful approach.

Also, while it is common practice to teach both the child and the parent, practitioners should ensure the child is fully adept at managing all aspects of lens wear such as insertion and removal, lens disinfection as well as taking necessary steps to prevent adverse events, such as avoiding lens wear when unwell or avoiding use of solutions other than those provided by the ECP.

For patients with myopia progression, a three- to six-month follow-up schedule is ideal for avoiding potential adverse effects such as blurred vision. Any drop in visual acuity of one line or more or over-refraction of 0.25D or more necessitates the need for a refractive error assessment so the lens power can be appropriately adjusted.

OUR RESPONSIBILITY
The rising prevalence of myopia and its notably progressive nature is an increasingly significant concern for ECPs and their patients. While further research regarding the underlying mechanisms of myopia is needed, current data points to contact lenses as a safe and effective means of delivering myopia control. Since progression of myopia is rapid in childhood, treatment strategies should be directed mostly to children and young adults, for whom studies show contact lenses provide a better risk-benefit than other forms of myopia control. Taking into consideration patient expectations and their ability to manage lens wear, ECPs should opt for myopia control contact lenses in treating individuals at risk of onset and progression.

CE TEST ~ FEBRUARY 2017

1. Which of these complications is associated with high myopia?
   a. Retinal detachment.
   b. Cataract.
   c. Glaucoma.
   d. All of the above.

2. What is the most effective strategy to reduce the burden of myopia?
   a. Contact lenses.
   b. Prevention.
   c. Vision therapy.
   d. Refractive surgery.

3. Studies show contact lenses can slow myopia progression by what percent?
   a. 1% to 10%.
   b. 10% to 20%.
   c. 25% to 72%.
   d. 60% to 70%.

4. Most clinical trials employ this type of contact lens design:
   a. Center-distance multifocal.
   b. Translating multifocal.
   c. Hybrid multifocal.
   d. Concentric bifocal.

5. At what age can clinicians consider prescribing myopia control contact lenses to patients?
   a. Six.
   b. Eight.
   c. Ten.
   d. Twelve.

6. Why should clinicians perform a cycloplegic refraction before prescribing contact lenses for myopia control?
   a. Avoid a more myopic refraction.
   b. Check visual performance.
   c. Examine the tarsal conjunctiva.
   d. Adjust the lens power.

7. Which of these complications can mimic or increase the severity or frequency of symptoms associated with multifocal lens wear?
   a. Part-time lens wear.
   b. Vernal conjunctivitis.
   c. Incorrect plus power.
   d. Excessive lens movement.

8. How long after lens placement should clinicians wait until evaluating visual performance?
   a. Visual performance can be evaluated immediately after lens placement.
   b. Five to 10 minutes.
   c. 20 to 30 minutes.
   d. 30 to 45 minutes.

9. All of these can lead to poor visual performance, except:
   a. Strength of the relative positive power in the optical zone.
   b. Power profile of the lens.
   c. Lens replacement modality.
   d. Pupil size.

10. How long should patients be advised to wear contact lenses for myopia control?
    a. All waking hours.
    b. Overnight.
    c. Eight to 10 hours a day.
    d. Six to eight hours a day.

EXAMINATION ANSWER SHEET

Fitting Multifocal Contact Lenses for Myopia Control
Valid for credit through February 1, 2020

Online: This exam can also be taken online at www.reviewofcontactlenses.com.
Upon passing the exam, you can view your results immediately. You can also view your test history at any time from the website.

Directions: Select one answer for each question in the exam and completely darken the appropriate circle. A minimum score of 70% is required to earn credit.

Mail to: Jobson Medical Information, Dept.: Optometric CE, 440 9th Avenue, 14th Floor, New York, NY 10001.

Payment: Remit $20 with this exam. Make check payable to Jobson Medical Information LLC.

Credit: This lesson is approved for 1 hour of CE credit. Course ID is S2285-CL.

Sponsorship: Joint-sponsored by the Pennsylvania College of Optometry

Processing: There is an eight-to-10 week processing time for this exam.

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

Evaluation questions (1 = Excellent, 2 = Very Good, 3 = Good, 4 = Fair, 5 = Poor)
11. Met the goal statement: 1 2 3 4 5
12. Related to your practice needs: 1 2 3 4 5
13. Will help improve patient care: 1 2 3 4 5
14. Avoided commercial bias/influence: 1 2 3 4 5
15. How do you rate the overall quality of the material? 1 2 3 4 5
16. Your knowledge of the subject increased: Greatly Somewhat Little
17. The difficulty of the course was: Complex Appropriate Basic
18. How long did it take to complete this course? _______________________
19. Comments on this course: _________________________________________
   ___________________________________________________________________
20. Suggested topics for future CE articles: _______________________________
   ___________________________________________________________________

Identifying information (please print clearly):
First Name __________________________ Last Name __________________________
Email __________________________
The following is your: Home Address Business Address
Business Name __________________________
Address __________________________
City __________________________ State __________________________
ZIP __________________________
Telephone #: __________________________ Fax #: __________________________

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.

Signature: __________________________ Date: __________________________

Please retain a copy for your records. LESSON 115633, RO-RCL-0217
Orthokeratology (ortho-k) is one of the more challenging treatment modalities in an eye care practitioner’s toolbox, especially considering effective myopia control treatment needs to begin by the age of six or seven. As challenging as these young patients may be, treating them with corneal reshaping can be immensely rewarding.

Orthokeratology has grown dramatically internationally; in China, for example, close to two million ortho-k lenses have been fabricated. However, less than 300,000 lenses have been dispensed in the United States—less than 1% market share of the entire contact lens industry. Additionally, the nature of our practice environment for contemporary eye care practitioners—which emphasizes low reimbursements and ever-increasing numbers of patients—makes it difficult to find the time to focus on corneal reshaping. But with myopia on the rise, it’s time we use all of our tools.

I feel ortho-k is the best possible treatment for eligible patients; using the human cornea in its new-engineered shape to limit the progression of myopia has proven hugely successful in my practice. Here are 10 tips to help you successfully integrate ortho-k into yours.

1 KNOW THE RISKS AND BENEFITS

Over 80% of orthokeratology fits on adolescents are for myopia control. Yet, ECPs are still reluctant to embrace the procedure, possibly because there are few procedures with a higher perceived risk than fitting adolescents with ortho-k. Risk aversion may inform some of this reticence, but a further understanding of the benefits of the procedure proves to overshadow the potential risks such as microbial keratitis, corneal abrasions, central corneal staining, lens binding and tear film instability. The FDA is willing to consider even a 30% reduction in myopia resulting from use of a medical device as clinically significant; orthokeratology—with close to a 50% reduction—serves as the gold standard.

Safety concerns tend to be based more in perception than fact. There are scores of studies showcasing the safety of this procedure. Out of the 5,000+ ortho-k lenses I’ve fit in the last 25 years, I’ve only had one incident of microbial keratitis. Early diagnosis and treatment, combined with effective antibiotic therapy, kept this patient’s microbial keratitis episode from causing vision loss. My longest wearing ortho-k patient just passed year 25, and his seven diopters of myopia at age seven hasn’t changed. Many of my patients are in year 15 to 20 and still wearing lenses safely. While we have had our share of corneal abrasions and superficial punctate keratitis, these have been easily remedied and haven’t negated the many benefits ortho-k has provided to my patients.

Even spherical aberration, initially thought to be a negative side effect of ortho-k, actually offers many positives when it comes to advanced custom ortho-k lens design. For example, by manipulating the positive asphericity in ortho-k designs, along with reducing the size of the treatment zone, you increase the elevation of the reverse curve, resulting in an increase in spherical aberration with more effective myopia control. Introducing a negative asphericity, however, can help increase add power while also manipulating spherical aberration.

