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A How-To Guide: Scleral GP Lens Care
From non-preserved saline solutions to eliminating bubbles before insertion, gas-permeable lenses have their own rules for successful wear.
Susan J. Gromacki, OD, MS

AN OUT OF THE BOX
What Culture Defines Your Office?
Gary Gerber, OD
R.I.P. RGP?
Several times over the past 20 years, Dr. Nathan Efron has predicted the total demise of rigid gas-permeable (RGP) and gas-permeable (GP) contact lenses. Well, we have yet to see that occur. I would, however, like to predict the demise of corneal GP lenses.

On the basis of my, as of now, only marginal experience with scleral lenses approximately—44 fits since January 2011— I ask: As contact lens fitters, why do we need corneal GP lenses when we have experienced the rebirth of the scleral lens, in highly gas-permeable materials, generated by algorithms on computer-driven lathes? This question is even more pertinent when you consider that these new lenses are more comfortable, stable and harder to lose or break; they are simply a more elegant device than corneal lenses.

—Bezalel Schendowich, OD
Optometrist and contact lens specialist
Sha’are Zedek Medical Center, Jerusalem, Israel

Dr. Efron Responds:
I appreciate Dr. Schendowich’s keen interest in my writings on the future of rigid contact lenses. However, I must make one important correction to his opening statement: Many years ago, I predicted the virtual (not total) demise of rigid lenses. The essence of my prediction was that, by the year 2010, rigid lenses would cease to be a mainstream form of contact lens correction and would essentially only be prescribed for specialty fittings (i.e., keratoconus, post-trauma, etc.). Now, international rigid lens prescribing data has shown this prediction to be correct: New rigid lens fits represent less than 5% of all contact lenses prescribed in 40 nations surveyed over the past five years.1

In the light of this overwhelming evidence, I have even published an obituary for rigid lenses!2

Dr. Schendowich refers to the “rebirth” of scleral lenses and suggests that this may reinvigorate rigid lens fitting. The statistics tell another story. The prescribing data referred to above shows that these new scleral lenses represent 0.05% of all rigid lenses prescribed—hardly a ringing endorsement for this lens type.2

Dr. Schendowich mentioned comfort when describing the success of this new generation of scleral lenses. However, comfort is a relative sensation. It might be true that comfort with these lenses is greater than with conventional corneal GP lenses. This is because scleral lenses are large and stable on the eye, whereas GP lenses move with blinking and buffet against the lid margins—the main source of discomfort. But what is also important is that rigid lenses of any form, including scleral lenses, are far less comfortable than soft lenses; this largely accounts for the dominance of soft lenses in the marketplace. The other benefits of new-generation scleral lenses mentioned are unlikely to offset the discomfort factor when it boils down to patient choice.

Instead, perhaps there is a psychosocial reason for Dr. Schendowich’s recent success with scleral lens fitting. The median age of contact lens wearers in Israel, where Dr. Schendowich works, is 27 ± 9 years, which means that most contact lens wearers are engaged in, or have recently completed, compulsory military service. Are these tough, young Israeli patients really going to complain to Dr. Schendowich about discomfort caused by a little piece of plastic in their eyes?

—Nathan Efron, PhD, DSc
Research Professor
Institute of Health and Biomedical Innovation and School of Optometry and Vision Science, Queensland University of Technology, Australia.

Don’t Forget to Look ‘Em in the Eye

Eyes can reveal a range of emotions that can help you better treat your patient.

Peering into patient’s eyes has become so second nature to us that, as eye care practitioners, we seldom think about the importance of eye gazing beyond the practicality of collecting diagnostic information. But eyes can reveal an abundance of information about the life of the patient. A wise clinician will take advantage of this opportunity to emotionally connect through the old adage, “Look a person in the eye.”

Modern medical clinicians and other health care personnel are continually becoming more efficient in record keeping and data collecting. Unfortunately, these digital notes do not translate to improved patient rapport. In 2010, Lisa Gualtieri, PhD, ScM, assistant professor in the department of Public Health and Community Medicine at Tufts University in Boston, penned, “Doctors need more eye contact with patients, not computers,” after one of her recent doctor visits, where a nurse sat at a laptop and fired away a series of questions without once looking over while typing.1

Pamela Ressler, RN, BSN, HN-BC, founder of Stress Resources and adjunct faculty member at Tufts University, indicated that medical professionals have prioritized information gathering over communication. “While it is essential to collect information to arrive at a correct diagnosis, simply collecting information without addressing the human experience creates disconnection instead of connection, often leading to dissatisfaction by both the patient and provider,” she said.

The reality is that our schedules are tight and our time is squeezed even further as the amount of information we are mandated to record increases. This, in turn, results in less patient interaction, which is disatisfying for both the patient and the doctor. But, there are some things we can do to show our patients that they are valued and are important to us. Here are some ideas:

• Establishing good communication skills can improve patient outcomes. When patients are engaged, they better understand direction and are generally more compliant. This translates to improved eye health.

• Time your eye contact. Lee Hopkins, author of “Non-Verbal Communication in Business,” suggests breaking eye-to-eye contact into five-second increments. That is, look at the other person for five seconds, then look away. By doing so, you won’t intimidate your patients. I suggest practicing to perfect the timing.

• Look for social cues and follow up with questions. When you look into your patient’s eyes, you may see confusion, worry, fear, sadness, frustration, uncertainty or disapproval—emotions that are easy to read in your patient’s eyes. Follow up the observation by asking if you can clarify something, or acknowledge the apprehension and ask if you can provide more guidance. This simple step can go a long way in developing long-lasting patient relationships.

• Redesign your patient rooms. As we know, the implementation of electronic health records requires adding computers into the exam rooms. Danny Sands, MD, MPH, director of healthcare for Cisco Systems, says eye care practitioners should work around it. When there is a computer in the room, it is part of the conversation. Therefore, it must be positioned in a way that it can be a part of the conversation without being an imposition; Dr. Sands said to think of it as if there is another person in the room. The computer should be the apex of an equilateral triangle with the human participants as the vertices. If using a tablet, the computer should be held by the optometrist, as the patient sits by his or her side.

“Too often, the computer is an intruder in the room and the goal of the clinician is to interact with the patient as a means of entering appropriate information into the machine,” says Dr. Sands.1 To achieve this, it may be necessary to rearrange the exam room to better facilitate eye contact while using the computer. Better yet, hire a scribe, if possible, to do the record taking while you do the communicating.

Philosopher Marcus Tullius Cicero put it best when he said, “Ut imago est animi voltus sic indices oculi”—The face is a picture of the mind, with the eyes as its interpreter. We must remember that it is a privilege to be able to connect with our patients, establish mutual respect and build a long and satisfying patient-doctor relationship.

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A Complete Lens Display

Have you even imagined being able to look up directions without having to take out your phone? Or reading a text directly from your lenses? Well, the technology is not quite there yet, but researchers are making big strides.

Belgian researchers have unveiled a new spherical, curved liquid crystal display (LCD) that can be embedded in contact lenses—the first step toward a fully pixelated contact lens display. Unlike LED technology, which is limited to a few pixels, LCD can use the entire surface of the lens. This could convert a contact lens into adaptive sunglasses or a display. This technology could also be used for cosmetic purposes or in medical applications, such as to control light transmission toward the retina in damaged irises.

“The main challenge was to create a very thin, spherically curved substrate with active layers that could withstand the extreme molding processes,” Jelle De Smet, head researcher for the project, said in a press release. This was accomplished by using new types of conductive polymers that were integrated into a smooth spherical cell.

The technology is currently only capable of creating simple patterns, such as the dollar sign unveiled in the prototype. Since the eye cannot focus on anything that is in that close a range, the display would only be visible to others—for now. Future applications of this technology have been compared to Google’s Project Glass, minus the headgear.

An Early Morning Regimen

For patients using 30-day extended wear/continuous wear lenses, a new study advises morning replacement. The data shows that replacing lenses at night is comparable to replacing lenses monthly, but replacing lenses every morning reduces the overall rate of ocular adverse events.

The study evaluated 215 patients using silicone hydrogel EW/CW lenses; the lenses were designed for overnight wear, but the patients put in fresh lenses every day (either at night before going to bed, or in the morning after waking). Patients were evaluated at regular clinic visits and the adverse events were compared between those who replaced lenses at night or in the morning vs. a previously studied group who wore the lenses continuously for a month.

Results showed a 4% adverse event rate for patients who replaced lenses in the morning and an 8% rate for those who replaced lenses at night vs. a 9% rate for the monthly wear patients. Furthermore, morning lens replacement was associated with a 1% rate of mechanical adverse events (i.e., scratches and abrasions of the cornea) vs. a little more than 5% with monthly replacement.

Researchers concluded that replacing lenses at night does not have a beneficial effect, perhaps due to the side effects of handling lenses just prior to overnight eye closure. The complete study was published in the December issue of Optometry and Vision Science.
It’s That Time of Year Again

A diligent eye exam and the availability of new lenses will help you keep patients in their contact lenses this allergy season.

With allergy season around the corner, our practices will soon see the return of runny, itchy and swollen eyes en mass. Allergies are not pleasant for anybody, and the irritation only intensifies when you add contact lenses to the equation. It’s no surprise then that most contact lens wearers avoid their lenses and revert to wearing glasses during the allergy season.

The good news is that the battle is not over and there is still hope for the contact lens wearers. They don’t need to wave the white flag. As technology continues to evolve, we now have a host of lens options and treatment paradigms to better manage your allergy-suffering patients.

Proper management of contact lens patients benefits both the patient and the practice. In fact, the prevalence of allergic conjunctivitis has been estimated to be as high as 40%, and discomfort, a common symptom in allergic conjunctivitis patients, is the most common cause associated with contact lens dropouts. Each contact lens dropout costs an optometric practice an average of $21,695 over the lifetime of that patient. These dropouts can be alleviated by working with your patients to find an appropriate treatment plan and contact lens system customized to their needs. To start, eye care practitioners should be very comfortable in recognizing the classic signs and symptoms of ocular allergy. This may be challenging since ocular allergic disease can be difficult to distinguish from other masquerading eye conditions. Depending on the location, the signs and symptoms of allergic conjunctivitis can often have common characteristics with other forms of ocular surface disease, including redness and inflammation.

