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Corneal Nerves Altered by Orthokeratology Wear

Long-term wear of orthokeratology lenses is associated with a reduction in central corneal sensitivity and nerve fiber density, reports a study published online in the journal Eye & Contact Lens.1 However, the results from the study are unclear with regards to whether patients are at risk for issues with their tear films.

Researchers from the University of New South Wales, Sydney, Australia conducted a cross-sectional study with 54 patients grouped into one of three categories, either non-lens-wearing, soft lens-wearing, or orthokeratology lens wearing. Each patient attended the clinic for a single visit during which corneal sensitivity measurements and in vivo corneal confocal microscopy were conducted on each individual’s right eye, with corneal sensitivity measured at the corneal apex and 2.5mm temporal to the apex using a Cochet-Bonnet esthesiometer. Corneal nerve morphology, in contrast, was assessed via sampling of a 1mm² area of the corneal sub-basal nerve plexus using the Heidelberg Retinal Tomography with Rostock Corneal Module at the corneal apex and 2.5mm temporal to the apex, and nerve fiber density was calculated via measurement of nerve fiber length per square millimeter.

Ultimately, results indicated a significant difference in corneal sensitivity between each group, with central threshold being significantly higher in the orthokeratology group than the non-wearer group and central nerve fiber density being significantly less in the orthokeratology group than in either the non-wearer or soft lens-wearer groups. Interestingly, mid-peripheral nerve fiber density was similar between all three groups, suggesting the presence of regional variations in corneal sensitivity following orthokeratology lens wear.

“Normal corneal sensitivity is essential for the health of the ocular surface,” the researchers note. “Any reduction in sensitivity can lessen the ability of the cornea to detect foreign bodies that could damage the ocular surface. The desensitization of the cornea might also compromise the lacrimal functional unit, leading to a reduction in aqueous tear film secretion and subsequently to dry eye.” As such, further research is necessary to determine whether alterations to corneal nerve morphology might “impact the stability of the pre-corneal tear film and integrity of the functional lacrimal unit in an [orthokeratology] lens-wearing population.”

1. Lum E, Golebiowski B, Swarbrick HA. Reduced corneal sensitivity and sub-basal nerve density in long-term orthokeratology lens wear. Eye Contact Lens. 2016. [Epub ahead of print.]
Contact Lens Washout Period May Not Impact Tear Film

A washout period may not be as necessary as initially believed when evaluating tear cytokines following contact lens wear or lens care product use, reports a study from the July 2016 issue of Eye & Contact Lens. Certain cytokines are responsible for promoting the inflammatory response on the ocular surface and are found in cases of dry eye, ocular allergy, bacterial keratitis and both soft and rigid contact lens wear.1,2

Researchers at the State University of New York and the University of New South Wales in Sydney, Australia investigated the tear makeup of 10 subjects immediately following contact lens wear and then after one, two, three, four and seven days without contact lens wear, looking for changes in the concentration levels of IL-1ß, IL-1Ra, IL-6, IL-10, IL-12 (p70) and TNF-α. Approximately 20µL to 30µL of pooled basal tears were collected bilaterally from each subject at each visit, and two custom multiplex assays were used to quantify the concentration of tear cytokines. Repeatability and reproducibility of multiple assays using tears has previously been reported.1,6

Slit lamp findings at baseline and seven days after contact lens removal were not significantly different, though several subjects displayed epithelial microcysts, corneal neovascularization and significant lid flakes at different points during the experiment. Average corneal staining was mild at baseline (4.9±4.3) and day seven (2.9±2.5). Overall, there was no significant change in tear cytokine concentrations, with alterations over the seven-day time period as follows: 4.6±2.8 for IL-1ß, 4.6±2.8 for IL-1Ra, 14.6±11.2 for IL-6, 7.9±11.2 for IL-10, 39.8±16.8 for IL-12 and 24.9±46.3 for TNF-α.

“This study has confirmed that the selected tear cytokine concentrations did not change significantly within one week after discontinuation of contact lens wear. This indicates that a seven-day washout period may not significantly affect the ocular surface inflammatory state observed with contact lens use, although a longer period may be required to return to the levels prior to contact lens wear,” the researchers noted. Also, “although the between-kit repeatability was poor, this study also showed that a well-trained operator can provide repeatable and reliable findings using custom multiplex assays.”


Adviser Index
Alcon..........................Page 7, Cover 3
Bausch + Lomb ...............Page 23
CooperVision..................Cover 2
Menicon .......................Cover 4
Understanding the Contact Lens Prescription Release Legislation

The next step in a legislative confrontation may mean better protection for lens wearers.