2 CONSULT AND EXAMINE

In my office, we ask that patients attend a free consultation before making an appointment for an ortho-k evaluation. It is crucial that parents accompany any adolescent patients. Often, I find the parents do little to explain ortho-k to their children because they don’t understand it themselves, and the consultation ensures both the parent and the patient are educated properly. During the consultation we...
answer questions and provide literature on the procedure while also gathering information about a patient’s eligibility. It’s also the perfect time to evaluate first impressions of the maturity level of an adolescent patient. Finally, after reviewing the risks and benefits, you should have parents, and the child if he or she is old enough, sign off on all the key points of an informed consent.

During the initial examination to determine suitability, clinicians must thoroughly rule out all complicating conditions. For example, the presence of any corneal pathology (such as keratoconus) is a contraindication. Practice extra caution when considering cases with irregular, limbus-to-limbus or against-the-rule astigmatism or decentered corneal caps—particularly if you are new to ortho-k. Factors such as dry eye should always be dealt with prior to fitting.

It is extremely important, especially when treating the pediatric population, that your staff knows how to gather this pertinent clinical information so the appointment can be flagged if they note complicating factors.

3 EVALUATE AND ASSESS

Following the initial examination is the actual ortho-k evaluation. This should begin with topography, which is the standard-of-care for ortho-k. The baseline topography will remain the reference for a patient’s fitting throughout their lifetime of ortho-k use, so it needs to be performed with great precision, and it’s imperative to take more than one topography reading. It’s not uncommon to need 10 or more readings on a patient per eye to arrive at an accurate assessment of the cornea prior to fitting, considering corneal topographers using a Placido disc are often inaccurate and provide different results each time a map is taken. It can be challenging to know which one of those 10 is the one to use as the reference. In my practice, I take an auto-k reading and match that to the topographies I have taken until I find the closest one to the topography reading. Avoid using topographies with missing data points or irregularities caused by tear pooling or lid infringement.

Topography provides valuable information on the cornea itself, including the much-needed eccentricity; however, be wary of a topographer’s accuracy. Besides pre-fit data, the evaluating treatment progress is one of its greatest benefits. All of the necessary information you need for evaluating the fit is at your fingertips, including axial, tangential, refractive, elevation and difference maps. Axial maps determine the radius of curvature at each particular point, which is helpful in determining the refractive change. Axial maps are also good for determining the type, shape and position of any corneal astigmatism. Tangential maps are best used for lens positioning in ortho-k, while refractive maps speak to the quality of vision. Subtractive or difference maps are ideal for showing the overnight change after ortho-k.

The ortho-k evaluation is also a good time to discuss other considerations such as haloes and adaptation for moderate-to-high myopia. Haloes in younger patients usually aren’t an issue, particularly after explaining how they are integral to the myopia control effect. The change from the prolate to oblate surface created after ortho-k causes haloes as it defines a new myopic image shell on the peripheral retina. Still, it’s helpful to know how sensitive patients are to slightly blurry visual effects such as haloes at distance.

Education is a key to success, so make sure parents and patients understand these myopia-controlling devices are not intended to give the ultimate in fine distance acuity but rather are a method of reducing myopia progression.

Prior to fitting any lenses, discuss how the patient’s accommodative system may need help with vision training during treatment. This is especially true with newer custom designed lenses that address the lack of peripheral defocus in patients with low myopia by creating more demand and a resulting moderately high hyperopia after lens removal during treatment (>1D).

4 SIGN A CONTRACT

If at this point all looks well and all parties involved opt for ortho-k, prepare a contract and go through it with the patient and parent before having them sign it. The contract should address all expectations and contingencies. Possible side effects need to be
covered, and suitable alternatives addressed. Lastly, payment expectations should also be included. Always remember when structuring your fees for this procedure to allow an extra margin in your final fees to account for additional lenses or extra time needed to achieve the necessary precision. This is especially important for myopia control, where the initial lens selection may fail to deliver a satisfactory result.

5 CHECK THE CORNEA
When performing ortho-k, it’s imperative to consider factors such as corneal volume: the more volume you have the easier it is to move tissue, even with higher myopia. Be wary of small, flat corneas due to low volume, as they can test your fitting abilities, even in low prescriptions. Extremely flat corneas can also pose a challenge, especially in higher prescriptions. For example, 34.00D is about as flat as you can expect after ortho-k, so a 6D myope with a flat K of 39.00D may be out of reach. Remember, over 40 microns of elevation difference between steep and flat meridians usually means a toric alignment zone with its increased complexity.

Eccentricity of the cornea is extremely important to know to help you determine how much flattening to expect on the cornea as you move towards the periphery and whether a five curve or higher design is warranted due to that change. Familiarize yourself with your topographer’s intricacies and margins of error, as most will either over or underestimate the “e” value. When possible, also evaluate the “e” value with other methods such as a trial lens fitting. This is done by determining the best fluorescein pattern available underneath that trial lens. Ortho-k designs are accurate to perhaps 3µm, and the human eye can pick up a difference in patterns of roughly 10µm to 15µm, permitting an accurate assessment of corneal eccentricity and best-fit profile.

When taking topographies on children, take note that they tend to be more fearful and fidgety during examinations. If you are unable to acquire that “perfect” topography reading, it may be best to send the child home with eye drops to practice keeping their eyes open and inform the parents of the need for a precise topography. Have the child open their eyes wide as they instill the drops. Often on return visits, they are more relaxed, giving you a better opportunity to document their topography.

6 BE READY FOR FITTINGS
The next step is fitting and ordering the lenses. The most popular methods for doing this are empirically, through trial lens fitting or custom design. Many ECPs forgo trial lenses and order an empirical or custom topographic design as “trial” lenses. In 80% of cases, they will work effectively and require minimal, if any, changes. Even though I have diagnostic data to help fit a patient, I often feel a trial fitting is much more accurate, as it provides additional information that helps me customize each fit. For instance, I can evaluate possible lid interactions such as overly tight lids.

When you are ready to trial fit, be sure to have the necessary time and space for ortho-k patients by providing a reclining chair so they can lay down with eyes closed for at least 15 minutes. This is much more valuable than open-eye assessment for lens fit and treatment. A mere 20 minutes of wear will often correct significant levels of myopia and astigmatism.

Many practitioners instill a drop of topical anesthetic before lens insertion to aid a young patient’s adaptation. With many different trial set diameters at my disposal, I can nail covering 95% of corneal surface, which is necessary for best results.

7 DISPENSE AND FOLLOW
When the lenses have arrived and passed inspection, bring the patient into the office and insert the lenses to make sure they fit well. If the patient and parent are satisfied, educate them on safe insertion, removal and care. If the patient is under eight years of age, it’s likely the parents will need to step in and provide support here, which may mean all of the insertion, removal and care. Allow enough time in your schedule for this process and, again, make sure this time is reflected in your fee structure.

Once you have dispensed the lenses, active follow up is necessary. In my practice, we see the patient the next day and then again in one month. Further follow-up visits are scheduled at three-month intervals. If it’s a higher amount of myopia or other factors such as high astigmatism are present, we ask patients to come in for follow-up appointments at two weeks as well. We also schedule the following year’s lens
replacements and evaluations during the initial year.

I replace lenses for a child yearly because I personally believe that will provide the healthiest and safest outcomes, given children cannot legally take responsibility for their decisions, particularly when it comes to lens care.

8 ADJUST ACCORDINGLY

Effective myopia control requires A-scans to determine axial length before and during treatment. You should take a new measurement every year. These readings, along with any changes in the over-refraction with ortho-k lenses at six and 12 months after initial fitting, will either confirm successful myopia control or lead to a new treatment strategy.

Modifications such as increasing the Jessen factor, using newer designs relying on six or more curves or using eccentricity in the base curve can lead to a greater elevation of the reverse curve and better myopic defocus in the periphery. The Jessen factor is the amount of lens flattening over and above the patient’s current prescription needs, which allows the eye to remain free from myopia, even after all-day wear. Research shows increasing the Jessen factor and reducing the treatment zone can create a better myopic image shell in the peripheral retina. Simply adding low-dose atropine (0.01%) in addition to ortho-k also may lead to better control without changing the lens.