The key symptoms of allergic conjunctivitis include itching, tearing, burning, foreign-body sensation and ocular dryness. Itching is the hallmark symptom. If it is absent, the diagnosis of allergic conjunctivitis should be questioned. Seasonal allergic conjunctivitis is often caused by pollen and typically peaks during the spring and summer months, whereas perennial allergic conjunctivitis can last throughout the year and is often instigated by such irritants as dust mites, pet dander and mold.

Talking with Your Patient

Start by establishing an open line of communication with your patients about allergies and how it affects their contact lens wear. Taking a proactive approach with your patients will help minimize the negative impact of allergic conjunctivitis on successful contact lens wear. A key component of any ocular allergy evaluation is a comprehensive ocular and medical history—this will establish whether a condition is acute, subacute, chronic, recurrent, or related to seasonal or environmental exposure.

Other clues are provided by the presence of recent upper respiratory tract infection, foreign body exposure, trauma and systemic or topical medication use (including vasoconstrictors and artificial tears). When collecting a thorough history, be sure to include questions about the daily environment, whether the allergies are a seasonal issue, at what point in the day the allergies are at their worst, and whether your patient takes any systemic medications.

An Appropriate Treatment Plan

After a comprehensive patient history has been recorded, start discussing appropriate treatment plans for your patient’s allergies and create a customized approach to his or her lens wear. Remember that your patients who suffer some chronic allergy symptoms may require complete disease resolution prior to lens continuation. For patients who have seasonal allergies that make lens wear difficult during certain times...
comfort for patients with ocular allergies when they were fit with daily disposable contact lenses.\(^4\)

Often, the best defense is a good offense. With peak allergy season around the corner, now is a good time to reevaluate contact lens-wearing patients who have ocular allergies. Whether your patient has previously worn contact lenses and discontinued wear due to allergies, is a first-time contact lenses wearer or is currently suffering with allergy-related discomfort, prompt education and treatment is critical.

Differiating between allergic disease and other ocular issues, conducting a comprehensive patient questionnaire and establishing an appropriate treatment plan are crucial steps to take when working with an allergy sufferer. Factor in today’s new lenses and your practice will be equipped with the ability to drastically reduce contact lens dropouts.\(^1\)


of the year even with medication, it may be optimal to discontinue use for a short period of time and resume wear when the symptoms taper off. Once daily antihistamine/mast cell stabilizer combinations, such as Pataday (olopatadine 0.2%, Alcon) and Lastacaft (alcaftadine 0.25%, Allergan), are optimal due to the convenient dosing schedule.

After identifying the proper therapeutic action, the next step is to customize your patient’s lens wear. Note: Allergy sufferers can wear contact lenses, even though it may seem impossible. Popular daily lenses, such as Acuvue Moist (Vistakon) or Dailies AquaComfort Plus (CIBA Vision), are great alternatives for allergy sufferers. Many patients appreciate the convenience and the comfort of having a new lens every day. This modality is safer than their two-week and one-month counterparts because the lenses collect less of a build-up of allergic irritants, and the regimen encourages a much higher compliance rate. One study reported a significant increase in comfort for patients with ocular allergies when they were fit with daily disposable contact lenses.\(^4\)
Once you have the right tools to gauge a patient’s satisfaction with contact lens wear, progress is possible.

If your car’s gas gauge had merely two settings—“empty” and “full”—you’d be at a great disadvantage on the roads. Luckily, your dashboard includes a finely graduated scale that tells you how much you have in the tank at any moment. Wouldn’t it be great if our patients also gave us such precise information? Actually, they can, if you know how to ask.

Because contact lens wear is a subjective experience, patient feedback is an essential tool that helps us fine-tune the results. If we can elicit specific, measurable data from patients, we stand a better chance of keeping them happy and healthy contact lens wearers. This month’s column will focus on how to quantify the factors that matter to patients—a critical yet under-used tool that will help improve patient care by minimizing contact lens dropouts.

The Value Scale

From contact lens solutions and drops to major advances in materials and modalities, we have an unprecedented opportunity to make our patients comfortable in their lenses. When do you introduce these products to your patients?

Think about the last few contact lens patients who visited your practice. Maybe they were using non-optimal solutions, materials and/or outdated lens design for their particular vision correction needs. When asked about their contact lens experience, did they reply with a vague “good” or “fine” as a response? These one-word answers that our patients use to describe their wearing experience make it difficult to understand what truly is happening.

There are two key components to successful contact lens wear: vision and comfort.1,2 So, how can you get an accurate understanding of your patient’s wear experience? Instead of ambiguously asking your patient how his or her vision is, try to specifically ask about the quality of the vision. Even more helpful, ask your patient to quantify the quality of his or her vision and comfort level so you can determine whether there may be an opportunity for improvement.

Present your patient with a scale ranging from zero to 10 (with zero being vision without contact lenses and 10 being the best the vision can be). Then ask your patient to rank the overall quality of his or her vision. Similarly, next ask your patient to rank his or her comfort level in the lenses. Any score below a perfect 10 should jump-start a conversation on new ways you can improve your patient’s lens wearing experience.

Implementation

The importance of quantifying a patient’s experience through a scale can be seen in a number of instances. For example, the Ocular Surface Disease Index (OSDI) allows a patient to quantify his or her “level” of dry eye symptoms.3 Also consider that in clinical research, participants are often asked to quantify their experience with some scaling system to help expose differences that may exist between treatment groups. Why is that? Two individuals who may address directed questions with the same one-word answer, such
as “good,” might respond very differently when given a scale to rate their experience. A scale helps us answer the follow-up question: How “good” was the experience?

If we can accurately understand our patient’s wear experience, we can better engage our patients in meaningful communication regarding new technologies in solutions, drops and lenses and their potential to improve comfort and vision.

A last word of advice: Follow up with your patient after you have changed some part of the lens regimen. We always begin by asking our patients to rate their experience with both their previous and their new regimens. This will give you a direct comparison to gauge the level of success or failure with the new option.

Quantifying a patient’s level of satisfaction or dissatisfaction with their lens-wearing experience creates a context for realistic discussions about their continued lens wear. Whether it is accomplished via a formal questionnaire that is completed with the history intake form or verbally with your paraoptometric or yourself, this information will give you a better understanding of your patient’s wearing experience and help derail dropouts.

Cystaran: A Cystine-Depleting Treatment

Although occurrences are rare, eye care practitioners should learn how to spot and effectively treat cystinosis.

Eye care practitioners are intimately familiar with the ocular manifestations of systemic diseases. However, some diseases like cystinosis are so rare that we may have never seen a presentation in our office.

What is Cystinosis?
Cystinosis is an inherited, autosomal recessive metabolic disorder of chromosome 17, in which the amino acid cystine is improperly transported out of the body’s lysosome cells. This causes cystine deposition in multiple organs, including the eye. The symptoms of cystinosis may present at any age, and the condition affects both genders and all ethnic backgrounds. There are only about 2,000 known individuals with cystinosis in the world—600 of those live in the U.S.1

If left untreated, children with cystinosis undergo kidney failure and die before age 10.2 So, how can you make the diagnosis? Slit lamp biomicroscopy reveals refractile, polychromatic corneal deposits, along with subjective symptoms of glare, photophobia, blepharospasm and recurrent corneal erosion.3 Visual acuity usually remains good.4 Rui Tavares, MD, and colleagues performed confocal microscopy on a 20-year-old female with infantile cystinosis and described the corneal crystals, found primarily in the anterior stroma, as hexagonal, needle-shaped and hyper-reflective. Cystine crystals can also be found in the iris, conjunctiva and the retina.5

Oral cysteamine, Cystagon (cysteamine bitartrate, Mylan), was FDA approved in 1994 for the management of nephropathic cystinosis in children and adults. Cysteamine works by converting cystine to cysteine and cysteine-cysteamine mixed disulfides, which are able to cleave lysozmes, thus reducing corneal cystine crystal accumulation. However, it is unable to prevent crystal formations in the cornea due to poor penetration.

Introducing Cystaran
In October 2012, the FDA approved Cystaran 0.44% (cysteamine ophthalmic solution, Sigma-Tau Pharmaceuticals), a topical ophthalmic drop for the treatment of patients suffering from corneal cystine crystal accumulation secondary to cystinosis. Cystaran has been manufactured since 1995 under the FDAs orphan drug provision for pharmaceuticals developed specifically for a rare condition.6

From 1986 through 2012, the clinical safety and efficacy of Cystaran was evaluated in 300 patients who were enrolled in controlled clinical trials at the National Institutes of Health. Patients underwent an eye exam that included tests of retinal function and evaluation of visual acuity, night vision and color vision, age permitting. They were prescribed cysteamine eye drops in both eyes for every waking hour.

Patients were seen daily for the first week, and yearly thereafter. Slit lamp photos were taken and a corneal cystine crystal score (CCCS) was calculated to assess the effects of treatment—absent or minimal corneal crystals were graded 0.0 to 0.25, while visible crystals were graded up to 3.00.7 The primary clinical efficacy endpoint was the response rate of eyes that had a reduction of at least one unit in the photo-rated CCCS when baseline CCCS ≥1, or a lack of an increase of more than one unit in CCCS when the baseline CCCS <1. Study 1 combined the data from three smaller studies: Eyes with a baseline of CCCS <1 had a 13% response rate and eyes with a baseline of CCCS ≥1 had a 32% response rate. Study 2 found a 62% response rate in ocular cystinosis patients who had a baseline of CCCS ≥1. Study 3 found a 33% response rate for ocular cystinosis patient eyes with a baseline of CCCS ≥1.7

The most frequent ocular adverse reactions include sensitivity to light, redness, ocular pain/irritation, headache and visual field defects.

Cystaran is dosed one drop in each eye, every waking hour. Because it contains benzalkonium chloride, contact lenses should be removed prior to application and reinserted 15 minutes after use. Cystaran is supplied in a 15mL opaque bottle. Unopened bottles must be kept frozen and then thawed for 24 hours prior to use. All bottles must be discarded after one week of use. Currently, Cystaran is available only through specialty pharmacy distribution channels.8

With the recent approval of topical Cystaran, patients suffering from cystinosis can effectively reduce or eliminate the deposition of corneal crystals and ease some of the ocular symptoms.9

References are available at www.reviewofcontactlenses.com.
New research into corneal staining associated with multipurpose solutions has sparked a name change and a new understanding among practitioners. Formerly known as solution-induced corneal staining (SICS), the new term—preservative-associated transient hyperfluorescence (PATH)—reflects that this is neither true corneal staining nor an indication of lens/solution bioincompatibility.