Though country singer Kelly Clarkson’s song lyrics, *What doesn't kill you makes you stronger*, are a far cry from being linked to anything medical in nature, there are still two applications she more than likely did not think of when lifting that line from Nietzsche. First, her song could actually stand as the theme song for exposure to pathogens: inoculations ultimately make us stronger—if they don’t kill us first. Second, there is some relevance attached to the legislation that was recently introduced by Senator Bill Cassidy, MD. The Consumer Health Protection Act (S.2777)—which aims to modify the 2003 Fairness to Contact Lens Consumers Act (FCLCA)—at first glance appeared to be problematic for us as eye care practitioners; but now, it may in fact yield some good with the modifications that were recently introduced.

**A HISTORICAL PERSPECTIVE**

In 2003, the FCLCA was introduced to organize the way in which contact lenses were dispensed and by whom. The legislation’s initial intent was to improve the level of protection for consumers; it requires practitioners to provide patients with a copy of their lens prescription so they might be able to look around for where they want to purchase their contact lenses from, if they so desire. As part of the Act, the Federal Trade Commission (FTC) was given the power to enforce the rules on both prescribers and sellers of contact lenses. Overall, the Act was implemented with the goal of reducing barriers for retail competition.

Unfortunately, the American Optometric Association revealed several examples of widespread abuse of the current FCLCA legislation scope by sellers, prompting the introduction of the more recent Contact Lens Consumer Health Protection Act of 2016. Its aim is to provide new patient safety requirements and accountability for online retailers. A number of significant modifications exist, including an allowance for the prescriber to email, fax or phone prescription confirmations to potential sellers depending on which is more convenient, thus avoiding the troubling “robo-calls” of the past. Additionally, this legislation is expected to help assure that a prescription is filled exactly as it is written. The legislation also establishes a hotline for patient safety, allowing prescribers to provide sellers with patient health information. Fines to sellers who do not adhere to the rules will be increased to $40,000 per infraction. The CDC will study the public health impact and direct health costs to online sales and abuses.

**OPPOSING VIEWS**

Opponents to the legislation argue that the bill is anti-consumer and would stifle competition in terms of securing lens sales. 1-800-Contacts, for example, argues that the legislation would in fact have unintended health consequences to the consumer, since it is the one that promotes healthy behaviors to lens wearers. Other contact lens retailers have also begun to report prescribers who don’t adhere to prescription expirations originally agreed upon to the FTC, even though they have the medical discretion to do so (i.e., in the case of patients requiring continuous wear lenses or following surgery.)

So, prescribers must remain committed to further educating contact lens wearers on the care of their contact lenses, including when to reorder, as we wait for the legislature to move forward. Advising patients that these products are in fact medical devices capable of causing sight-threatening problems when handled improperly can help hammer home the fact that discussion with a licensed prescriber is key to maintaining good contact lens wear. Though not perfect, the FCLCA did not kill us in its original form. Could the removal of known issues make the revised legislation stronger than ever?

A FLEXIBLE LENS-WEARING EXPERIENCE TO HELP PATIENTS SEE, LOOK AND FEEL THEIR BEST…

DAY OR NIGHT

Scot Morris, OD, FAAO
Optometrist
Eye Consultants of Colorado
Conifer, Colorado

In my 20 years of practicing optometry, I have come across various types of patients with a multitude of visual and lifestyle needs - busy professionals, frequent travelers, new mothers, doctors and nurses with unpredictable work schedules, and even those who live in low-humidity environments like right here in Conifer, Colorado (elev. 8,200 feet). It is only by listening to our patients and understanding their needs that we can recommend the contact lens option that will give them the best contact lens experience.

When patients express dissatisfaction with their contact lens-wearing experience, it may stem from their sleeping habits. Around 30% of contact lens-wearing patients admit that they sleep in their lenses, and it may stem from their sleeping habits.

These patients share one common need—a flexible lens-wearing experience which will allow them to wake up with comfortable, clear, immediate vision to perform their best. The one contact lens that immediately springs to my mind for these patients is AIR OPTIX® NIGHT & DAY® AQUA contact lenses from Alcon.

In addition to the proprietary SmartShield™ Surface Technology, which is featured in the entire AIR OPTIX® family, I like that AIR OPTIX® NIGHT & DAY® AQUA contact lenses are made of a material (lotrafilcon A) which has the highest oxygen transmissibility in the market,* and an established safety profile.†

AIR OPTIX® NIGHT & DAY® AQUA contact lenses are the first to be introduced with these features and the only contact lenses designed to provide comfort for up to 30 nights of continuous wear. They are the #1 practitioner-recommended contact lens for people who sleep in their lenses, and ideal for people who lead busy lives. I also prescribe these to my patients who not only sleep in their lenses but also face lens dehydration and discomfort from living in our low-humidity environment, knowing that lenses from the AIR OPTIX® family maintain lens surface wettability and provide comfort throughout the wearing period.