Management decisions should be based on any changes in the axial length after the beginning of treatment. Even high myopia is within reach—although ortho-k may only get you part of the way there. Correcting at least 4D with corneal reshaping and then the rest with glasses can still reduce myopic progression by at least 50%.

9 DON'T STOP TOO SOON

A common mistake parents make is assuming that, once the riskiest years of myopic progression have passed, their child should switch from ortho-k to daily wear lenses or glasses. This is nearly always the wrong route to take, as many younger patients have no desire to limit their much-improved quality of life by making that switch. Further, in my experience, long-term wear of ortho-k lenses shows no signs of increased risk. I have many patients who have been wearing their ortho-k lenses for more than a decade with no signs of any adverse corneal changes. In fact, their corneas remain pristine even after years of overnight wear.

I consult with my long-term wearers at least once a year on their success with the procedure. When they are ready for LASIK or feel wearing the lenses nightly is impacting their lifestyle, I wash them out of their lenses. This process may take up to six months to accomplish in long-term wearers (>10 years).

10 WATCH YOUR PATIENTS AND PRACTICE GROW

Ortho-k can dominate a practice. My specialty practice is now about 80% corneal reshaping, which has translated into a healthy practice. Once you decide to incorporate ortho-k into your practice, be prepared for a younger patient base. At the same time, my younger corneal reshaping patients have proven extremely loyal, and I have a special opportunity to participate with parents in fostering their growth. While kids may be resistant to parental advice, they will often listen to an authority figure such as their ECP. Don’t waste that opportunity.

Taking a proactive role in the myopia epidemic and incorporating ortho-k into your practice can make a positive difference in your young patients’ lives. Controlling myopia progression at age six or seven by just 30% will eliminate 75% of all high myopia (>5D) cases and the subsequent increased risk of ocular pathology. Further, evidence shows ortho-k is impactful on adolescents’ visual performance and binocular function. The improvement in quality of life afforded by ortho-k lenses is extremely rewarding to witness.

With myopia rates increasing, it’s time to fully consider all the options at our disposal. As far as I’m concerned, ortho-k is the way of the future. Don’t waste the opportunity to provide this amazing specialty to your pediatric patients. Taking the road less traveled can indeed make all the difference.


With myopia on the rise, it’s more important than ever to treat patients as early as possible.\textsuperscript{1,2} Luckily, eye care practitioners have several treatment options available, including corneal reshaping with orthokeratology (ortho-k). Several studies show the effectiveness of ortho-k in slowing myopia progression in children.\textsuperscript{3,4} Researchers found axial elongation was 51\% to 57.1\% less compared with a control group wearing spectacles or soft contact lenses.\textsuperscript{6,8}

But many patients with myopia have astigmatism, which can sometimes complicate ortho-k therapy. Nearly one quarter of patients wearing soft contact lenses require astigmatism correction, and 32\% of patients with myopia present with astigmatism of 0.75D or greater in both eyes.\textsuperscript{9} These statistics suggest the number of patients with astigmatism is associated with the increasing of the number of patients with myopia. To effectively treat this patient population, clinicians must find creative alternatives to traditional ortho-k therapy. This article takes a closer look at the use of toric ortho-k lenses for myopia control in patients with astigmatism.

**EFFICACY OF TORIC ORTHO-K**

Researchers have suggested toric lenses can slow axial elongation in patients with myopia with astigmatism.\textsuperscript{10,11} A study investigating the effectiveness of toric ortho-k lenses for myopia control in children ages six to 12 with myopia from 0.50D to 3.00D and with-the-rule astigmatism from -1.25D to -3.50D found that, after one year of therapy, the axial elongation in subjects wearing toric ortho-k lenses increased by an average of 0.15mm.\textsuperscript{10} This was 58\% slower than the control group, all of whom wore spectacles. After two years of therapy, the axial elongation in the toric ortho-k group increased by 0.31mm, 52\% slower than the control group.\textsuperscript{10}

In another study—comprised of 24 treated patients without a control group—researchers noted no myopia progression and no alteration in the axial length in myopic children ages nine to 16 after one year of toric ortho-k lens wear.\textsuperscript{11}

**CLINICAL NEED**

Ortho-k treatment with spherical reverse geometry lenses presents two significant problems for patients with astigmatism, limiting their use to with-the-rule astigmatism up to 1.50D and against-the-rule and oblique astigmatism up to 0.75D.\textsuperscript{12,13} First, a spherical accelerated ortho-k lens on a toric cornea will have poor centration because the lens’s sagittal depth is equal in each meridian and the cornea’s sagittal depth is different in each meridian. This leads to ‘smiley face’ (high ride) or ‘frowny face’ (low ride) topography patterns, induced astigmatism, glare and poor vision (Figures 1a and 1b).\textsuperscript{16}\textsuperscript{19} As a result, symmetric reverse ortho-k designs can only flatten the flattest meridian, which may actually cause the astigmatism to increase.\textsuperscript{16} A toric ortho-k design will extend the bearing area of the lens circumferentially to improve both lens fit and clinical outcome.

Second, spherical reverse geometry lenses cannot achieve the peripheral touch necessary to ensure stabilization, centration and properly modulated hydrodynamic forces. Ortho-k treatment is achieved by combining two pressures: the positive push force in the central cornea and the negative pull force in the mid-peripheral cornea.\textsuperscript{20} The negative fluid pressure necessitates a 360° total touch in the landing zone to prevent fluid outflow along the steepest meridian (Figures 2a and 2b).\textsuperscript{21} Therefore, the total peripheral touch is important not only

**ABOUT THE AUTHOR**

Dr. Fadel is an optometrist specializing in contact lenses for irregular cornea, scleral lenses and orthokeratology. She has a contact lens private practice in Italy, where she designs special customized contact lenses. She lectures and publishes, especially on contact lenses for the irregular cornea, scleral lenses and ortho-k. She is the founder and president of the Italian Academy of Scleral Lenses (AILeS), a board member of the Italian Academy of Contact Lenses (AILAC) and a member of the Scleral Lens Society (SLS). Email: dfadel@tin.it.

By Daddi Fadel, DOptom

**RESHAPING Ortho-k**
Toric lenses can expand myopia management to include patients with astigmatism.

for better lens stabilization and centration, but also to modulate the hydrodynamic forces that lead to corneal flattening in each meridian. In case of limbus-to-limbus astigmatism, the semi-closed, fluid-filled system in the reverse zone is achieved only with a toric ortho-k design.

WHEN TO FIT TORIC ORTHO-K
Corneal astigmatism can be classified as apical, limbus-to-limbus or peripheral. In the apical form, astigmatism is greater centrally than peripherally. In limbus-to-limbus, central and peripheral astigmatisms are equal. Finally, in the third category, astigmatism is greater peripherally than centrally. The evaluation between corneal and refractive astigmatism can either be equal or different.

Research suggests toric ortho-k lenses be used for apical astigmatism, measured with a corneal topographer, higher than 1.75D, limbus-to-limbus astigmatism higher than 1.25D and peripheral astigmatism higher than -1.00D. Using the toric back optic zone is recommended for corneal astigmatism that differs from refractive astigmatism. If the axes of corneal and refractive astigmatism do not coincide, the optical and the alignment zones require different axes.

A recent study suggests toric ortho-k use may be beneficial when the sagittal height differential between the two principal meridians is greater than 25µm, or 1.00D of toricity. This might be better managed with a toric ortho-k design, especially for toric corneas. The majority of eyes looked at in the study had a peripheral astigmatism greater than central astigmatism.

DIFFERENT DESIGNS
Since their first introduction at the Global Orthokeratology Symposium in 2005 for the correction of astigmatism, toric ortho-k lens designs have varied across studies and case reports.

CLINICAL STUDIES
A study involving patients with astigmatism greater than 1.25D at any principal corneal meridian orientation used a lens design containing five toric zones, with reverse curves in the second and the fourth. This design is known as the “full toric double reservoir.” The researchers suggested that to achieve an adequate effect with a toric ortho-k lens, mechanical and hydrodynamic forces must occur differently in each corneal meridian, with greater flattening in the meridian where the myopia is greater. Results demonstrated an 85% change in initial astigmatism.