What is PATH?
PATH is asymptomatic transient superficial corneal staining associated with the release of biocides from a contact lens. Importantly, it has not been correlated with pathology, infection or inflammation of the cornea. The staining has an onset between 30 minutes and four hours after lens insertion, and resolves within six to eight hours.\(^1,2\) In contrast, true corneal staining has a longer duration, varies in depth and fluorescein take up, and may have stromal streaming. It is also associated with other signs, such as hyperemia or infiltrates and future complications.

Contact lens solution preservatives—such as polyhexylmethyl biguanide (PHMB), Polyquad and Aldox—are absorbed into all soft contact lens materials, albeit in different amounts depending on the lens material, the specific preservative and the formulation of the care product.\(^3,4\) The various preservatives are then released from the lens at different rates. The Polyquad and Aldox release is greatest at 30 minutes, while PHMB is released between one to four hours after absorption.\(^5,6\) The release rates depend on the preservative and the lens material and coincides with the peak observable PATH.

Positively-charged molecules, such as the cationic preservatives in contact lens solutions, are attracted to the negatively-charged fluorescein (FL). Recent research suggests that the cationic lens solution biocides may associate with the anionic sites on the corneal epithelium and, concurrently with the anionic fluorescein, effectively bond the fluorescein to the corneal epithelial surface. The FL and preservative bonding strength varies between the different types of preservatives; FL with Polyquad is weaker than FL with PHMB.\(^7\)

There may be predisposing factors that can increase one’s susceptibility to preservative-associated staining. One study found that 36% of contact lens wearers were “stainers.”\(^7\) Furthermore, there were no significant differences between stainers and non-stainers in regard to age, sex, refraction or keratometry. Stainers were more likely to show upper and lower palpebral hyperemia and tarsal roughness. The study did find that poor tear quality was related to preservative-associated staining.\(^7\)

The varying uptake and release patterns of the preservative in the lens/solution combinations, as well as the intrinsic strength of the preservative bond with either the cornea or FL, and the status of the tear quality, help explain the transient nature and high degree of variability of this phenomenon. It is important to differentiate PATH from the more clinically significant staining that results from pathological conditions so that appropriate intervention—monitoring, lens/solution changes or medical treatment—can be administered.\(^8\)


A new understanding of preservatives in solutions can help practitioners better differentiate the presentation of corneal staining.
Aesthetic Treatments for Anesthetic Corneas

Consider a scleral lens for neurotrophic corneas, particularly those with persistent epithelial defects.

Neurotrophic keratitis can be one of the more difficult corneal conditions to manage. It is a rare degenerative disease caused by an impairment of trigeminal corneal innervation, which then leads to corneal anesthesia.

The most common causes of neurotrophic keratitis are viral infection by either the herpes simplex or herpes zoster viruses, followed by chemical burns, physical injury and, ultimately, surgical complication.¹

These cases can be difficult to manage, despite our best efforts. Many times corneal defects develop and worsen despite careful monitoring and therapeutic intervention. On the other side, watching corneas develop scarring, large and deep defects that can lead to deteriorating vision and perforation in some cases can be unattractive. In this month’s column, I will suggest an aesthetically pleasing way to manage individuals with this condition.

A Case Study

A 52-year-old white male was referred to my office for a corneal evaluation. His history was significant for the development of herpes zoster of the right branch of V1 four months prior to his visit. Lesions erupted and subsequently became infected with Staph. At the time of his presentation, he still had many open lesions on the right side of his scalp.

Approximately one month prior to his visit, he noticed issues with his right eye. He developed blurry vision, a burning sensation in the right orbit and mild photophobia. He was initially treated with artificial tears; an antibiotic drop was later added. Despite the therapy, his vision continued to deteriorate.

His presenting acuity in the right eye was 20/100 with correction. A slit lamp examination revealed a small epithelial defect, as well as anterior stromal haze and mild tissue loss. At this point, I added prednisolone acetate 1% QID.

One week later, his eye had improved and his vision was up to 20/50 OD. He continued on this therapy and was stable for three weeks.

At a follow-up one month after his initial presentation, he reported that his eye was increasingly uncomfortable and his vision was once again deteriorating. His best-corrected acuity was 20/100 OD. He was still using the prednisolone acetate 1% QID, in addition to artificial tears and an antibiotic drop. Slit lamp examination at this visit revealed a 4mm x 1.5mm central epithelial defect just below the visual axis. Erythromycin ointment was added QID and he was scheduled to return in one week.

At the next follow-up, he reported improvement again. Vision returned to 20/60 OD and the epithelial defect measured 50% smaller than the previous visit.

At the next follow-up, he reported improvement again. Vision returned to 20/60 OD and the epithelial defect measured 50% smaller than the previous visit.

The same regimen was continued; in one week, the defect was larger but the patient did not have any worsening symptoms. I decided to place a bandage soft lens on the right eye and discontinue the erythromycin ointment.

Unfortunately, he had difficulty keeping the lens in place. Over a four-week period, we tried several lenses, including an 18mm soft lens, but all the lenses had dislodged within three days of placement. Autologous serum drops were added Q2H OD.

At the next follow-up (now two months after the original visit), the patient said he did not feel that the lenses were helping, and that his vision was getting worse. He was using autologous serum drops Q2H OD., as well as prednisolone acetate 1% TID OD and ofloxacin drops TID OD. His visual acuity was now 20/300 OD. Slit lamp examination revealed a 5mm x 3mm epithelial defect, as well as irregular epithelium over the remaining cornea. The anterior stroma was developing haze.

Desperate Measures

We had reached a point of desperation. I decided to fit the eye with a scleral lens to act as a protective device for the cornea.

Based upon the shape of the unaffected eye, he was fitted with a 46.00D, 18.2mm diameter scleral lens. The lens exhibited an estimated 400µm of vault. After an evaluation for proper fit, the lens was removed, coated with a low viscosity non-preserved artificial tear, and replaced. I instructed the patient to leave the lens in place, continue...
all of the same drops and return in 48 hours. He returned two days later reporting that he was tolerating the lens well, and that his vision was slowly improving—it was 20/100 OD, and the epithelial defect was 80% resolved. I removed, cleaned and replaced the lens, and instructed him to return in five days.

At the visit five days later, he reported continued improvement in comfort and vision. His vision had increased to 20/50 OD and the epithelial defect was completely closed (figure 1). The cornea still had a mild degree of haze and the epithelium was far from smooth, but improvement was obvious (figure 2).

We had him continue to use the lens on an extended basis and return weekly for removal, cleaning and replacement. I also instructed him to continue to use the autologous serum, prednisolone and ofloxacin QID.

He continued the extended wear of the scleral lens for three more weeks. After four weeks of continuous wear, we educated the patient on proper application and removal of the lens. He continues to use the lens daily, removing the lens at bedtime and inserting the lens upon waking. The epithelium has remained intact and his vision is 20/30 OD with the lens in place.

Treatment for neurotrophic keratitis has traditionally included artificial tears, antibiotic eye drops, steroid eye drops, tetracyclines, autologous serum drops, vitamin therapy, bandage lenses and tarsorrhaphy, depending on the condition and the severity.2,3 Scleral lenses—with their high degree of oxygen permeability, capability of holding a moisture chamber to the corneal surface, ability to vault over the cornea and avoid contact with the corneal surface, and large overall diameter for comfort and stability—seem to be a natural choice for treating these conditions.

What's The Solution
By Charles H. Aldridge, OD

It has been amazing to witness the technological advancements in contact lenses over the three decades that I have been in practice! The majority of our contact lenses today are made of silicone hydrogel materials that provide oxygen permeability to the cornea in amounts once thought impossible. However, this success would not have been achieved without the magic of engineering and design that work to minimize the two shortcomings of silicone hydrogel materials; namely, hydrophobicity and lipid deposition. Contact lens manufacturers have created very clever ways to make these contact lenses more hydrophilic and also resistant to troublesome lipid deposits, which in turn enhances comfort.

Many solutions in the marketplace were designed only to be used with older generation hydrogel lenses. Since these solutions all provided adequate disinfection, both doctors and patients alike assumed one worked as well as the other and would perform equally well with the new silicone hydrogel lenses. Unfortunately, this led to doctors failing to recommend one particular contact lens solution and, in turn, patients picking the least expensive option.

Although the advances in wetability and lipid deposit reduction were a positive step, patients still presented with dryness and lipid deposits on their silicone hydrogel lenses. This gave rise to the question, “Could the solution be the solution?”

OPTI-FREE® PureMoist® MPDS

With the debut of Alcon’s OPTI-FREE® PureMoist® MPDS, the debate seems to have settled with a resounding “yes.” The contact lens solution was specifically designed to address two complications of silicone hydrogel wearers—hydrophilic areas and lipid deposits. OPTI-FREE® PureMoist® MPDS uses the ALDOX® and POLYQUAD® dual disinfection system, and the HydraGlyde® Moisture Matrix. HydraGlyde® Moisture Matrix is a blocking co-polymer molecule that has two very distinct components: poly(oxyethylene) x [EO] and poly(oxybutylene) y [BO]. BO is tremendously attracted to dry surfaces, such as dehydrated areas on a contact lens surface, and will form a very strong bond with this area in the lens matrix, allowing for all-day wear. EO has a strong affinity for moisture. As the contact lens is soaked in OPTI-FREE® PureMoist® MPDS, the EO will pull moisture from the solution in the case and, in conjunction with BO, create a layer of moisture enveloping and adhering to what was a previously dry surface on the contact lens. This has been shown to last from insertion to removal of the contact lens.

OPTI-FREE® PureMoist® MPDS demonstrates clinical efficacy against lipid deposition. So how does HydraGlyde® Moisture Matrix continue to fight against lipid deposits? We know that lipid deposits bond to a dry contact lens surface. Interestingly enough, when lipids compete with the BO in the HydraGlyde® Moisture Matrix to bond to this dry contact lens area, the BO wins every time, effectively blocking the lipid from adhering to the contact lens surface. The end result is a significant reduction in lipid deposition.

By recommending OPTI-FREE® PureMoist® MPDS, I achieved enhanced wettablility and reduced lipid deposition. Not only is recommending OPTI-FREE® PureMoist® MPDS effective, but it is much easier than taking an optimal fit contact lens and refitting it into a different material to improve comfort. Even then, success is short-lived. Now I don’t change the contact lens, I change the contact lens solution.