I am confident in recommending AIR OPTIX® NIGHT & DAY® AQUA contact lenses for extended periods and encourage you to give them a try. The benefits are quick and easy to communicate, and you can rest assured that they will give your patients the flexible lens-wearing experience they need to see, look and feel their best.

*DK/t = 175 @ -3.00D. Other factors may impact eye health.

Unnecessary Work Schedules
Need immediate vision waking up for shift

Busy Professionals
Eyes fatigued looking at my mobile devices

Frequent Travelers
Travel too often to hassle with my lenses

Moms with Young Kids
Can’t see clearly getting up throughout the night

Relevant Precautions:
Not everyone can wear for 30 nights. Approximately 80% of wearers can wear the lenses for extended wear. About 20% of wearers may not be able to wear the lenses due to corneal infection. Permanent reduction in visual acuity from the localized inflammation of the cornea, which may be accompanied by mild to severe pain and may require the use of antibiotic eye drops for up to one week. Other less serious side effects were conjunctivitis, lid irritation or lens discomfort including dryness, mild burning or stinging. To avoid these effects, consult with your eye care professional for the proper fit and use of your contact lenses. Additional Information: Lenses should be replaced every month. If removed before then, lenses should be cleaned and disinfected before wearing again. Always follow the eye care professional’s recommended lens care, care and replacement schedule. Consult package insert for complete information, avoidable without advice by calling (800) 241-5999 or go to myairoptix.com.


See product instructions for complete wear, care and safety information. © 2016 Novartis 06/16 USAND165-2124

Our passion is to help your patients see, look and feel their best.
Treating the Ocular Surface: Resistance is Futile

The human microbiome supports our existence, but it also serves as the source of infection. Resistance is on the rise, and clinicians have to prescribe carefully.

In 2008, the National Institutes of Health launched the Human Microbiome Project with the purpose of identifying the organisms that live both on and inside the human species. The ocular surface was of particular interest, and the project estimated that over 200 species of bacteria colonize the human conjunctiva. Among the most typical species were Staphylococcus, Streptococcus and Corynebacterium—all gram-positive. Pseudomonas and Neisseria were those identified among the gram-negative organisms.1,2

The purpose of this complex community of organisms is somewhat difficult to discern. Given that we mostly live symbiotically with these microbes, it’s possible they are present to prevent more severe organisms from attacking. As an example, Clostridium difficile is present in the intestines but is held in check by other normal flora until something, such as overuse of antibiotics, erases the natural population, providing C. diff. a window of opportunity.

The ocular surface has similar complexities. The ocular surface’s biofilm lifecycle varies from days to weeks, depending on the organisms present and is associated, in most instances, with mucus that have evolved with us over millennia.

Over the last decade, we have seen significant erosion of the efficacy of commonly used agents, especially in the gram-positive arena. The ARMOR study analyzed 3,237 bacterial isolates at 22 sites from 2009-2013. It looked at isolates common to the ocular surface (Streptococcus pneumonia, Staphylococcus aureus, coagulase-negative Staphylococci, Pseudomonas aeruginosa and Haemophilus influenzae), as well as commonly used antibiotics, including fluoroquinolones, aminoglycosides, macrolides, cephalosporins and penicillins.3

**CORNEAL DISEASE**

Beginning almost two decades ago with earlier generations (ofloxacin and ciprofloxacin), fluoroquinolones evolved into the go to drugs for the treatment of corneal disease, including microbial keratitis. Typical treatment protocols varied from QID to Q 1 hour, depending on disease severity. As use increased, the efficacy against gram-positive isolates (specifically Staph.) began to erode, and the next generation agents, gatifloxacin and moxifloxacin, replaced their precursors and were considered incapable of developing resistance due to the necessity of a dual, simultaneous mutation.5

Unfortunately, this proved untrue and today the resistance to both generations by methicillin-resistant Staphylococcus aureus (MRSA) is extremely high; some studies indicate less than 20% efficacy against these organisms.6

Commonly, clinicians initiate microbial keratitis treatment with a fluoroquinolone on a Q 1 hour to Q 3 hour basis, depending on the severity of presentation. But data on methicillin-resistant isolates demonstrates the need for vigilance after the first 24 to 48 hours of therapy in patients who have not demonstrated clinical stabilization or improvement.7 In those cases, the best alternative is fortified vancomycin (30mg/ml) in addition to the fluoroquinolone on a Q 1 hour or Q 1/2 hour basis. According to ARMOR, fluoroquinolones have a low level of sensitivity to gram-positive MRSA while maintaining good sensitivity to other gram-positive isolates as well as the more typical gram-negative isolates such as *Pseudomonas*. So, if treatment fails to improve the patient’s condition, the most likely cause is a non-sensitive gram-positive organism. Additionally, the study demonstrated excellent MRSA coverage for vancomycin.