An additional study, with subjects age nine to 16, used a design with reverse and alignment toric zones, which are more appropriate for toric corneas because they allow for better centration. The corneal astigmatism was gradually decreased, resulting in a success rate of 92.8%. This suggests that toric ortho-k designs are able to reduce moderate-to-high corneal astigmatism.

CASE REPORTS
One case report used a toric alignment zone and spherical back optic and reverse zone for a 13-year-old patient with spectacle correction of -4.25 -1.50x165° OD and -4.25...
-2.50x180° OS. According to the report’s authors, the advantage of placing a spherical optic zone on a toric cornea is that the flattest lens meridian creates a normal ortho-k effect while the steepest meridian results in a greater ortho-k effect—leading to the correction of the corneal astigmatism. Other case reports used the same design, as did the first studies on toric ortho-k lenses for astigmatism.  

These studies demonstrated a 95% toric ortho-k first lens fit success rate in correcting low-to-moderate myopia in children with moderate-to-high astigmatism, which was better than the trial lens rate of 73.5%, as well as a reduction in the axial elongation amount.  

In another case report, of a 22-year-old patient presenting with -4.25 -3.75x8° OD and corneal astigmatism of -3.10x7°, the authors fit a reverse ortho-k lens with two toric zones: the reverse and the landing. The correction of high corneal astigmatism needs a perfectly closed reverse zone in each meridian to properly modulate the hydrodynamic forces, allowing for separate corneal flattening in each meridian. At two months post-treatment, the patient’s corneal astigmatism was largely reduced, and the subjective correction was cyl -0.50Dx8° with uncorrected visual acuity (VA) of 20/20.  

One case report used a hexa-curve (i.e., six back curves) design with two back toric zones, as well as optic and landing zones for a 44-year-old patient with mixed astigmatism in which the cylindrical component was greater than the spherical, the patient presented with +1.00 -2.00x180° OD and +1.25 -2.25x180° OS. The vertical meridian was steeper than the horizontal meridian in the midperipheral landing zone and vice versa in the optical zone. Three months after ortho-k fitting, the subjective correction was +0.50 -0.50x10° (uncorrected VA of 20/16) OD and +0.25 -1.00x3° (uncorrected VA 20/16) OS.  

In a more recent case report, a 48-year-old female presented with -0.75 -2.50x170° add 1.50D OD and -1.50 -1.50x20° add 1.50D OS. Her best-corrected VA was 20/16 in both eyes. The patient’s cylindrical component was three times larger than the spherical component in the right eye, while the two were equal in the left eye. Also, she had refractive astigmatism higher than corneal astigmatism (i.e., -1.82D OD and -1.39D OS) and low eccentricity. The lens fit was a tetracurve toric with optical, reverse and landing zones. According to the author, having the cylindrical component three times higher or equal to the spherical component and the refractive astigmatism greater than the corneal astigmatism was necessary for the toric optical zone. The toric reverse and alignment zones promoted the negative and hydrodynamic forces needed for treatment, better stability and centration of the lens.  

While these reports are not conclusive, they do illustrate that various designs have proven useful for specific patients presenting with-the-rule, against-the-rule or oblique in any axis astigmatism up to -4.00D. Additionally, they show that possibilities exist for correction of different corneal and refractive toricity, as well as limbus-to-limbus astigmatism.  

Having a wide range of toric ortho-k lens designs available expands the therapeutic options for the vast majority of patients. Practitioners can also design their own lenses, whether through contact lens fitting simulations in free style upon the corneal map with topography; empirical fitting software using keratometry and eccentricity through topography and refraction data; or downloadable topography software. Evidence suggests children and adolescents with astigmatisms up to 4.00D in all directions, even limbus-to-limbus, can benefit from ortho-k and myopia control, as toric ortho-k lenses have proven to be efficient in reducing moderate-to-high astigmatism and slowing axial elongation.  

As eye care practitioners (ECPs), we are often faced with the question, “How old does my child need to be before he can wear contact lenses?” Although answers to this question will vary, most doctors feel confident in fitting children older than 10 in contact lenses. Younger children such as toddlers (from one to three years of age) can also be safely and successfully fitted in contact lenses when they are necessary to enhance visual function or provide therapeutic benefits. Important considerations when fitting children in contact lenses include: the benefits of lenses for the child, the risks associated with fitting the child in contact lenses and whether the child and parents are ready for contact lens wear. Although fitting pediatric and adolescent patients in contact lenses seems intimidating, these patients are often less complex and more compliant than adult patients. Unpackaging these considerations can boost your clinical knowledge and give you the confidence to care for this patient population.

**Benefits to Fitting Pediatric Patients**

For the adult population, improved cosmesis is one of the most common reasons patients choose contact lenses over spectacles—and the same could be said about pediatric patients. The ACHIEVE study found children wearing contact lenses felt significantly better about themselves in the areas of athletic competence, social acceptance and physical appearance compared with study participants wearing spectacles.

In children who are not compliant with spectacle wear because of cosmetic concerns, contact lenses can lead to an overall improvement in compliance with refractive correction. This is particularly important for children with significant refractive errors, as contact lenses will increase the field of view particularly well in patients with a high refractive error. Patients with corneal irregularities or high refractive errors may experience improved visual acuity and comfort with contact lenses. Children with significant anisometropia benefit from the decrease in aniseikonia with contact lens wear compared with spectacle wear, which not only decreases asthenopia, but also can improve binocularity.

**Concerns for Clinicians**

One of the first concerns that many practitioners have when fitting children in contact lenses is the potential increase in chair time. Contrary to popular belief, fitting a young child does not necessarily take more time than fitting an older child or an adult. The Contact Lens In Pediatrics study found that it takes, on average, only 15 more minutes to fit children age eight to 12 compared with children older than 12. Most of this extra time was spent on insertion and removal training, a task that can generally be delegated to staff members.

Another notable concern clinicians have in fitting children—particularly younger ones—in contact lenses is the risk of an adverse event. However, younger children are actually less likely to have an adverse event during contact lens wear than teenagers and young adults, and microbial keratitis is uncommon in this population.

**Ready or Not (to Wear Contacts)**

Determining if a child is ready for contact lens wear is one of the most challenging parts of the fitting process. Although most parents ask at what age we begin fitting contact lenses, the patient’s age is generally not the limiting factor. The pediatric population is not homogeneous, and each patient must be treated individually. While some children as young as seven may prove ready for contact lens wear, some adolescents are not good candidates.

Often to the caregiver’s surprise,

**About the Authors**

Dr. Jenewein completed a residency in pediatrics and binocular vision at Nova Southeastern University. She is an assistant professor at Salus University Pennsylvania College of Optometry.

Dr. Bhagat is a faculty member at the Pennsylvania College of Optometry at Salus University. She specializes in managing ocular surface disease and fitting specialty contact lenses.
From infancy to adolescence, contact lenses prove a viable and beneficial treatment option for a range of conditions.

By Erin C. Jenewein, OD, MS, and Kriti Bhagat, OD

the best resource for answering the question of a child’s readiness is the parents or guardians themselves. Questioning parents about the overall responsibility level of the child will help to determine if the child is ready for the responsibility of contact lens wear. Are they able to take responsibility for homework or chores at home? Does the child make their bed every morning and keep a clean room? Will they remember to remove the lenses before bed every night and clean them properly? The parent can also give insight into the child’s personal hygiene, which can impact their ability to properly care for contact lenses.

Both patient and parent motivation is essential to successful lens wear in pediatric patients. If a child is reluctant to wear lenses, it can be challenging to successfully fit them in contact lenses. Similarly, if a parent is reluctant to allow a child to wear lenses, it may be an indication the parent realizes the child is not ready for contact lens wear.