References:
We frequently see patients with corneal disorders who need corneal transplant surgery, but surprisingly few actually undergo the procedure. Of the 10 million people worldwide who suffer from infectious and inflammatory eye diseases that result in corneal scarring and loss of best-corrected vision, only 1% receive corneal transplants. That's a rather poor showing in our efforts to combat the fourth leading cause of global blindness. Corneal disorders follow cataract, glaucoma and AMD—all eminently more treatable—in the rankings of vision-threatening diseases.

Fortunately, in the United States, we have some of the best facilities and specialists needed to perform corneal transplants; about half of all such procedures take place in our country. But collectively, eye care practitioners even here in the US should make a more concerted effort to bring these life-changing interventions to more people. Newer technologies and less invasive surgical techniques can make that possible.

This article will provide an overview of the different corneal transplant surgery techniques and resultant postoperative care.

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transplant surgeries, suitable candidates and recommended postoperative care.

Understanding Corneal Transplant Surgery
Keratoconus (and other non-inflammatory thinning disorders), pseudophakic bullous keratopathy and Fuchs’ dystrophy are three main indications for corneal transplantation in the Western world. Asia and Africa have a higher prevalence of infectious keratitis, corneal scars, late-stage endothelial disease and allograft rejection, naturally as a consequence of inadequate (or underserved) medical and surgical eye care in such regions.

Corneal transplant procedures include standard full-thickness penetrating keratoplasty (PK), endothelial keratoplasty (EK), anterior lamellar keratoplasty (ALK) and keratoprostheses. The clinical indications may be visual, structural, therapeutic, cosmetic or a combination. An important preoperative consideration in corneal transplant surgery is timing, because vision may be worse for up to six months after surgery. Complicating factors include eyelid disorders, dry eye, surface and intraocular inflammation, poor IOP control, previous grafts and incisions.

Success can be defined as better vision, less pain, comfortable spectacle or contact lent wear, reduced glare and, most importantly, an improved quality of life. Optometrists play a key role in the meticulous comanagement of the patient’s preoperative and postoperative care.

New Techniques and Technologies
New developments in corneal transplant surgery include limbal stem cell transplantation, femtosecond lasers, anterior and posterior lamellar keratoplasties, keratoprostheses and biosynthetic corneas.

• Limbal stem cell transplantation. Stem cell research will help determine the best type of limbal stem cell to transplant, the best method to transfer cultured cells to the eye surface and measures to decrease the risk of rejection through immunosuppressive therapies. Patients with multiple graft failures or those considered high risk for rejection may benefit from this procedure, which is currently available through ongoing research in academic clinical centers.

• Femtosecond lasers are increasingly useful for specialized donor or recipient tissue preparation for PK and EK, and particularly lamellar dissections for ALK. Femtosecond lasers allow the surgeon to more precisely measure and shape corneal tissue in graft preparation. As the enhanced quality and affordability of such lasers increases the value of using such technology, more surgeons will gravitate toward using it routinely for their corneal surgery patients.

• Lamellar keratoplasty. This surgery involves techniques to transplant an individual layer of the cornea and is evolving into the preferred surgical method for corneal disease. By replacing only the abnormal layer with a donor graft, the cornea is more structurally intact.

In some cases of EK, such as Descemet’s stripping automated endothelial keratoplasty (DSAEK) and Descemet’s membrane endothelial keratoplasty (DMEK), lamellar keratoplasty can eliminate surface incisions. The procedure is sutureless, which helps avoid suture-related complications and surface irregularities, and results in faster wound healing, smoother topography and quicker and greater visual stability.

There is lower risk of endothelial rejection with ALK; deep anterior lamellar keratoplasty (DALK) and superficial anterior lamellar keratoplasty (SALK) will essentially become steroid-sparing surgeries.

• Posterior lamellar endothelial transplantation. Currently known as EK, cases may be further categorized as either DSAEK or DMEK. Both procedures preserve the anterior to posterior stromal cornea and thereby avoid surface irregularities, suture-related issues and wound-healing complications associated with PK. Patients with chronic corneal edema associated with Fuchs’ dystrophy or pseudophakic bullous keratopathy comprise the vast majority of suitable candidates.

The 30- to 45-minute procedure may be performed alone or in combination with cataract surgery. Descemet’s membrane is stripped and the peripheral posterior stroma scored to allow adhesion of the donor graft, which has
been carefully sized by the surgeon through either manual dissection using a microkeratome (DSEK) or automated dissection using a femtosecond laser (DSAEK).

The graft in DSAEK and DSEK consists of posterior stroma, Descemet’s membrane and endothelium and is approximately 150µm thick. In DMEK, a more technically challenging procedure, the graft is thinner and consists only of Descemet’s membrane and endothelium—essentially a replacement of host with donor tissue. In both procedures, the donor endothelium is protected with viscoelastic as the delicate graft is carefully folded, inserted and centered in apposition to the host cornea. Sterile air is injected into the anterior chamber to promote attachment and stabilization of the graft, followed by wound closure and application of a pressure patch to complete the surgery. The typical follow-up requires a few more visits compared to cataract surgery and may even be daily from day one pending anterior chamber stabilization.

Postoperative comanagement involves looking for wound leaks, quantifying the percentage of air bubble in the anterior chamber, using a slit lamp to carefully look for graft separation by optic section, evaluating the degree of stroma edema, measuring IOP and ruling out pupillary block in patients with an air bubble in the eye. At the immediate post-op exam, visual acuity may be 20/200 or worse. Expect long-term gradual improvement even with mild interface haze present; by six months, the majority of patients see better than 20/40.

2. DALK with a running suture.

University of Erlangen-Nuremberg in Germany compared 38 DMEK to 35 DSAEK outcomes in a consecutive case series of patients treated for Fuchs’ dystrophy or pseudophakic bullous keratopathy. The results indicated that DMEK provided faster and more complete vision rehabilitation by six months, compared to DSAEK. However, there was no significant long-term difference in best-corrected visual acuity outcomes between DSAEK and DMEK.

• Anterior lamellar keratoplasty (ALK). This category of procedures, which includes deep anterior lamellar keratoplasty (DALK), sometimes involves the big bubble technique—when sterile air is injected between the corneal stromal lamellae to dissect out the abnormal diseased anterior layer. After the diseased anterior layers have been removed, the carefully sized donor graft is sutured into position with either a single running or interrupted sutures, or a combination of the two.

Suitable candidates for DALK include patients with thinning disorders (such as keratoconus, pellucid marginal degeneration and Terrien’s corneal degeneration), as well as patients with deeper stromal non-perforating corneal scars (such as trauma, post-corneal ulcer, herpetic disease with stromal involvement and shallow RK).

While poor lamellar candidates for DSAEK or DMEK include complex anterior reconstruction cases, phakic patients and angle closure glaucoma suspects, poor candidates for DALK include cases that involve both stromal and endothelial disease, hydrops in keratoconus, old scars through Descemet’s membrane such as deep RK with prior perforation, complex anterior reconstruction cases and prior PK. Patients considering ALK should be educated regarding the better long-term endothelial results, the relative uncertainty of a successful lamellar procedure and the possibility of converting to a full-thickness PK should the lamellar approach prove to be unsuitable at the time of surgery.

The progressive decay of endothelial cell counts after full-thickness PK was clinically demonstrated in a study that revealed that 17% endothelial cell loss occurs by two months post-op and 67% by 10 years. Other published research on corneal graft survival confirmed that in PK, there is a 90% survival rate at five years and that rate progressively diminishes at 10 years and dramatically thereafter; however in DALK, there is a 99.3% survival rate at 10 years and only 11% endothelial cell loss from six months to 10 years on average. Therefore, this steroid-sparing lamellar surgery has distinct advantages and should be considered in suitable candidates.

Postoperative comanagement involves looking for a double anterior chamber (treated by the surgeon with anterior chamber air injection) and stromal edema. Expect long-term gradual visual improvement even in the presence of mild interface haze.

• Keratoprosthesis. Advances in surgical techniques, improvements in material design and a better
understanding of the pathophysiology of immune rejection have allowed for the development of artificial corneas, or keratoprostheses. Patients with multiple graft failures or those who have a high risk of rejection (e.g., severe ocular cicatrical pemphigoid, Stevens-Johnson syndrome or severe chemical burns) are suitable candidates. The ideal keratoprosthesis would be inert and not rejected by the patient’s immune system, quick to implant, maintain long-term clarity, be easy to examine and allow an excellent view of the retina, while being relatively inexpensive.

The AlphaCor Artificial Cornea (Addition Technology Inc.) is a biocompatible, flexible, one-piece hydrogel implant with a porous periphery and a central optical element. First implanted in Australia in 1998 and FDA approved in 2003, it requires a complex two-stage surgical procedure with meticulous aftercare to reduce the risk of inflammation and stromal melt. Post-operative care is typically done by the corneal surgeon.

The Boston Type 1 Keratoprosthesis (Massachusetts Eye & Ear Infirmary), the most commonly used keratoprosthesis in the United States, has been under development since the 1960s. The design and therapeutic management has gradually been perfected, and received FDA clearance in 1992. Implantation is a one-stage procedure using a donor cornea. A collar button-shaped device consisting of a PMMA optic and a back plate with the donor tissue clamped in between is sutured into the trephined host cornea, similar to PK. Postoperative care typically involves placement of a large-diameter, extended wear bandage soft contact lens, lifelong prophylactic antibiotic (vancomycin), and careful comanagement that includes regular follow-up with the surgeon.

It is essential for optometrists to stay abreast of the most recent advances in corneal transplant surgery. This knowledge can then be used to educate patients and guide their clinical care. As specialized corneal transplant techniques and available technologies are further developed, patients suffering from visual disability will increasingly benefit from the improved surgical expertise of corneal surgeons. Furthermore, development of sound inter-professional relationships between optometrists and skilled corneal specialists will ultimately benefit the overall care of the patient.


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CE TEST

1. What percentage of the 10 million people worldwide who suffer from corneal scarring and loss of best-corrected vision receive corneal transplant surgery?
   a. 1%.
   b. 5%.
   c. 10%.
   d. 15%.

2. Common indications for corneal transplantation in the Western world include all of the following, EXCEPT:
   a. Keratoconus.
   b. Fuchs’ dystrophy.
   c. Recurrent corneal erosion
   d. Pseudophakic bullous keratopathy.