Another concern is that the best agents are not available on patients’ formulary or they cost too much. Thus, it’s useful to know which other agents can be used. Data show that Polytrim (trimethoprim/poly-mixin B sulfate, Allergan) maintains good sensitivity to MRSA and that earlier generation fluoroquinolones are reasonably similar to the next generation for initial ulcer treatment when newer generation agents are not available at effectively the same dosage patterns.3,4,6

**CONJUNCTIVITIS AND BLEPHARITIS**

When treating common conjunctivitis, the ARMOR study indicates that typical therapy patterns have not changed materially other than the notable decline in the sensitivity of tobramycin and macrolides.6
While these agents may show success in some patients, if the patient’s condition does not improve, it is most likely the consequence of increased resistance, making selection of an alternative agent, such as Polytrim, appropriate. Additionally, clinicians can consider using Neosporin Ophthalmic Solution (neomycin and polymyxin B sulfates, and gramicidin, Pfizer) given the relative increase in sensitivity generated by its absence in the ophthalmic market.

In the treatment of blepharitis, several studies show little improved efficacy in the use of antibiotics versus lid hygiene in long-term management of these conditions.7 Given the ARMOR data on the poor performance of tobramycin, look for other alternatives. Numerous new topical regimens for cleaning the lids and multiple versions of lid scrubs, allow practitioners to avoid antibiotic use altogether.

If I must use an antibiotic for lid-related disease, I select an ointment for night time use and combine it with aggressive lid hygiene. Agents such as Bacitracin (Pfizer), Polymyxin (Sagent Pharmaceuticals) or their combination have excellent coverage against typical isolates and have the advantage of being non-preserved. Several studies have looked at the treatment of ocular surface disease related to posterior lid disease for recurrent chalazia that involve the long-term use of re-esterified omega 3 fatty acids at approximately 3,000mg per day. This avoids the need for doxycycline, which has the potential for significant side effects as well the development of resistance.8

**PRESEPTAL DISEASE**

With preseptal cellulitis, the organisms typically involved are similar to those seen in microbial keratitis rather than *Pseudomonas*. Since *Staphylococcus* and some *Streptococcus* primarily populate lids, selection of an appropriate agent should be based on the patient’s allergy history and the known performance of the antibiotic against *Staph*.

In the penicillin class, drugs such as ampicillin and dicloxacillin at 1,000mg to 1,500mg per day are typically effective. Many clinicians prefer Augmentin (GlaxoSmithKline), a combination of ampicillin and clavulamate, which is a beta lactamase inhibitor that increases efficacy of therapy (875mg BID). As for the cephalosporin class, first generation agents have greater efficacy against gram-positive organisms than 2nd or 3rd generation agents. Keflex (Advancis Pharmaceutical) and Duricef (Bristol-Myers Squibb) are both effective and cost efficient for the majority of patients. The newer classes of drugs such as macrolides (clarithromycin) and fluoroquinolones have shown little improvement in outcomes but do demonstrate increased side effect profiles at a higher cost.9

In the United States, pathogens resistant to antibiotics cost us approximately $20 billion a year and add eight million additional hospital days. A 2014 WHO update shows continued erosion of drug efficacy in all key categories worldwide with continued loss of efficacy in the FQ and cephalosporin classes even in treatment of last resort settings.10 As eye care practitioners, it is critical we understand the impact of the market on our decisions and our patients. Antibiotic resistance is one of the biggest health issues, and we all must work toward changing the course of its impact on our patients and ourselves.11

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An Antibacterial Q&A

New antibiotics are scarce—here’s why, and what’s being done about it.

Since treating corneal infections is the focus of this edition, it seemed like a good time to talk about the new antibiotics. Wait—there aren’t any to talk about! So, I guess this column will focus on the status of antibacterial agents by answering some questions surrounding this topic.