SPECIAL INDICATIONS
Some pediatric patients who may not be ideal candidates for contact lens wear may, nevertheless, need to be fit in contact lenses to improve vision, comfort or binocularity. The overwhelming benefits of contact lenses over spectacles in these patients may make contact lens wear the best option for the pediatric patient, regardless of the patient’s age. In these cases, parental motivation and support is the key to successful contact lens wear. Children who are aphakic—either from congenital aphakia or from cataract removal at an early age—are often fit in contact lenses as infants or toddlers. Infants and toddlers with extremely high refractive error or high amounts of anisometropia may benefit from contact lens wear to improve acuity and binocularity.

Contact lenses can also be used for penalization therapy in amblyopia, either by overplussing the non-amblyopic eye to cause blur significant enough to switch fixation to the amblyopic eye or using a lens with an opaque pupil to occlude the non-amblyopic eye. When using the plus therapy, the lens-induced blur must be greater than the blur experienced by the amblyopic eye.

Additionally, tinted lenses can be fit for patients with achromatopsia or other cone dystrophies to decrease photophobia and enhance color perception. Patients with achromatopsia often prefer red, magenta or brown lenses in lieu of wearing tinted spectacles. Although the contact lens tint can be seen under the slit lamp, it is not detectable under normal viewing conditions, providing a more cosmetically appealing option. Colored lenses can decrease photophobia, improve vision and provide better cosmesis for patients with iris abnormalities such as iris coloboma and aniridia.

Pediatric patients with corneal irregularities may experience better vision as well as increased comfort with contact lenses.

CHOOSING THE RIGHT LENS
Options for fitting children in contact lenses are similar to those with any other age group. Soft lenses are the most commonly used modality for general refractive cases such as myopia, hyperopia and regular...
astigmatism. Many manufacturers offer extended range parameters for patients with high amounts of myopia and hyperopia, keeping the overall cost to a minimum for the patient and avoiding the need to switch to custom soft lenses.

Daily lenses decrease the likelihood of contact lens-related adverse events. Daily disposables can also be easier for children to handle, eliminating the need for cases and solution bottles.3

Children with aphakia, significant corneal cylinder, irregular corneas or ocular surface disease can be fit with rigid gas permeable lenses, including scleral lenses. When fitting rigid lenses in children, it may be beneficial to use a Burton lamp or a Bluminator for lens evaluation outside of the slit lamp. This allows the child to sit comfortably in a stroller or parent’s lap during the lens evaluation. Prosthetic contact lenses are an option for children with iris or corneal irregularities. These lenses can help decrease photophobia, diplopia or improve cosmesis.

**INSERTION AND REMOVAL**

Training in the pediatric population can be slightly more challenging than in adult patients. Parents or guardians should be present to listen to the instructions given to the pediatric patient so the parent also learns about proper contact lens care in case they need to assist the child. This is crucial for children too young to insert and remove the lenses themselves, as the parent will be handling this process for the child.

With every new pediatric patient, there is always an insertion and removal training in-office. For parents of infants and toddlers, clinicians should stress the importance of having a secure hold of the infant’s head and body. Many times, this becomes a two-person effort, as one person holds the infant while the other inserts or removes the contact lens.

For children able to insert and remove lenses on their own, clinicians should begin by emphasizing the need to wash your hands before insertion and removal. Generally, the practitioner places the lenses first, so the child will have the lenses in during the fitting process. Therefore, training will entail teaching removal skills first, followed by lens storage and ending with insertion techniques. It is important to guide the child the first time to help increase confidence and then let them do it on their own. This will show them they can do it and indicate they may be ready to take the lens home.

Clinicians should watch the child insert and remove the lenses at least twice before dispensing. This ensures patient and parent have the proper technique and are comfortable with the lenses. If the first training is unsuccessful, stop before the patient and parent become frustrated and have them return to attempt training on a different day.

Laying a towel over the sink drain can help young patients avoid losing lenses, and labeling solution bottles and contact lens boxes and cases carefully can avoid misusing the solution or wearing incorrect lenses.

**COMPLIANCE**

Children are more likely to share their lenses with friends, so it is important to educate them that they cannot do so with anyone else or allow anyone try their lenses on. As with any medical device, compliance is always an issue. A handout that details how lenses are to be worn and the proper care method can help with this. Written instructions that includes the solution names, replacement schedules, wearing time and signs and symptoms of common complications can be extremely helpful. Regardless of age, clinicians should also warn against swimming in lenses, and stress the need to always rub the lenses with solutions, store them with new solution each night and replace the case every three months.

Many pediatric patients can easily and safely use contact lenses, even young children, with proper oversight. Contact lenses can provide improved confidence, better visual acuity, higher levels of comfort and better potential for binocular vision in pediatric patients. Although fitting young children can be intimidating at first, it can be equally rewarding for both the patient and practitioner. 

IT’S TIME TO SEE A SPECIALIST.
(For your practice, that is.)

If you’re like many medical practitioners, you provide first-rate patient care—but when it comes to running your private practice, excellence doesn’t always come as easily. That’s because operating a small business requires a completely different skillset—one that you’ll build in the one-of-a-kind MedPRO360 business education program. In one day, you’ll learn how to boost your overall profitability with proven strategies in marketing, management, analytics, human resources and more. Learn from the pros and give your practice the level of care it deserves—the good health of your business is worth your attention.

Medical professionals in all fields will benefit from this intensive program.
REGISTER TODAY at www.seco2017.com/medpro360

MARCH 1, 2017
Georgia World Congress Center | Atlanta, GA

BONUS! Program registration includes a FREE one-year subscription for the recorded sessions—so you can refresh your knowledge on demand!
Although it may not seem common, the prevalence of congenital cataracts ranges from one to 15 per 10,000 children. Approximately one-third of congenital cataracts are inherited, while the remaining causes are associated with in utero drug reactions, systemic diseases such as rubella and measles or idiopathic. In addition to obstructing vision, congenital cataracts may cause other complications including pediatric glaucoma and strabismus. For at-risk patients, cataract surgery is indicated; however, there is some uncertainty regarding the best age to perform the surgery. Generally, cataract extraction should be performed around six weeks of age for unilateral cataracts and between six and eight weeks for bilateral cataracts with a one- to two-week period between surgeries for each eye.

Post cataract surgery, eye care providers face the challenge of finding the proper refractive correction to reduce the risk of amblyopia. If sufficient capsular support is present, intraocular lens (IOL) implantation can be performed once the patient is two years of age. However, contact lenses can be fit on infants and may even be a preferable long-term option. The Infant Aphakia Treatment Study Contact Lens Experience, which compared contact lens correction for unilateral aphakia with IOL implantation for children between one and six months of age, showed visual acuity outcomes were similar at age one and four and a half. The rate of adverse events was lower in the study’s contact lens wearers, and few patients in that group required additional intraocular procedures.

These outcomes demonstrate that contact lenses are a viable option for managing aphakia—and rushing into IOL implantation is not always the right answer for patients who are less than ideal candidates.

Choosing a lens
Silicone elastomer soft contact lenses are commonly used in the early treatment of aphakia; however, they present challenges that may be exacerbated when treating the pediatric population: (1) while highly permeable to oxygen, they are prone to surface deposits, (2) limited power and fitting parameters can make it difficult to properly manage a patient and (3) financial costs associated with contact lens replacement, either due to power changes or lens loss, can result in poor compliance and follow up. Gas permeable (GP) lenses are a great resource for managing aphakic infants. Due to infants’ small corneal diameter and narrow lid fissures, they can easily tuck underneath the taut lids and stay in place. They are available in a wide range of prescriptions and can be customized to the desired power and base curve. They are durable and simple to handle, often making it easier on parents to insert and remove.

Although GP lenses provide the least incidence for microbial keratitis, lens loss and ocular irritation tend to be the most common issues with this lens material.

Fitting GPs for aphakia
Because most patients are initially examined under anesthesia, corneal measurements, keratometry values and a refraction by retinoscopy should be available prior to the contact lens fitting appointment. When fitting a patient in GP lenses, clinicians should select a base curve that is 1mm to 1.5mm steeper than the flattest keratometry reading—a value based off the Infantile Aphakia Treatment Study Protocol. Evaluating the fluorescein pattern may lead to a change in base curve. The overall lens diameter is usually 10mm or larger, although this can vary depending on the patient’s corneal diameter. The optimal fitting lens displays a well centered alignment fit, with adequate edge clearance evidenced by an approximately 1mm band of fluorescein around the lens edge. Topical anesthetics to facilitate the contact lens fitting evaluation, and during insertion.