3. Associated adverse factors that may diminish the prognosis of obtaining a clear graft following keratoplasty include all of
CE TEST

the following, EXCEPT:
- a. Tear film dysfunction.
- b. Ectropion, entropion and trichiasis.
- c. Uveitis.
- d. Catarract.

4. What is NOT an example of corneal transplant surgery?
- a. Endothelial keratoplasty (EK).
- b. Penetrating keratoplasty (PK).
- c. Limbal stem cell transplantation (LSCCT).
- d. Deep anterior lamellar keratoplasty (DALK).

5. How is success with corneal transplant surgery defined?
- a. Reduced glare and better vision.
- b. Improved quality of life.
- c. Comfortable contact lens or spectacle wear.
- d. All of the above.

6. What is the benefit of femtosecond lasers in keratoplasty?
- a. Allow the surgeon to more precisely measure and shape corneal tissue in graft preparation.
- b. Allow lamellar keratoplasty (LK) when more suitable than PK.
- c. Allow PK when more suitable than LK.
- d. Enhanced value due to the cost of femtosecond lasers.

7. Why choose posterior lamellar endothelial transplant surgery?
- a. The procedure is technically easier than full-thickness PK.
- b. The procedure may be performed alone or in combination with cataract surgery.
- c. The procedure preserves the anterior to posterior stromal cornea and thereby avoids surface irregularities, suture related issues and wound-healing complications associated with PK.
- d. The procedure spares postoperative use of topical corticosteroids.

8. Who is NOT a suitable candidate for DALK?
- a. Patients with thinning disorders (such as keratoconus, pellucid marginal degeneration and Terrien’s corneal degeneration).
- b. Patients with deeper stromal, non-perforating corneal scars (such as trauma, post-coneal ulcer, stromal herpetic disease and shallow RK).
- c. Patients who may be considering future PRK, following stable keratoplasty.
- d. Patients with both stromal and endothelial disease, hydrops in keratoconus, old scars through Descemet’s membrane (such as deep RK with prior perforation), complex anterior reconstruction cases and prior PK.

9. Who is a suitable candidate for keratoprosthesis?
- a. Patients with multiple corneal graft failures or high risk for rejection.
- b. Patients with severe ocular cicatricial pemphigoid.
- c. Patients with severe chemical burns.
- d. All of the above.

10. What is the most commonly used keratoprosthesis in the United States?
- a. AlphaCor artificial cornea.
- b. Boston keratoprosthesis.
- c. Osteo-odonto keratoprosthesis.
- d. Biosynthetic cornea.
The resurgence of scleral gas-permeable contact lens fittings can be considered one of the most noteworthy contact lens developments in the past two years. With the advent of newer, more oxygen-permeable GP materials, the hypoxia that previously plagued the frequent use of this modality has been virtually eliminated. In addition, industry’s new manufacturing technologies have improved reproducibility and reduced cost, which have contributed to greater usage.

Because the reemergence of these lenses has been so recent, many of the frequently cited textbooks do not provide detailed instructions on proper handling and care. And what’s more, practitioners are divided on the issue. In a recent survey of experienced scleral lens fitters, 72% of optometrists prescribed GP solutions for lens storage vs. 48% who chose peroxide and 17% who recommended soft contact lens solutions.

From non-preserved saline solutions to eliminating bubbles before insertion, gas-permeable lenses have their own rules for successful wear.

By Susan J. Gromacki, OD, MS
(respondents were allowed to select more than one option). In addition, 72% recommended non-preserved saline solution for lens insertion, compared to 22% who preferred GP solutions, 7% who chose soft lens solutions, 7% who preserved with saline and 28% who answered “other” (primarily artificial tear supplements).1

This article will provide tips on how to handle and care for scleral GP lenses.

What are Scleral Lenses?

By definition, scleral gas-permeable contact lenses measure 12.5mm to 25mm in diameter. They are then further subdivided into three categories: corneo-scleral, mini-scleral and large-scleral (see Table 1, above).2

To provide a healthy, stable fit, scleral lenses are intended primarily to rest on the sclera, bridging over the cornea and bathing it in tears (figure 1). As a result, they can provide tremendous refractive, fit and comfort benefits for patients with keratoconus, keratoglobus, pellucid marginal degeneration, post-LASIK ectasia, post-transplantation and irregular astigmatism.

However, due to their large diameters and the manner in which they are fit, scleral lenses require very specific handling and care instructions.

### Table 1. Scleral Lens Categories and Lens Diameters

<table>
<thead>
<tr>
<th>Category</th>
<th>Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corneo-scleral*</td>
<td>12.5mm to 15.0mm</td>
</tr>
<tr>
<td>Scleral:**</td>
<td>15.0mm to 25.0mm</td>
</tr>
<tr>
<td>Mini-Scleral:</td>
<td>15.0mm to 18.0mm</td>
</tr>
<tr>
<td>Large-Scleral:</td>
<td>18.0mm to 25.0mm</td>
</tr>
</tbody>
</table>

*other names: corneal-limbal, semi-scleral, limbal
**other name: haptic

### Handling Guidelines

Scleral contact lenses need to be filled with solution prior to application. Although still considered off-label in the United States, most experienced scleral lens fitters (per the Scleral Lens Solution Survey) recommend non-preserved saline solution for this purpose.1,3,4 Because there is minimal tear exchange behind a scleral lens, the solution that is placed inside the lens prior to insertion must remain in contact with the cornea over the course of the day.

Therefore, it is important to prevent exposing the cornea to preservatives or buffers that may induce allergic or hypersensitivity reactions.5 However, you must instruct patients to avoid soaking their lenses overnight in non-preserved saline due to the risk of microorganism growth and subsequent eye infection.6 Also, be sure to educate patients on the potential for contamination within a bottle of non-preserved saline. This type of solution needs to be disposed prior to the expiration date and/or if the tip of the bottle comes in contact with any surface.

To eliminate the contamination risk entirely, many practitioners recommend off-label use of unit-dose artificial tears or 0.9% NaCl inhalation/irrigation non-preserved saline in 3ml or 5ml vials.5,6 The latter is free of preservatives and buffers, and can be purchased online or at most pharmacies.6,8

One of the most challenging aspects of scleral lens fitting and wear is the presence of air bubbles that commonly enter a lens upon insertion (figure 2). To avoid this, here are some helpful tips:

- Teach your patient to insert the lens into the eye with the face parallel to the ground.
- Instruct the patient to fill the entire lens to the edge or rim.3,5,7,8 This ensures that there will be enough fluid remaining if there is any spillage during application.
- For the patient who consistently loses solution prior to insertion, have him or her partially or completely fill the lens with a high-viscosity individual-use...
**Care Instructions**

Scleral lenses are prescribed primarily for daily wear and should be cleaned and disinfected nightly. Cleaning typically is performed manually with a daily cleaner that is suitable for GP lenses, such as Boston Cleaner (Bausch + Lomb), Boston Advance Cleaner (Bausch + Lomb), Opti-Free Daily Cleaner (Alcon) or Optimum Extra Strength Cleaner (Lobob). Less abrasive agents (e.g., Optimum Extra Strength Cleaner) or an isopropyl alcohol-based cleaner (e.g., Sereine Extra-Strength Daily Cleaner [Optikem International]) may be preferred for high-Dk materials. The cleaner then needs to be completely rinsed off with non-preserved saline solution. Keep in mind, the FDA recommends that tap water not be used for this rinsing due to its association with *Acanthamoeba* keratitis.

Disinfection is achieved by using a GP conditioning/disinfection solution, such as Boston Advance Comfort Formula Conditioning Solution (Bausch + Lomb), Boston Conditioning Solution (Bausch + Lomb) or Sereine Wetting & Soaking Solution (Optikem International). For patients who are minimal depositors, a multi-purpose GP solution such as Boston Simplus Multi-Action Solution (Bausch + Lomb), Menicon Unique pH (Menicon), Opti-Free GP (Alcon) or Optimum C/D/S (Lobob) may be used for both cleaning and disinfection.

Heavy depositors may require periodic protein removal with Boston One-Step Liquid Enzymatic Cleaner (Bausch + Lomb), Opti-Free Supra-Cleans (Alcon) or Progent (Menicon). Previously available in the United States for in-office use only, Progent is now FDA approved for patients to use at home.

Sensitive patients also may need to rinse the lens with non-preserved saline prior to application. While this removes any residual solution and its preservatives, it also has the potential to diminish wettability. Alternatively, they could use Clear Care (Alcon) for cleaning and disinfection. For GP lenses, Clear Care’s indication includes a digital rubbing step. Scleral lenses with 16.00mm diameters or less fit well into the Clear Care lens basket. For lenses from 16mm to 30mm, a larger case may be purchased online from the Dry Eye Zone.

3. Patients may use a plunger—placed on the edge of a scleral lens to release the negative pressure—to facilitate lens removal from the eye.

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**Table 2. Contact Lens Education Websites**

- www.contactlenses.org
- www.allaboutvision.com/contacts/contact_lenses.htm
- www.contactlens.com

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3. DeNaeyer G. Personal communication from Jul 29 to Aug 4, 2011 and on Nov 2, 2011.
The majority of contact lens patients today are fit in silicone hydrogel lens materials. These lenses, first introduced in the late 1990s, allow for increased oxygen to reach the cornea. But, as we all know, advances in contact lens materials alone cannot forestall all contact lens-related complications.

Even with the introduction of newer materials and solutions, noncompliance is still a challenge that manufacturers and eye care providers face. Research has shown that 40% to 90% of contact lens wearers are noncompliant in at least one aspect of their wear. When you consider that patients cite comfort as the primary reason for discontinuing contact lens wear, it is even more important for practitioners to prescribe the right pairing of contact lens material and contact lens solution to reduce complications.

This article will describe the three new silicone hydrogel-compatible multipurpose solutions available today.

The History of MPDS

Multipurpose disinfecting solutions have always tried to strike the appropriate balance between convenience and efficacy. Recognizing patient reluctance to use a two-step regimen, they allow patients to use a single product to rinse, disinfect and store their contact lenses. These solutions contain preservatives, buffering systems and disinfecting agents that decrease microbial activity while enhancing patient comfort.

It is important for eye care practitioners to be aware of how different contact lens materials react to various solutions. This interaction can play a key role in the overall performance of the contact lens. Three of the most recently introduced multipurpose solutions on the market today—Biotrue (Bausch + Lomb), Opti-Free PureMoist (Alcon) and RevitaLens OcuTec (Abbott Medical Optics)—have been specifically approved by the FDA for use with silicone hydrogel contact lenses. When recommending solutions for our silicon hydrogel lens wearers, it is important to select a solution that has adequate disinfecting properties—which helps rid the surface of proteins and lipids, while not compromising surface wettability.