**CAN CURRENT ANTIBACTERIAL AGENTS MANAGE TODAY’S INFECTIONS?**

Infectious diseases are still the third leading cause of deaths in the United States and the second leading cause of death worldwide.1 According to a 2013 report by the Centers for Disease Control and Prevention (CDC), more than two million people are infected with resistant strains annually, and more than 23,000 die from these infections.2 In 2013, The World Health Organization (WHO) issued a report on priority medicines, stating that the lack of effective antibiotics poses a significant threat to global health and will require the involvement of many different organizations to respond.3

Just a year later, the WHO issued its first global report on antibiotic resistance, further emphasizing that antimicrobial resistance is a serious threat that “is no longer a prediction for the future, it is happening right now in every region of the world and has the potential to affect anyone, of any age, in any country.”4

**IS THERE A SHORTAGE OF NEW ANTIBIOTICS?**

Only four new classes of antibiotics have been introduced in the past 40 years.5 The US Food and Drug Administration (FDA) approved only two antibiotics in the past five years, which represents a drop off of 88% in approvals since the mid 1980s.6 Table 1 summarizes the approval of antibacterial agents in the United States over the past several decades.5

According to the WHO, antimicrobial resistance is one of the three greatest threats to human health.4 Of the drugs in the pipeline today, very few appear beneficial over existing drugs, and few appear to target the “ESKAPE” pathogens: Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumanii, Pseudomonas aeruginosa, and Enterobacter species. This acronym was so named after the organisms currently causing most of hospital infection in the United States and because they escape being managed by currently approved antibiotics.7

Many of the new drugs coming out lack a novel mechanism and are merely a new generation of an existing antibiotic—in other words, a follow-up drug.8 Therefore, even most drugs that have been developed recently are not significantly improved or better than what we already have.

**WHY IS THERE A SHORTAGE OF RESEARCH AND DEVELOPMENT?**

Drug development is costly; pharmaceutical companies spend, on average, $5 billion in research, development and clinical trials for each drug they bring to market.6 Additionally, approximately 80% of drugs fail to make it through safety and efficacy studies.6 Therefore, each drug that makes it to market needs to be highly profitable to help recoup these extensive costs.

Economically, the return on investment (ROI) for antibiotics is poor for many reasons, including:

1. Antibiotics are typically taken for a short period of time, and they typically cure the disease. Pharmaceutical companies are far more attracted to the development of drugs that need to be taken for chronic conditions such as hypertension, hyperlipidemia, etc.

2. The rapid development of drug resistance shortens the clinical lifespan.

3. New antibacterial drugs often have a short patent life.

All of these situations reduce the ROI for new drugs, making their development an unattractive financial venture.

Added to the financial concerns, developing an antibacterial drug is often more challenging than developing other classes of drugs. An antibacterial drug has to be effective against many pathogens, be able to

Table 1. Antibiotics Approved in the United States, 1983–20115

<table>
<thead>
<tr>
<th>Dates</th>
<th>Number of Antibiotics Approved</th>
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<tbody>
<tr>
<td>1983-1987</td>
<td>16</td>
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<tr>
<td>1988-1992</td>
<td>14</td>
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<td>1993-1997</td>
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<td>1998-2002</td>
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<td>2003-2007</td>
<td>5</td>
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<tr>
<td>2008-2011</td>
<td>2</td>
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treat a variety of infections and have effectiveness at different sites within the body.9

There are also ethical concerns about clinical trials that compare the investigative drug to an existing drug. If there is a high level of resistance to the comparator drug, randomizing patients to receive that therapy is ethically questionable.10,11

While there is still a push for pharmaceutical companies to develop new antibiotics, at the same time there is a competing initiative to limit their use because of increasing resistance.8 These concerns ultimately highlight the underlying paradox of antibacterial drug research and development: as the antimicrobial resistance increases dramatically, there is a marked decline in the number of antibiotics in the development pipeline.

WHAT IS THE STATUS OF THE ANTIBACTERIAL PIPELINE?
As reported by the CDC in 2011, only five major pharmaceutical companies had active antibacterial discovery programs in place.12 In a 2009 European report entitled The Bacterial Challenge: Time to React, researchers found that only 15 antibiotics out of the 167 being developed had a new mechanism of action to potentially address the multidrug resistance challenge.12

Currently, there are 37 new antibiotics in the pipeline, and given that only roughly 60% of drugs that ever reach Phase 3 trials will receive FDA approval, the pipeline is not sufficient for the rising health care needs.13 Right now, 11 of the 37 drugs are in Phase 1 trials, 13 are in Phase 2 trials and 13 are in Phase 3 trials. Eleven are expected to have activity against ESKAPE pathogens and an additional four possibly may be effective.2

According to one study, in the last 40 years only two novel classes of antibiotics have been brought to market—and both were discovered before 1987.14 Today, the greatest threat is multi-drug resistant gram negative organisms. Unfortunately, most large pharmaceutical companies have closed (or greatly reduced) their antibacterial research units. Now, a large portion of research in this field is occurring in academia or in smaller biotech companies.14

As for the few drugs that are new, researchers evaluated the characteristics of the new antibiotics approved from 2010 to 2015. There were eight approved, with only one having a new mechanism of action. Half of the drugs were for the same condition—acute bacterial skin infections. Three of the eight showed activity against the ESKAPE pathogens. One drug demonstrated activity against Clostridium difficile, one of the CDC’s greatest-threat pathogens. None of the drugs studied demonstrated superior outcomes on patient survivability over what is currently available. At the very least, the data did show that the FDA is approving new antibiotics efficiently.15