Although it may not seem common, the prevalence of congenital cataracts ranges from one to 15 per 10,000 children. Approximately one-third of congenital cataracts are inherited, while the remaining causes are associated with in utero drug reactions, systemic diseases such as rubella and measles or idiopathic. In addition to obstructing vision, congenital cataracts may cause other complications including pediatric glaucoma and strabismus. For at-risk patients, cataract surgery is indicated; however, there is some uncertainty regarding the best age to perform the surgery. Generally, cataract extraction should be performed around six weeks of age for unilateral cataracts and between six and eight weeks for bilateral cataracts with a one- to two-week period between surgeries for each eye.

Post cataract surgery, eye care providers face the challenge of finding the proper refractive correction to reduce the risk of amblyopia. If sufficient capsular support is present, intraocular lens (IOL) implantation can be performed once the patient is two years of age. However, contact lenses can be fit on infants and may even be a preferable long-term option. The Infant Aphakia Treatment Study Contact Lens Experience, which compared contact lens correction for unilateral aphakia with IOL implantation for children between one and six months of age, showed visual acuity outcomes were similar at age one and four and a half. The rate of adverse events was lower in the study’s contact lens wearers, and few patients in that group required additional intraocular procedures.

These outcomes demonstrate that contact lenses are a viable option for managing aphakia—and rushing into IOL implantation is not always the right answer for patients who are less than ideal candidates.

Choosing a lens
Silicone elastomer soft contact lenses are commonly used in the early treatment of aphakia; however, they present challenges that may be exacerbated when treating the pediatric population: (1) while highly permeable to oxygen, they are prone to surface deposits, (2) limited power and fitting parameters can make it difficult to properly manage a patient and (3) financial costs associated with contact lens replacement, either due to power changes or lens loss, can result in poor compliance and follow up. Gas permeable (GP) lenses are a great resource for managing aphakic infants. Due to infants’ small corneal diameter and narrow lid fissures, they can easily tuck underneath the taut lids and stay in place. They are available in a wide range of prescriptions and can be customized to the desired power and base curve. They are durable and simple to handle, often making it easier on parents to insert and remove.

Although GP lenses provide the least incidence for microbial keratitis, lens loss and ocular irritation tend to be the most common issues with this lens material.

Fitting GPs for aphakia
Because most patients are initially examined under anesthesia, corneal measurements, keratometry values and a refraction by retinoscopy should be available prior to the contact lens fitting appointment. When fitting a patient in GP lenses, clinicians should select a base curve that is 1mm to 1.5mm steeper than the flattest keratometry reading—a value based off the Infantile Aphakia Treatment Study Protocol. Evaluating the fluorescein pattern may lead to a change in base curve. The overall lens diameter is usually 10mm or larger, although this can vary depending on the patient’s corneal diameter. The optimal fitting lens displays a well centered alignment fit, with adequate edge clearance evidenced by an approximately 1mm band of fluorescein around the lens edge. Topical anesthetics to facilitate the contact lens fitting evaluation, and during insertion.
A two-month-old female patient was referred for a contact lens evaluation following cataract extraction. The patient presented wearing a Silsoft Super Plus (Bausch + Lomb) 7.5 base curve, 11.3 overall diameter (OAD) and +32.00D power—inserted by her cataract surgeon for extended wear until she could be seen by a specialty contact lens fitting optometrist.

At the first contact lens visit, retinoscopy showed a +4.50D over-refraction. Examining the contact lens fit using a 20D lens and transilluminator revealed adequate centration, good movement and full corneal coverage. Although an adequate fit, the Silsoft contact lens has a maximum power of +32.00D, and a GP contact lens was considered in the near future.

The parents were trained on insertion and removal of the soft contact lens and advised to remove the lens each night and clean it with a hydrogen peroxide solution. An online video on insertion and removal was recommended in case at-home review was necessary. A multipurpose solution safe for immediate contact with the eye was also dispensed in the event the lens required immediate cleaning.

**RECHECK**

Two weeks later, during the recheck, retinoscopy revealed an over-refraction of +4.50D. Examination demonstrated good centration and movement of the contact lens. Because the patient needed additional plus power, a GP contact lens fitting was initiated.

The initial lens trialed was a 6.75 base curve, 8.5 OAD and +20.00D. Examination using a blue light demonstrated a steep fit with bubbles and poor centration. Flatter diagnostic lenses were trialed until an apical alignment or minimal apical clearance pattern was evident. Over-refraction was completed and the new power was determined by adding an additional +3D to ensure the patient was left 3D myopic. A larger OAD lens was ordered, along with a larger optic zone to maintain alignment pattern and improve centration. The new lens parameters were 7.34 base curve, 9.20 OAD and +40.00D.

**DISPENSING**

On the dispensing visit, the lens was slightly too steep and was decentering temporally. A few modifications to the base curve assisted with centration and overall fit. The parents were trained on GP insertion and removal, and hydrogen peroxide solution was recommended for lens care. Once the lens was finalized, a spare lens was ordered and dispensed as well. The patient was followed every one to two months initially, then by three-month intervals once lens changes became less frequent. She was routinely seen by the pediatric ophthalmologist and prescribed aggressive occlusive therapy for amblyopia management.

At age two, the patient returned for a contact lens evaluation. The lens power was modified to correct for distance, and overlay polycarbonate unilateral bifocals were prescribed for full-time wear. The patient was seen every three months until age three, then followed every three to six months.
Corneal Collagen Crosslinking: Not Just for Adults

Treatment plans for pediatric patients with keratoconus may get an upgrade soon with this newly approved technology.

Corneal collagen crosslinking (CXL) is quickly becoming a first-line approach for managing progressive keratoconus in adults, accelerated by the FDA’s approval of the Avedro system in early 2016 for patients older than 14. CXL photosensitizes the collagen of the corneal stroma and increases its biomechanical rigidity, thus halting or possibly reversing the progression of keratoconus. But adults aren’t the only ones in need of treatment. A retrospective study to determine the incidence and presentation of pediatric keratoconus (younger than 14) found that over a five-year period, 541 of 2,972 patients were diagnosed with keratoconus—an incidence of 0.53%, representing 2.96% of all cases diagnosed during that time. In comparison, the incidence in the adult population is 3.78%.

Because studies evaluating the efficacy of CXL have focused on adults, the incidence and severity of keratoconus in children is poorly understood, as is the potential role for CXL in the pediatric population.

PEDIATRIC CHALLENGES
Treating children presents a number of unique challenges. Most management strategies successful with adults, such as specialty contact lenses, are less so with children, given complications such as difficulty with wear and care compliance and poor outcomes with corneal transplantation. Keratoconus in children is often associated with vernal keratoconjunctivitis and eye rubbing, which can lead to hydrops, so care must be taken to quell the surface inflammation with topical anti-allergy and steroid drops.

Additionally, keratoconus in children tends to be more severe at initial presentation and progresses more quickly than in newly diagnosed adult patients. A retrospective study of 49 patients younger than 15 and 167 older than 27 with keratoconus at initial presentation found the disease was more severe at diagnosis in subjects in the first group: 27.8% were already at stage 4 using Krumeich’s classification, as compared with 7.8% of adult subjects. In comparison, the incidence in the adult population is 3.78%.

CXL IN KIDS: THE LITERATURE
Given the difficulties in fitting the pediatric population with contact lenses and the greater propensity for full thickness corneal graft rejection, CXL could be the answer, as preliminary studies indicate it stabilizes the disease process and reduces the need for keratoplasties. So far, three studies have evaluated the efficacy of CXL—with a standard epi-off treatment—and the progression of keratoconus in the pediatric population. Patients were pretreated with topical anesthesia and removal of the corneal epithelium, followed by a soak of 0.1% riboflavin/20% dextran solution (varied from 10 to 30 minutes) and then 30 minutes of UVA irradiation (six times for five minutes each), with instillation of riboflavin/dextran every five minutes. Post-procedure, antibiotic and cycloplegic drops were instilled, along with a bandage contact lens. Some children required general anesthesia, while others required only topical.