The International Organization for Standardization (ISO), charged with grouping contact lenses for testing purposes, categorized lenses into four groups based on water and ionic content of the lens material. The FDA approved these categories in 1994. However, with the subsequent introduction of silicone hydrogel lenses to the market, it became obvious that...
these unique materials need their own group designation.

The ISO created a fifth group in 2009 to encompass all silicone hydrogel lenses. Efforts are currently underway to further subdivide group 5 based on lens porous structure, water content, lipid affinity/hydrophobicity, ionic charges, surface treatments and preservatives/surfactants differences.

In 2010, the FDA made new labeling recommendations for healthier contact lens wear: The terminology, “no-rub,” was to be removed from solution product labels and the importance of rubbing for proper cleaning was to be enforced by the practitioner.7

New Market Additions

• Biotrue is Bausch + Lomb’s newest addition to the multipurpose contact lens solution market. Designed to mimic the biology of the eye itself, this solution contains a pH level equal to that of healthy tears, which the manufacturer says minimizes irritation upon contact lens insertion. Biotrue contains hyaluronan, a naturally occurring lubricant found in tears, which increases contact lens wettability. It also includes dual disinfectants—polyquaternium-1 and polyhexamethylene biguanide—to enhance the solution’s antimicrobial activity by keeping lysozyme and lactoferrin active.8

• Alcon’s Opti-Free PureMoist is one of the newer multipurpose solutions to enter the market. It has similar disinfecting properties, polyquaternium-1 (PQ-1) with myristamidopropyl dimethylamine (Aldox), to other Opti-Free brand solutions but was designed to decrease corneal staining and promote contact lens end-of-day comfort.1 Opti-Free PureMoist has a higher concentration of Aldox (0.0006%) compared to Alcon’s Opti-Free Replenish (0.0005%). With a Polyquad and Aldox dual action disinfecting system, combined with the proprietary HydraGlyde Moisture Matrix wetting system, the manufacturers report a decrease in corneal staining, which may reduce a patient’s risk of microbial infection and enhance patient comfort. The solution also contains EDTA, a chelating agent. Contact lenses can be stored safely in this solution for up to 30 days.3

• RevitaLens OcuTec multipurpose solution from Abbott Medical Optics is the third new introduction to the market and reports a similar disinfection kill rate as hydrogen peroxide-based systems. But unlike hydrogen peroxide systems, which lose their effectiveness once neutralized, RevitaLens maintains its disinfecting properties for up to 30 days. The solution contains dual acting disinfecting agents—PQ-1 and alexidine dihydrochloride—and is considered >99.9% effective against Acanthamoeba trophozoites and resistant cyst stage, as well as other microbial pathogens.9

Keep in mind that current ISO standards do not require Acanthamoeba testing for new multipurpose solutions entering the market, but the FDA has recommended that this criteria be added.1 Research has shown RevitaLens sustains antimicrobial ability in noncompliant patients who “top off” the solution in their contact lens cases.10

Each system offers unique features, and this product class is developing a body of scientific evidence that may guide product selection in the future.11,12 For now, patients wearing a SiHy lens would likely do better with any product in this category than with a single disinfection system. Might these systems achieve parity with hydrogen peroxide disinfection, but in a more convenient and material-appropriate way? Time will tell, but there is cause for optimism.

The Generic Problem

Generic, or more appropriately termed “store brand,” solutions should not be considered equivalent to, or an appropriate substitution for, branded contact lens care systems.12

To some patients, generics appear more cost-effective, especially when they are available to be purchased in bulk. Adding to the confusion is that the same major manufacturers of contact lens solutions often supply most of the generic brands, so it is easy to believe the two are interchangeable. However, the store brands are often older versions of branded solutions with significant differences in chemical make-up, including key preservative changes. Store brands will typically keep the same name and label appearance from year to year even if they change producers—and, thus, the chemistry of the solution itself. Unless consumers compare the package inserts, most do not know what formulation of solution they are actually using when they purchase a generic or store brand contact lens solution.

While we continue to struggle with patient noncompliance and microbial resistance, new technology gives our patients a fighting chance.

Today’s available solutions—Biotrue, Opti-Free PureMoist, and RevitaLens OcuTec—have all demonstrated their compatibility with silicone hydrogel lenses. Informing our silicone hydrogel contact lens wearers about the benefits of the newest multipurpose solutions available will maximize corneal health and comfort, and minimize contact lens dropouts.13

Patients sit in our exam chair every day and describe ocular issues that run the gamut from a little blurry vision to sight- and even life-threatening conditions. As eye care practitioners, we focus on healing, alleviating discomfort and, at the very least, offering some palliative options. As exciting as it can be to immediately employ today’s supremely effective pharmaceuticals, it is important to remember that many cases can be managed appropriately with a high-quality artificial tear.

Ocular surface lubrication often is the key component to ensuring proper healing—both in the immediate (e.g., following refractive surgery) and the long-term (e.g., prevention of recurrent corneal erosions) phases of corneal regeneration. And of course a multitude of conditions in between, which we most often encounter, stand to benefit from copious lubrication as well.

For most practitioners, the problem is not offering artificial tears as an option but rather selecting the most appropriate one, given the clinical circumstances. We need to know and understand the artificial tear products on the market to prescribe the right one, as well as educate the patient as to why this particular option is ideally suited to their condition.

In this article, we’ll provide an overview of the different artificial tears and moisturizers on the market today, discuss how they differ, and explain why it is important to understand all the options available.

**The Artificial Tear Options**

ODs are well aware of the traditional model of human tears that separates the tear film into three distinct layers. The anterior lipid layer, containing oils secreted by the meibomian glands, coats the aqueous layer and provides a hydrophobic barrier that retards evaporation. Next, the aqueous layer—consisting of water and other substances, such as proteins secreted by Krause’s, Wolfring’s and lacrimal glands—serves to promote spreading of the tear film, control infectious agents and regulate osmotic forces. Finally, the inner-most mucous layer, secreted by the conjunctival goblet cells, coats the cornea with

Consider artificial tears as the “first responders” when treating patients who present with ocular discomfort.

By Gina Wesley, OD, MS, and Jason Miller, OD, MBA
a hydrophilic surface to allow for even distribution of the tear film.

Understanding the human tear can help us better differentiate artificial tear products by the layers they affect and their active ingredients. Because differing demulcent systems can have diverse effects when treating dry eye, we try to place these products into several clearly delineated categories:

- **Cellulose-based eyedrops** are the most common type of artificial tears. The advantage of cellulose is that it adds volume to the aqueous layer of tears. Examples include Refresh Tears and Refresh Liquigel (Allergan), and Tears Naturale and Genteal (Alcon).

- **Glycerin-based drops** are designed to help lubricate the ocular surface and increase the spreading of the tears by treating the aqueous and mucin layer of the tears. Examples include Refresh Optive (Allergan), Blink Tears (Abbott Medical Optics), Oasis Tears (Oasis Medical) and Systane Ultra (Alcon).

- **Emulsions or oil-based derivatives** include drops such as Systane Balance (Alcon), Refresh Endura (Allergan) and Soothe XP (Bausch + Lomb). These agents are designed to help replace the lipid layer of the tear film and prevent evaporation.

Associated challenges common to all the aforementioned products include difficulty in clearing the eye without disrupting vision, the risk of potentially washing out the tears too quickly, and the presence of ingredients that may cause burning and/or stinging upon instillation.

An eye care practitioner must be able to choose the right product for each specific condition or situation. For instance, a sudden-onset keratitis due to improper use of a contact lens solution may require a different type of tear product than what is necessary for a chronic dry eye patient, or someone who is suffering from severe meibomian gland dysfunction.

**Dry Eye**

It’s easy for some doctors—perhaps even a few optometrists—to dismiss dry eye as a mere nuisance, but keep in mind that moderate to severe dry eye can be debilitating for many patients. We most frequently prescribe artificial tear products to treat dry eye. But the question remains: Can rewetting drops or artificial tears provide prolonged relief? Also, what factors must we consider before application?

In 2007, the International Dry Eye Workshop Study (DEWS) defined dry eye as “a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability.”¹ Dry eye syndrome, accompanied by increased osmolarity of the tear film and inflammation of the ocular surface, is one of the most frequent eye conditions that we encounter in our practice. Females present with the disease two to three times more frequently than males.²

Lubricating drops may indeed help to relieve the problem, but they also can exacerbate the condition if the appropriate dosing and drop specifications aren’t prescribed. Remember to wet both the ocular surface as well as the contact lens. Rewetting agents for contact lenses are “surface active,” meaning that they are comprised of surfactants and other ingredients that increase the spreading and penetrating properties of the liquid by lowering its surface tension.¹ Some drops simply add more tear volume for aqueous deficient dry eyes, while others have coating properties for evaporative dry eye patients. Either way, they are designed to help stabilize the tear film.

By rubbing a drop of rewetting tears between your fingers, you can gauge its surfactant volume. If the drop allows the fingers to glide easily, there is presence of surfactants. If the drop makes the fingers feel “squeaky” to the touch (think of how rubbing alcohol feels on your hands), there is probable level of surfactants. Too much surfactant and you emulsify the lipid layer of the tears, which in turn increases tear evaporation and worsens dryness symptoms.²

Keep in mind, you may have to try varying levels of surfactant-comprised rewetting drops before you learn what works best for your contact lens patient.

What options are on the market today? For patients without lid disease who are looking to add volume for aqueous deficient dry eye, available products include Refresh Optive, Blink Tears, Systane Ultra and Oasis Tears. Some eye care professionals prescribe Soothe XP and Diffuse fluorescein corneal SPK helps identify dry eye patients. Conjunctival lissamine green staining may help identify mild to moderate dry eye patients.
The fitting of a contact lens is vital for an optimal outcome. Their treatment—including artificial tears at some point in their treatment—is important in maintaining sterility. However, several studies have shown that these agents can cause dose-dependent toxic effects that compromise tear film stability and cause damage to the cornea and conjunctiva. Preservatives also been shown to alter the lipid layer, affecting its stability and causing excess evaporation, which increases ocular dryness. Impairing the protective layers of the tears exposes the eye to inflammation and potential conjunctival metaplasia.