WHAT IS BEING DONE TO ADDRESS THE PROBLEM?
Research suggests 20% to 50% of antibiotics prescribed in United States acute care hospitals are not needed or not appropriate.16 In 2014, the CDC recommended that all acute care hospitals implement Antibiotic Stewardship programs. These stewardship programs pro-
more judicious use of antibacterial agents, increase the correct prescribing and prophylaxis use of antimicrobials and overall improve patient safety.16

The increase in resistance to the antimicrobials available to practitioners has led to numerous initiatives, these stewardship programs among them. But this alone cannot fix the problem; researchers need to develop new drugs.1 To address the barriers to developing antibacterial drugs, several efforts are underway, including: public-private partnerships (PPP), modified regulatory processes, outside-the-box reimbursement plans, and an increase in government investment.11

In 2012, President Obama signed the Generating Antibiotic Incentives Now (GAIN) Act into law. This legislation extends the market exclusivity of certain antibiotics that treat serious or life-threatening diseases. It also grants those drugs priority review status so they can undergo an expedited FDA approval process. Under the GAIN act, the FDA must maintain a list of pathogens that have the potential to pose a significant public health risk and update it every five years. The FDA must also provide clinical trial guidance on the development of drugs that target specific bacteria.17

Eight drugs have been approved since the initiative launched—but not in areas of greatest need such as treatment for C. difficile and drug-resistant Neisseria gonorrhoeae.13

Of the 37 antibiotics currently in development, roughly 24 are qualified infectious disease products (QIDPs). All drugs approved since 2014 have been QIDPs.11

There are several other legislative proposals in play that will help with the drug approval process. For example, the Antibiotic Development to Advance Patient Treatment (ADAPT) Act has been referred to the US House of Representatives, which, if passed, will speed up the FDA approval process for antibotics, antifungals or biological products for the treatment of a serious infection.13

At the 69th World Health Assembly this past May, the WHO announced the formation of a public-private partnership, the Global Antibiotic Research and Development (GARD) Partnership.18 It was created by the Drugs for Neglected Diseases Initiative, in conjunction with WHO, to develop new antibiotics to meet the challenges of resistance and to promote conservation but equitable access. GARD is now in the start-up phase and is receiving seed money from various organizations throughout Europe. Hopefully, such a partnership will allow the development of products that the pharmaceutical industry may pass on due to lack of profitability.18

In 2010 the Infectious Diseases Society of America launched the Bad Bugs No Drugs – 10 x ‘20 initiative, which aimed to have 10 new systemic antibacterial drugs developed by 2020. An interim report on the 10 x ‘20 initiative suggests there is progress, but the pace of research and development needs to speed up if it is going to reach its goal by 2020.19

In 2009 a transatlantic task force was created to focus on bolstering the antibacterial pipeline, strengthening infection control interventions and promoting antimicrobial stewardship in human and veterinary settings.6

With so much global attention on this antibacterial shortage, hopefully these unified efforts will garner a sufficient stockpile of antibacterial agents to manage the serious infections of today and tomorrow.42


REVIEW OF CORNEA & CONTACT LENSES | SEPTEMBER 2016
MEETINGS CO-CHAIRS:
MURRAY FINGERET, OD
ROBERT N. WEINREB, MD

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Partially supported by an unrestricted educational grant from Alcon
A female patient presented to the clinic on a Tuesday morning after a holiday weekend with a sudden-onset red and painful right eye, reporting that she had also been exhibiting tearing and light sensitivity for the past day. She was a current contact lens wearer who had not visited the office since her last annual eye examination more than one year ago. Patient history included noncompliance with a monthly lens replacement schedule—the patient reported replacing her lenses every two months while also using numerous brands of multipurpose solution and failing to replace her contact lens case as recommended. The patient also acknowledged noncompliance with proper case cleaning and could not recall when she began using it; the case itself was covered with the dry and crusted remnants of her contact lens solution.

Following a thorough exam, the patient was diagnosed with microbial keratitis, empirically treated with a topical broad spectrum antibiotic eye drop, and given information on contact lens and lens case hygiene. She returned to the clinic for appropriate follow up care as recommended. Luckily for this patient, the location of her infection was peripheral and did not permanently affect her vision. After the infection resolved, she was re-fit into daily disposable contact lenses.

Unfortunately, this presentation is all too commonly seen in contact lens patients who experience lens-related problems or infections. Though the majority of new contact lens patients are educated on the importance of proper care and replacement, in some cases they become complacent in their routine along the way, and these lapses enable infections to occur.