One study evaluated patients age 10 to 18, divided into two groups by corneal thickness: less than 450µm and greater than 450µm. At 36 months post-CXL treatment, no adverse events were reported and both groups showed an improvement in uncorrected Snellen visual acuity, topography and coma. There was a faster functional response in patients with thinner corneas.

Another study evaluated the refractive, topographic, aberrometric and tomographic results in patients ages nine to 18 for up to two years. There was a slow but continuous improvement of most of the indices up to 24 months after surgery, with no adverse events noted.

Finally, a study evaluating patients age nine to 19 for progression of keratoconus and the efficacy of CXL up to three years postoperatively found 88% exhibited progression (an increase in the maximum keratometry of at least 1.00D over a one-year period). The researchers analyzed maximum keratometry...
values, corrected distance VA, corneal thickness and the keratoconic index. They found the maximum keratometry value was reduced by three months and remained for up to 24 months. However, at 24 months, it began to show progression, suggesting pediatric corneas do not allow for long-term improvement, although the best-corrected distance VA continued to be better than pre-CXL.\(^9\)

One study performed transepithelial (epi-on) CXL on 13 eyes in patients ages eight to 18.\(^8\) While the procedure was safe, well tolerated and the corrected distance visual acuity was improved at 18 months of follow-up, it did not halt the progression of keratoconus as seen with the standard epi-off treatment.\(^9\)

This research suggests keratoconus in pediatric patients is more severe and progresses more quickly than in adults, and standard CXL is safe and effective, although perhaps more transient, in patients younger than 18.

More studies with longer follow-up are needed, but it appears CXL can be seriously considered in our treatment of keratoconus for patients as young as 14.\(^8\)

Noncompliance is one of the biggest problems with aphakic management. Loss of contact lenses, poor fit and cost of lenses are some reasons for noncompliance in pediatric patients.

Although managing aphakia can be challenging, clinicians should consider GP lenses due to their reasons for noncompliance in pediatric patients. Close follow up is imperative for success with GP contact lenses in managing infantile aphakia. The corneal radius and diameter rapidly change during infancy, resulting in several lens changes throughout the first year.

Questions regarding photophobia, irritation, excessive blinking, redness or discharge should to be addressed at each visit. Contact lens wearing time should be gradually increased starting with a few hours initially until wear time during all waking hours is achieved.


A New Year, a New Look at the Cornea

Learning to recognize the processes that govern corneal health and function will allow you to gain a deeper understanding of pathologies and their treatments.

Imagine a new patient presenting to your office with a painful eye and profoundly reduced acuity. There is no infiltrate, but the cornea appears hazy, perhaps edematous, though it’s difficult to tell. What would your working diagnosis be? What happens to your diagnosis if the patient is an extended wear contact lens user? What if they qualify their pain as superficial, or deep? What if they had a corneal transplant to this eye six months, or even 20 years, ago? What if they had a transplant, but to the fellow eye? Finally, what happens if your original treatment fails?

These situations come up periodically in my clinic and each subtle variation in history should generate a separate primary differential and treatment. Transitioning smoothly among these differentials, being able to separate the important clinical finding or historic element from the red herring, is key to effectively managing these patients.

Welcome to my first edition of Corneal Consult, a column in which I hope to explore the diagnostic and therapeutic challenges we face when dealing with corneal pathology and provide real-world, clinically useful practice pearls each edition.

In my first column, I’d like to introduce myself and share my background, training and current clinic environment, as well my future goals for this column.

MY CLINICAL WORLD

Most of you (statistically, it’s closer to “all of you”) don’t know me. I’m Aaron Bronner, an optometrist working in the Kennewick, Wash., office for Pacific Cataract and Laser Institute (PCLI), a multicenter, comanagement group.

PCLI was one of the first comanagement groups in the nation and was one of the earliest to perform Medicare-approved outpatient cataract surgery. Our mission statement is to provide the best care possible to our optometric referral network, and we deal exclusively with referral-based care.

At my facility, beyond the standard menu of cataract and refractive surgeries, we provide surgical and medical corneal care for a large part of Eastern Washington and Oregon. In addition to the 100 or so great ODs I work with indirectly through comanagement, I work directly with two skilled optometrists, Brian Johnson and Bruce Flint, and five gifted, gracious ophthalmologists, Jim Guzek, Jason Leng, Loren Seery, Ron Sugiyama and Marshall Ford—they all bear mentioning because they are, unwittingly, contributors to this column. (Thanks, guys!)

At PCLI, ODs maintain some level of involvement at all levels of perioperative and medical care—even in very complex medical cases, we stay involved with clinical decision making and will collaborate with our MDs rather than simply referring to our MDs for consultative services. It’s an exciting, sometimes stressful, way to practice and provides a phenomenal opportunity to continue learning. I hope to draw on this experience and make this column as useful to the readers as possible. In addition to clinical responsibilities, I also teach residents though the Jonathan Wainwright VAMC clinic in Walla Walla, Wash., and you’ll be reading about them from time to time.

MY INTERESTS

I became interested in both corneal care and teaching during my residency, which was performed at Davis Duehr Dean Eye Care in Madison, Wis., about 10 years ago. During my residency, I rotated through some amazing ophthalmologic clinics; I spent about half of my time in the cornea clinic of Chris Croasdale, MD. During this time, I realized that, despite my training, I was a fish out of water with complex surgical or severe corneal disease cases—they were so far outside my experience I couldn’t formulate effective diagnoses or treatments.

After taking a mental accounting of how and why I was struggling, my initial step to remedying the situation was to observe Dr. Croasdale’s approach to clinical problems. First of all, he just knew way more than me. Given where I was in my career path, and where he was in his, there was nothing I could do about this gap—research and continued learning were the only tools I could use to help narrow that difference to a more acceptable margin.

But there was one area I could address immediately: the stark difference in how we mentally approached cases. He employed what I’d call a process-driven approach, while I, at the time, used a results-driven approach.

MY FIRST PRACTICE SHIFT

My results-driven approach to clinical cases was perfected by four
years of optometry school and its incumbent testing. I had learned to assess each finding not as a process taking place within the eye, but only as a piece of a puzzle that, once put together, led to a diagnosis—finding X is tied to diagnosis Y. In essence, I simply memorized a large number of findings and their respective diagnoses, and if a case I encountered showed enough associated findings, I would have a diagnosis. At its root, this results-driven approach was not based on any actual understanding of pathologic and physiologic processes, but on memorization. Perhaps this was less elegant, clinically, than an in-depth understanding of pathophysiology, but it was effective much of the time and was adequate during school.

Dr. Croasdale, however, approached cases quite differently. Rather than focusing exclusively on a finding tied to a diagnosis, his process-driven strategy emphasized what pathologic and physiologic process the finding represented within the eye.

This was a revolutionary discovery for me. By shifting from my own memorization-based approach to Dr. Croasdale’s process-driven approach, I focused on understanding the processes taking place and realized a deeper understanding of the pathology and the appropriate diagnoses, which was particularly useful for cases that weren’t textbook.

Though both of these approaches work when a clinician is familiar with the underlying diagnosis, the results-driven approach breaks down immediately when faced with an unfamiliar constellation of findings on non-textbook presentations.

**MY COLUMN GOALS**

I have two goals for this column. First, I hope to share some of these diagnostic and therapeutic associations and hopefully help you, too, realize a deeper understanding of what is actually taking place in corneal pathologies and their respective treatments. I believe understanding mechanisms involved will encourage a process-driven approach and benefit you in clinic.

Second, I’d like to revisit some of the vast corneal findings we learn about in our training. The nature of our optometric education requires us to assimilate so much information so rapidly that it becomes impossible to assign the appropriate context to register all of it in our long-term memory. I hope to re-explore some of these findings and help assign more clinical relevance to them to allow better recall.