When more than four to six drops per day are required, prescribe a non-preserved artificial tear to minimize excessive exposure to toxic preservatives. One such product is Lacrisert (Aton Pharma), a sustained-release ophthalmic insert for use with patients suffering from moderate to severe dry eye. The product is inserted into the inferior lid cul-de-sac, and can keep the eye moist for up to 24 hours. Other non-preserved artificial tear products that are available in individual vials include Oasis Tears, Systane Preservative-Free (Alcon), Refresh Free, Blink Free and Tears Naturale (Alcon). Many store brand generics also come preservative-free, but remember to consider other factors before making a recommendation. For example, if the level of osmolarity is too high or too low, it can cause discomfort and interfere with the application of the product onto the ocular surface.

Preservative-free tears are particularly beneficial in post-surgical care, as well as in the treatment of acute keratitis. We commonly see patients with sensitivities to the preservative BAK in our practices. For these, and any patients with sensitivities to ophthalmic drug ingredients, the preservative-free option is suggested. For those patients who are regularly using topical medications, allergy eye drops or drops for chronic conjunctivitis, BAK can contribute to burning, stinging, irritation and disruption of overall vision. BAK can also affect the tissues of our eye.

Preservatives

Preservatives found in topical ocular products are extremely important in maintaining sterility. However, sometimes overlooked, artificial tears are an important part of an eye care practitioner’s toolbox. It is important to be familiar with all the different products on the market today, so as to make an informed decision when selecting the best option for your patient. Remember, if you do not properly prescribe the correct treatment to your patient, he or she likely will make the decision without your consultation.

3. The “grab bag” approach: Do you throw a bunch of different artificial drops in a bag and let the patient determine the best one?

Systane Balance for patients with concurrent lid disease and/or evaporative dry eye. FreshKote (Focus Laboratories) may be useful for patients with more severe dry eye and/or recurrent corneal erosion.

While the treatment protocol for dry eye continues to evolve, there are some basic steps that you can recommend to your patients. These include modifying the environment (e.g., limit time on computers and stop using the ceiling fan) and daily routine (e.g., reduce caffeine intake and quit smoking); identifying possible contributing medications (e.g., antihistamines, antidepressants, antihypertensives, antidiuretics and anticholinergics); increasing fluids; and using supplemental nutrients (e.g., omega-3 and omega-6 fatty acids) and artificial tears. The next level of treatment often includes punctal plugs and prescription drugs (topical and oral).

However, most dry eye patients need artificial tears at some point in their treatment—so finding the right fit is vital for an optimal outcome.

4. What confusing array of products do your patients see when they go to purchase artificial tear products?

Although sometimes overlooked, artificial tears are an important part of an eye care practitioner’s tool-box. It is important to be familiar with all the different products on the market today, so as to make an informed decision when selecting the best option for your patient. Remember, if you do not properly prescribe the correct treatment to your patient, he or she likely will make the decision without your consultation.

References

The Infiltrate Debate: Material Matters

Practitioners should consider the frequency of infiltrate presentations in extended wear silicone hydrogel patients.

By Ken Daniels, OD

Silicone hydrogel (SiHy) contact lenses were designed to increase oxygen permeability so as to eliminate the hypoxic responses known to occur from wearing conventional hydrogel materials on an extended wear basis. The new standard is “more oxygen,” suggesting that a higher level of a critical Dk/t (diffusion coefficient/thickness) of contact lenses is required to avoid ocular surface compromise, limbal redness, corneal acidosis and to reduce central corneal edema.

It has been shown that the mean peripheral Dk/t required to avoid a change in limbal redness is $125 \times 10^{-9}$ units. As such, the introduction of silicone hydrogel contact lenses with a higher oxygen transmission should lead to fewer complications and a reduced risk of microbial keratitis and inflammatory concerns.

The new generation of materials, SiHy lenses have been deemed clinically safer to wear for an extended period—welcome news to practitioners and patients alike. Yet, the question remains: Why are there more infiltrates found in wearers of SiHy materials than conventional HEMA?

What are Corneal Infiltrates?

Corneal infiltrates are single or multiple discrete aggregates of gray or white inflammatory cells that have migrated into the normally transparent corneal tissue. They are seen as small, hazy, grayish areas (local or diffuse) surrounded by edema. The infiltrates are an accumulation of polymorphonuclear leukocytes (neutrophils), lymphocytes and macrophages released from the limbal blood vessels.

Under hypoxic or stressed conditions, such as when contact lenses act as barriers for normal oxygen flow to the cornea, glucose converts to lactate, which diffuses into the stroma and results in corneal edema due to metabolic acidosis. The change in the corneal metabolism will lead to inflammation, contact lens-induced acute red eye (CLARE) and the accumulation of white blood cells that migrate from the limbal vasculature.

Infiltrates are often small (<2mm) and demonstrate little to no epithelial staining. These cells migrate from the limbal vasculature as a response to local tissue damage or may be...
associated with chemotactic factors derived from antigens and environmental toxins, or from an exogenous source such as contact lens solutions or accumulated bioburden. These vessels are typically located near a vascularized region of the limbus, which may also subsequently appear hyperemic (reddened).

When Do We See Them?

Infiltrates are a consequence of the corneal inflammatory response to insult with an increased microbial bioburden; solution preservatives and hypoxic conditions are responsible for more than a 70% of the total risk of corneal infiltrates in silicone hydrogel extended wear. There have been suggestions that silicone hydrogel lenses, when worn on an extended wear basis, increase the relative risk of infiltrative keratitis. In one study, researchers cited that there was a two-fold higher risk for corneal inflammatory events with individuals who wore SiHy lenses for extended wear (30 days) as compared to individuals who wore low Dk extended wear lenses for seven continuous days. They could not fully link the risk to material alone.

Another study found that there are differences in symptomatic (clinically relevant) and asymptomatic (clinical observed) cases. The incidence of symptomatic patients presented at a rate of 1.9%. Asymptomatic patients (observed in follow-up) presented at a rate of 7.2% for daily use and 26% for extended wear with use of silicone hydrogel lenses. During 30-night extended (continuous) wear with silicone hydrogels, the incidence of symptomatic corneal infiltrates (or ≥Grade 2) were documented to be at an incidence rate of 2.5% to ~6% per year.

In a separate meta-analysis of 23 studies, the incident rates are significantly higher with silicone hydrogel. Between 1990s until 2006, it was reported that infiltrates occurred at a variant annual rate (14.4% for silicone hydrogels and 7.7% for traditional hydrogel materials) between symptomatic and asymptomatic corneal infiltrate events.

Collectively, this suggests that extended wear patients require more intensive follow-up and greater surveillance than their daily wear counterparts. If infiltrates occur, it is suggestive that compromise has already occurred and intervention is clinically required.

Barring the duration of wear, there is no one specific reason for the risks of inflammatory events other than material interactions with care products and the effect on the ocular surface and flora. As discussed by Joseph Hutter, PhD, of the FDA, the classification of SiHy materials is based on the material interaction with care products and protein interactions. Solutions (surfactant, buffer or preservative agents) react differently to SiHy materials vs. conventional HEMA materials; the variance in the chemistry of the SiHy lenses may have an effect on the protein relationship that may induce an inflammatory reaction. Both HEMA and SiHy lenses have protein deposition and related material pore blockage, therefore both have the same potential for bioburden and a decrease of listed Dk/t for the specific material.

There are several relationships that have been suggested to enhance the risk factors of inflammatory infiltrates in all lenses, including silicone hydrogels. These include patient age, degree of refractive error and wear schedule, according to one study. The study concluded that younger patients may have increased “at risk” behavior related to compliance and hygiene issues, and a more dismissive (wait and see) health care attitude. In addition, men were substantially more dismissive of addressing health care issues than women. This may also be related to the presentation of symptomatic vs. asymptomatic patients.

Age might also be considered in the related bioburden issues, such as periocular and ocular surface flora leading to a stressed normality. When prolonged wear times with the developing imbalance of the bacterial homeostatic relationship is also added into the equation, the potential infiltrative response recipe increases. In older patients, there may also be lid anomalies (blepharitis or dry eye syndrome), a stressed

2. Circumlimbal epithelial splitting from extended wear SiHy lenses.

3. CLARE presenting with extreme conjunctival injection in absence of corneal infiltrates.

4. AIK with a visual complaint: Central cornea haze edema with epithelial compromise and sub-epithelial infiltrates.
corneal metabolism and a weakening of the strength and integrity of the corneal structure due cell loss of the endothelium over years.

The study also suggested that higher degrees of ametropia (5D or greater) had an increased risk of infiltrates even though no specific relationship was noted. Here, a supposition about the relationship between material and oxygen can be made. Dk/t is a measure in the central core of the material and does not relate oxygen transmissibility well to other portions of the overall lens. The peripheral architecture of the lens has a direct impact on oxygen transmissibility and the overall oxygen supply of the anterior cornea. A significant decrease in the overall Dk/t occurs based on the power

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### Table 1. Differentiation of AIK/CLPU and MK