CASE REPORT
Most patients are not aware of the danger inadequately managed contact lens cases in particular can present; without proper cleaning and storage procedures, free-floating microbes can easily attach themselves to the inside of a contact lens case and begin to secrete proteins that create a protective outer coating, known as a biofilm.1 This matrix-like structure can attach to both living and non-living surfaces, and has been found on other medical devices including prosthetic heart valves, coronary stents, prosthetic joints, cochlear and intraocular lens implants.1

The primary culprits of contact lens-associated microbial keratitis that can be found in contact lens case biofilms are Staphylococcus aureus, Pseudomonas aeruginosa, Serratia marcescens, Fusarium solani and Acanthamoeba. Together, these organisms account for more than 30,000 cases of microbial keratitis per year in the United States.1

ABOUT THE AUTHOR
Dr. Lagina is a clinical assistant professor at the University of Michigan’s Kellogg Eye Center and also practices at the VA Ann Arbor Health Care System.
For practitioners to adequately prevent or reduce biofilm formation, it is necessary to first understand how biofilms occur. Five stages of biofilm formation and transferability exist:

**Stages 1 & 2.** First, the biofilm begins as a reversible collection of floating cells in the solution near the case's surface (stage 1), then as an attachment of the cells on the case (stage 2).

**Stages 3 & 4.** Next, more cell layers are constructed (stage 3), followed by the creation of a protective outer covering (stage 4).

**Stage 5.** Finally, the microbes detach and disperse into the solution within the case or onto the contact lens itself.¹

A poorly fitting or potentially contaminated contact lens may alter the integrity of the corneal epithelium, allowing easy access from possible freeloading microbes from a biofilm to penetrate the compromised cornea and cause an infection.¹ Furthermore, the presence of a contact lens on the eye can also negatively influence the antimicrobial action of the tear layer, causing an increase in the bacterial load and subsequent corneal invasion from transported biofilm microbes.¹

Once a layer of cells has attached itself to the case and has begun to grow and reproduce, it is significantly more resistant to antimicrobials; as such, it may warrant further study. Current methods of attacking a biofilm—e.g., including bactericidal agents in contact lens solutions and cases, modifying contact lens case hygiene directions—are only designed to address the early stages of biofilm formation.

**THERE’S THE RUB**

Both multipurpose and hydrogen peroxide-based contact lens solutions are designed to clean and disinfect contact lenses. For the most part, debris, makeup residue, proteins and mucus all need to be removed from the lens during the cleaning process—this must occur prior to the disinfection process in which the bacteria is destroyed.² If the lenses are not thoroughly cleaned prior to disinfection, the antimicrobial action of the solution is reduced. This highlights the importance of mechanically cleaning, or rubbing, the contact lenses prior to soaking them in contact lens solutions for disinfection. Simply rubbing and rinsing lenses yields a 1-log reduction of microbes from the lens surface.

Common multipurpose solution disinfectants Polyquad (polyquaternium-1) and PHMB (polyhexamethylene biguanide) are found in different products, depending on the solution’s manufacturer, but the mechanism of action is the same: the chemical is incorporated into the cell membrane of the bacteria to cause membrane permeability and, ultimately, cell death.² Hydrogen peroxide-based solutions, in contrast to multipurpose ones, use the oxidizing activity of the cleaning liquid to disrupt microbial DNA.

Contact lens solutions must meet the requirements of the International Standards Organization’s (ISO) standard 14729, “Microbial requirements and test methods for products and regimens for hygienic management of contact lenses.” These requirements address the antimicrobial efficacy against free-floating (planktonic) and non-attached cells of the following microbes: *Pseudomonas aeruginosa*, *Serratia marcescens*, *Staphylococcus aureus*, *Fusarium solani* and *Candida albicans* (Table 1).³ Recently com-

### Table 1. ISO 14729 Specific Test Microbes

<table>
<thead>
<tr>
<th>Bacteria</th>
<th><em>Pseudomonas aeruginosa</em></th>
<th><em>Serratia marcescens</em></th>
<th><em>Staphylococcus aureus</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fungi</td>
<td><em>Fusarium solani</em></td>
<td><em>Candida albicans</em></td>
<td></td>
</tr>
</tbody>
</table>

A keratoconus patient with Type II diabetes who developed an infection following hybrid contact lens wear. Though most infections occur following soft contact lens wear, in rare cases improper care of GP and hybrid lenses can also lead to issues: this patient ran out of his prescribed hydrogen peroxide solution and elected to use a saline solution instead.
BEWARE THE BIOFILM

Completed research has demonstrated that current brands of multipurpose solutions are able to reduce biofilm formation.