It takes a certain amount of ego to think you can offer to teach a similarly credentialed group of colleagues, and academic lecturing is not my intention in these pages. A smart person once told me that “study is a means to an end, it isn’t the end itself.” As ODs, academic knowledge supports clinical practice, not the other way around. So while occasionally the column may delve into academics, I will always attempt to tie it back into a concept with clinical value. Each of the concepts I will discuss started as something I was initially unaware of, and upon learning the concept, felt it helped shape my clinical thinking. I enjoy presenting information in a new manner, and I hope you enjoy the column and learn as much from my experiences as I have. Cheers!
Daily disposable lenses have revolutionized our patient care. Not only do our current contact lens wearers benefit from daily disposable lenses, but also those new to contact lenses or those who are interested in wearing them on a part-time basis. Other than daily replacement, there are a number of other indications when daily disposables may be appropriate, including:

**Solution sensitivity.** Individuals wearing a frequent replacement lens not approved for extended wear require multipurpose disinfecting solutions to care for their lenses. Some individuals may experience solution sensitivities over time. Removing care solutions by prescribing daily disposable lenses will often alleviate the signs and symptoms associated with solution sensitivity.

**Compliance issues.** Research demonstrates a clear link between noncompliance with manufacturers’ recommended replacement frequency (a common problem with frequent replacement lens wearers) and a degradation in contact lens comfort levels.

In addition, studies show most individuals do not clean and replace their storage solution appropriately. Daily disposables help avoid these challenges, as cleaning and storage are not required. Further, at least one study shows daily disposable lens wearers are the most compliant of all lens wearers.

**Medical history.** Certain medical conditions such as seasonal allergic conjunctivitis warrant consideration for daily disposable lenses. After treating the underlying condition, daily disposable lenses are a beneficial option, considering allergens and other immune complexes commonly seen in the tears of allergy sufferers will be disposed of at the end of the day.

Giant papillary conjunctivitis (GPC), in particular, is a much more chronic form of allergy that usually requires more aggressive medical therapy. GPC is typically caused by excessive deposition on contact lens surfaces, causing an immunological response of the conjunctival tissue and leading to “giant papillae.” Removing care solutions by prescribing daily disposable lenses will often alleviate the signs and symptoms associated with solution sensitivity.

**NEW TECHNOLOGIES**

With so many advantages to daily disposable lens wear, it is no wonder that we are more frequently reaching for this modality with our contact lens wearers. Limited parameter availability has traditionally hindered our ability to fit a number of our contact lens wearers for daily disposable lenses. But, in the last several years, contact lens manufacturers have introduced a variety of technologies that allow our patients to have an enhanced daily disposable lens wearing experience through new materials and the availability of multifocal and toric contact lens options.

The availability of toric contact lens options in a daily disposable modality is critical when fitting the contact lens neophyte, including pediatric patients. One study disproved the preconceived notion that patients younger than 13 cannot wear contact lenses. The advent of daily disposable astigmatism designs offers more individuals the comfort and convenience our spherical lens wearers currently enjoy.

**ASTIGMATISM**

Healthy ocular findings, high motivation and maturity are the markers of a good pediatric candidate for astigmatic correction through contact lenses. These daily disposable astigmatism correcting contact lenses are well suited for any individuals requiring astigmatic correction, especially children:

- **1-Day Acuvue Moist for Astigmatism (Johnson & Johnson Vision Care).** This lens material is the same technology in the 1-Day Acuvue Moist spherical lens: etafilcon A and 58% water. It provides stability through a blink stabilized design based on a dual thin zone,
along with additional stabilization factors that interact with both the upper and lower lid. The orientation markers are located at the six and 12 o’clock position (Figure 1). Notably, there is no fear of placing this lens upside down on the eye; either orientation will feel identical to the patient and provide the same visual experience.

- **Biotrue OneDay for Astigmatism (Bausch + Lomb).** This lens is made of the same material as its spherical predecessor, the Biotrue OneDay lens: nesofilcon A and 78% water content. It contains polyvinylpyrrolidone (PVP) that facilitates the high water content and polyoxamer 407, which helps retain moisture and prevent dehydration on the lens. The lens is stabilized on the eye with a peri-ballast design and has a light blue visibility tint. The orientation marker on this lens is located at the six o’clock position and is easily seen at the slit lamp. A fine laser-etched mark indicates the axis of the lens.19

- **Clariti 1 Day Toric (Cooper Vision):** This lens is a silicone hydrogel daily disposable made of sofsoftcon A and is 56% water. The material is the same as that in the Clariti 1 Day sphere and multifocal lens.20 The modulus of the lens is relatively low for a silicone hydrogel lens, which makes it feel similar to a hydrogel when handling the it. The stability of the lens is created through a prism ballast design in addition to a back surface toric profile. The orientation marker is located at the six o’clock position, making it easily visible at the slit lamp.

- **Dailies AquaComfort Plus Toric (Alcon).** This lens is made of nelfilcon A and is 69% water, the same as the Dailies AquaComfort Plus sphere and multifocal lenses. This lens contains hydroxypropyl methycellulose, which aids in initial comfort. Additionally, moisturizing agents polyvinyl alcohol and polyethylene glycol are released from the lens throughout the day.21 The lens is stabilized through a dual thin zone along with a back surface toric design with scribe marks located at the three and nine o’clock positions. There is also an “OK” inversion indicator on the lens (Figure 2). The back of the “K,” located 90 degrees from the horizontal meridian, can be used as an indicator of rotation.

With the growing number of daily disposable toric lens options, we can provide more patients than ever with the benefits they bring, especially for new contact lens wearers and children. Make use of these ever-improving options when appropriate to offer your pediatric patients the benefits of a daily disposable lens.22

---

Shown here is a 26-year-old female patient who previously underwent penetrating keratoplasty (PK) for *Acanthamoeba* keratitis (AK) unresponsive to medical therapy. The graft size is larger than average due to the advanced state of the AK ulcer and the need for sufficient border zone of healthy, unaffected tissue. She is two years out from the transplant with all her corneal sutures removed, although the broken suture remnants visible here will permanently remain in her cornea. Healing response to graft placement is positive, with no evidence of rejection or failure. The corneal scarring and suture fragments will not affect vision. However, the retained suture fragments could provide a vector for microbial infection, requiring heightened vigilance from both the clinician and patient.

**CALL FOR ENTRIES:** Do you have great clinical images of fascinating cases you would like to share with your colleagues on this page and online? Send large, high resolution photos (corneal disease or contact lens wear only) and a brief case description to: photos@jobson.com.
“A game changer for my patients and my practice, has been the implementation of HVID testing and the Extreme H2O contact lenses.”

extremeH2O®

The only molded disposables available in three diameter options.

Studies show that 27% of patients (one out of every four patients) has an HVID that is outside the normal range of 11.3 to 12.3. These patients could experience improved comfort if fit in a smaller or larger diameter lens that is more HVID appropriate. Despite this fact, most contact lenses come in one standard diameter which overlooks this large segment of your patient base.

We are the ONLY manufacturer to combat this issue by offering Extreme H2O Daily and Extreme H2O Weekly in three diameters: 13.6, 14.2 and 14.8. This enables you to get the right fit on all your patients for improved comfort.

3D-Comfort®

13.6 Smaller Corneas - a smaller 13.6 diameter provides the right fit on smaller eyes.

14.2 Average Corneas - provide improved comfort with an ultra-hydrating material that keeps eyes moist and comfortable all day long.

14.8 Active Lifestyles - a larger 14.8 diameter is more stable and less likely to decenter or fall out during athletic activity.

Contact X-Cel Specialty Contacts to learn more
877.336.2482 | www.xcelspecialtycontacts.com
Pick the winner that makes loving lenses easy for your patients. Recommend the bubbling power of CLEAR CARE® PLUS.

To learn more, visit clearcareprofessional.com.

PERFORMANCE DRIVEN BY SCIENCE™