<table>
<thead>
<tr>
<th>Findings</th>
<th>Observations/Findings and Recommended Treatment</th>
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<tbody>
<tr>
<td>Contact lens-induced acute red eye (CLARE): figures 1-3:</td>
<td>Inflammation in the anterior segment involving both the conjunctiva and cornea with a non-specific etiology accompanied by epiphora, ocular awareness and possible variance to vision. Observational findings, other than acute injection, may be accompanied by infiltrates with increased sectoral injection, conjunctival compression from contact lens and the potential for corneal staining. Related to tight lens syndrome (epithelial splitting), exogenous debris, associated allergic reaction, solution toxemia, hypoxia, contact lens dehydration (leading to associated tight lens and entrapment of metabolic debris), and/or toxicity or a reaction to bacterial toxins. Tx: After ruling out any form of epithelial break, consider antibiotic/steroid combination such as Zylet or Tobradex q4H for 3-7 days with discontinuation of contact lenses and later refit after resolution.</td>
</tr>
<tr>
<td>Asymptomatic infiltrative keratitis (AIK) or corneal infiltrates (CI): figures 4,5.</td>
<td>Appears as a white and quiet eye without any patient symptoms nor complaints. This is an observational finding upon exam. AIK is observed as simple, singular or multiple non-confluent white “dots” within the underlying of the epithelium at Bowman’s layer junction. Rule out corneal scarring as well as symptomatic viral infection. Tx: If an absence of epithelial compromise, then soft to hard steroid intervention can be incorporated. If subtle, or when concerned during pregnancy, consider a simple solution of sodium chloride 2% for 48 to 72 hours.</td>
</tr>
<tr>
<td>Contact lens-induced peripheral ulcer (CLPU);</td>
<td>CLPUs are an active phase that always include an overlying frank epithelial defect with an underlying infiltrate and active inflammation caused by bacterial bioburden and colonization of contact lens surfaces by pathogenic organisms. Most commonly, gram-positive bacteria related to toxins expressed from Staphylococcus aureus and S. epidermidis. Intra-corneal infiltrate juxtaposed to sectoral section of the limbus and range in size from 0.1mm to 2.0mm with limbal satellite lesions. It is usually a result of dirty contact, producing toxic bacterial metabolic waste or toxins that are damaging and induce an “inflammatory” non-infectious reaction. Symptoms may be absent, or may be significant with moderate foreign-body sensation, redness and tearing. Presenting symptoms include mucopurulent discharge, lid edema, variant diffuse bulbar and limbal hyperemia, possible anterior chamber reaction (flare and cells, possibly a rare hypopyon). Symptoms are less than microbial keratitis and respond more expeditiously to therapy. Tx: Combination steroid and antibiotic. As a precaution, consider an aggressive fluoroquinolone load 24 hours prior to the introduction of steroid. After resolution, contact lens refit to daily wear soft (HEMA or SiHy) with peroxide-based care; consider daily disposable or gas permeable and rigorous patient education.</td>
</tr>
<tr>
<td>Microbial keratitis (MK) – ulcer:</td>
<td>Resultant of bacterial bioburden and overload in which the natural ocular defense is overcome, allowing aggressive infiltration of microbial pathogens to filter into a compromised epithelial junctional barrier. Patients will present with a much greater level of symptoms similar to CLPU. Increasing severity of signs and symptoms after lens wear is discontinued. Irregular infiltrate with raised edges; satellite lesions are common. Mucopurulent discharge adherent to the lesion, lid edema, severe diffuse bulbar and limbal hyperemia, endothelial reaction and marked anterior chamber reaction (flare and cells, possible hypopyon). Consider these to be much more aggressive gram-negative pathogens. As such, deeper and more extensive corneal stromal involvement will result with a greater risk of corneal compromise, scarring and possible loss of corneal integrity that may ultimately compromise the eye in whole. Tx: Aggressive topical, and possible, fortified topical and/or oral antibiotic intervention with cycloplegia is required. Pain control may be required at a narcotic level. It is highly advisable to defer steroid intervention until a substantial microbial load is reduced. If there is reoccurrence after antibiotic treatment, consider potential for fungal or protozoal infiltration into the corneal tissue.</td>
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of poor compliance. In socioeconomics, are characteristic of contact lenses online and changes in storage case hygiene, purchasing contact lenses online and changes in socioeconomics, are characteristic of poor compliance.

### A Treatment Plan

When observing corneal infiltrates it is important to critically differentiate between infectious and/or sterile influences to determine a treatment course. CI can be classified as either asymptomatic infiltrative keratitis, asymptomatic infiltrates, CLARE, contact lens-induced peripheral ulcer, infiltrative keratitis or microbial keratitis.

There are many variant presentations of corneal infiltrates that can be solely inflammatory or may have an infectious etiology (see Table 1, pg 32). Since all these entities have an inflammatory component, steroid intervention is an important consideration. Note: It is critical to consider a potential infectious co-disease that may suggest concurrent antimicrobial coverage. Do not forget to rule out systemic viral associations in light of contact lens wear.

The differential diagnosis of contact lens-related infiltrative keratitis is used to determine the appropriate level of concern and to guide the clinical approach to effective management (see Table 2, above). While it is easy to over-treat infectious processes, the possibility of under-treatment is of greater concern, as it may exacerbate the condition. Determining whether antibiotic should be used alone and/or in combination with a steroid is always a difficult clinical decision. Always be cautious and consider antibiotic monotherapy if there is any form of epithelial compromise. Antibiosis used in conjunction with cycloplegia for 24 to 48 hours will reduce the bacterial load to a safer level, after which steroid intervention may be introduced if needed.

Silicone hydrogel lenses are touted as delivering more oxygen, with reduced hypoxia-associated complications, and they deliver on that front. But more oxygen does not always mean fewer complications. The clinical management of a patient must go beyond simply switching from HEMA to silicone materials based on the sole characteristic of oxygen transmissibility.

Remember, a contact lens is a barrier in the natural physiology of the cornea and anterior segment. Hypoxia is reduced with silicone hydrogel lenses, but the material itself can cause other compromises to the cornea due to misuse of the lens material and improper care products. Clinical awareness and management is critical in decreasing and avoiding complications. This comes down to proper patient care and education to foster the optimal use of these materials.

### Table 2. Differential of Microbial Keratitis

<table>
<thead>
<tr>
<th>Probability</th>
<th>Clinical Presentation</th>
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<tr>
<td>High probability sterile keratitis (aka CLPU or CLPI) = 1+ infiltrates, ¾ to 1mm in diameter, outside the 6mm central zone, minimal anterior chamber reaction, no mucopurulent discharge and mild pain.</td>
<td>Tx: If no epithelial compromise, soft &gt; hard steroid intervention with possible antimicrobial prophylactic coverage.</td>
</tr>
<tr>
<td>High probability of IK with etiology indeterminate (aka CLARE) = 1+ infiltrates with signs/symptoms not clearly meeting MK or CLPU.</td>
<td>Tx: If no epithelial compromise, soft &gt; hard steroid intervention with possible antimicrobial prophylactic coverage. If there is any form of epithelial compromise, antibiotic prior to steroid. Mild cycloplegia may be required if there is a concern of anterior chamber reaction.</td>
</tr>
<tr>
<td>High probability of MK = 1+ infiltrates &gt;2mm in diameter and either an anterior chamber reaction, or pain, or mucopurulent discharge or positive culture, will produce scarring.</td>
<td>Tx: Aggressive antibiotic therapy with strong cycloplegia to reduce bacterial load. If persistent inflammation after the initial 24-48hrs, then consider steroid. For additional analgesia, as needed, acetaminophen and/or ibuprofen combination to a maximum of q4h can replace any need of narcotic agent.</td>
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**5. Viral-related infiltrates in a contact lens wearer.**


Additional references at [www.reviewofcontactlenses.com](http://www.reviewofcontactlenses.com).
What Culture Defines Your Office?
Implementing a solid office culture can mean a successful year for your practice.

There are probably as many different ways to build your practice as there are numbers of practitioners in the field. New practices focus on drawing in patients, while established practices work on retaining current ones. Those two tasks alone can lead to several additional subsets within practice building and can be further broken down by factors like geography and budget.

But, as you start 2013, there is only one thing that every practice should focus on to ensure a profitable year. And it is not technology, marketing, education, social media, analytics or even innovation. In the end, none of these will matter if your practice doesn’t have an established culture.

The Office Culture
Practitioners often approach my consultants with the following scenario: My practice runs great and my staff gets it—until I leave the office for vacation. If I am not here to mind the store, things start to slowly unravel. Or, even worse, we hear practitioners say that when they are in the exam room, they can’t believe some of the things they overhear their staff say.

How does this happen in an office that has weekly staff meetings, a great website and state-of-the-art equipment? The answer is simple. The practitioner has not invested the proper energy to define and stress the importance of maintaining his or her vision of the office’s culture.

In every practice, the number of contact points between your staff and patients (whether it be in person, on the phone or online) keeps increasing. And each of these points of contact are connected and related. Therefore, each person involved in patient communication must also share the same predefined set of practice values; tersely written emails, curt front desk welcomes and brusque phone conversations are simply not acceptable.

Remember, you can’t script everything—and you shouldn’t have to. Instead, you should take the time to build and define your practice culture. We live in a world where any of the aforementioned interactions have the ability to go viral in seconds. Your patients are likely connected to the Internet through their smartphone and have the ability to email, tweet or add a status on Facebook about their experience within minutes of leaving your practice. Websites like Yelp allow consumer-driven reviews to rank practices and build (or break) reputations. You, as the owner of the practice, have to be extra conscientious to ensure reviews are positive rather than negative.

As clinical technology evolves via new diagnostic equipment and treatment modalities, a patient base that is exposed to a constant and consistent culture will continue to seek you out as a source of knowledge. This is because they have already internalized your relationship and are comfortable “coming home” to a place that has never let them down. Patients are less likely to stray to competitors when they feel at home with your practice, and that includes your staff and the culture you have instilled in your office.

Getting Started
Start by clearly and concisely defining your practice culture to create a foundation of action for your staff. For example, the Mayo Clinic mission statement clearly summarizes its primary value: “The needs of the patient come first.”

With that fundamental understanding, everyone involved in the Mayo Clinic’s staff—from neurosurgeons to valet parking attendants—knows how to treat patients. Just as every surgical contingency can’t be planned for, neither can every situation in the hospital gift shop or the accounting office. But as long as “the needs of the patient come first” is understood, and employees are empowered and unencumbered by excessive rules and policies, the organization will prosper.

I recommend that once you’ve succinctly stated your culture, write out a Zappos-esque list of core values in a way that is easily understood. Then, of course, lead by example and embody these guidelines in your own patient encounters.

Reiterate the importance of your culture by repeating the message, both in daily action and in preparation at regular office meetings. Positively reward success by sharing examples of how a staff member interacted with a patient in a way that reinforced the practice’s core beliefs. Conversely, be willing to let a staff member go if he or she fails to adhere to your practice culture and values. And remember, building a strong culture is the most effective practice-building technique you have in your pocket. 
Maybe that’s why Boston® lenses are prescribed 3 times more often.*

The Boston team knows what it takes to be a leader in the GP lens market. For years we have provided products with excellent performance and high Dk. In addition, we offer education and fitter training for specialty lenses, both on our own and partnered with our authorized laboratories. It’s what our customers tell us they need to provide better vision care. And it is exactly what they can expect from a leader.

* Boston lenses are prescribed 3 times more often than the closest GP competitor. Source: Survey conducted by Decision Analyst, March 2011.
MYTHS, METHODS AND MEANS FOR SOOTHING END-OF-DAY CONTACT LENS DISCOMFORT

Fig. 1: Headstand in an ice bucket.  

Fig. 2: Switch to Avaira®.

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