Of course, past events like the *Fusarium* outbreak linked to ReNu with MoistureLoc (Bausch + Lomb) and the *Acanthamoeba* outbreak in connection with Complete MoisturePlus (Abbott) have taught practitioners that multipurpose solutions alone cannot be our only defense mechanism against biofilm formation. For example, ReNu with MoistureLoc was found to have adequate antimicrobial activity against free-floating *Fusarium*, but limited activity against a sessile (i.e., adherent) biofilm; as such, a *Fusarium* biofilm in a contact lens case with this solution was able to continue to grow, develop further antimicrobial resistance and subsequently cause an infection.1 Complete MoisturePlus was found to have limited activity against *Acanthamoeba*, allowing cysts to form, which led to keratitis.1 Both solutions were eventually voluntarily recalled from the market.

As more attention and interest is paid to alternative and complementary medicine and organic therapies, research is also being completed on the antimicrobial activity of certain types of plant oils in combination with contact lens solutions.4 For example, cinnamon oil has been found to contain cinnamic aldehyde and eugenol, which have a bactericidal effect on cell membranes and have been shown capable of detaching sessile bacteria from a surface.4 One study found that cinnamon oil combined with a multipurpose solution had an increased antimicrobial effect greater than that of cinnamon oil or the multipurpose solution alone. However, additional study is required to determine the risk of corneal toxicity, contact lens material damage or adverse reactions from mixing cinnamon oil in a contact lens solution.

ON THE CASE

Most contact lens cases are comprised of a mix of three plastic polymers: polypropylene, styrene and polyethylene. During the production process, the contact lens solution manufacturer tests the efficacy of their solutions with a designated contact lens case; as such, it is important to remind patients to use the case included with the solution they purchase to ensure the cleaning and disinfecting properties of the solution are given the best possible environment to work within. In some instances, use of a specific solution with a contraindicated case can actually lessen its effectiveness.

Researchers have attempted to make special modifications to the material composition of the contact lens case to engender a bactericidal effect, namely by adding silver or organoselenium in an effort to reduce and prevent biofilm formation. Silver-lined cases work by slowly releasing silver ions into the lens solution during the disinfection process. Silver is known to have antimicrobial properties: it inhibits bacterial DNA replication and disrupts the cell membrane to cause cell death.5 Patients using silver-lined cases should soak their lenses for at least 24 hours, however, as only minimal antimicrobial effect was found at six- and 10-hour soaking times.5 Additionally, patient compliance with cleaning and replacing these cases is also an issue: over time, the silver ions are depleted from the case, limiting the antimicrobial activity.6

The addition of organoselenium into the polymer of the contact lens case was the subject of a recent study.7 The antimicrobial action of organoselenium serves as a catalyst to create superoxide free radicals that disrupt bacterial cell membranes. The advantage of the addition of organoselenium into the case composition over silver is that the organoselenium will not be depleted with time and use of the case, allowing for additional antimicrobial activity to occur despite the age of the case.

BACK TO THE FUTURE

Revisiting disinfection methods that have been used in the past may also be an effective means to...
counteract biofilm development. Twenty to 30 years ago, contact lenses were predominantly cleaned using a device that plugged into an electrical circuit to create heat. The advent and ease of use of multipurpose solutions caused the heat system to fall out of favor with many patients and providers; however, a recent study found that using a warming device that reached a temperature of 140°F for three hours with a multipurpose solution was more effective against biofilm formation than the multipurpose solution alone. As such, further research is needed to develop a warming device that could be easily manufactured and potentially used by our contact lens patients.

The habits of noncompliant lens wearers have been thoroughly studied; hallmarks include reuse and topping off of solution, and not cleaning or replacing the case or contact lenses regularly. Some patients do some of these things, while others do all of them; regardless, not making these actions a habit can lead to a 4.4-fold higher risk of microbial keratitis. Interestingly, contact lens case contamination has been found in 58% to 85% of patients without any symptoms of infection. As such, proper contact lens case hygiene can have a significant impact on the reduction and removal of biofilm.

Practitioners should also refrain from recommending that patients discard used multipurpose solution from their lens cases, rinse the wells of the case with hot water or fresh multipurpose solution and let the case air dry, as exposure to water can place both the case and contact lenses in contact with *Acanthamoeba* and other microbes. Research has indicated the most effective method for cleaning a contact lens case is to rub each well with a finger, rinse the case with fresh multipurpose solution, wipe the case with a clean tissue and then place it face-down to air dry. The Centers for Disease Control and Prevention and the Food and Drug Administration have both updated their consumer safety websites with the new case cleaning recommendations.

So what does this mean for practitioners and their patients? Unfortunately, there does not seem to be a quick fix for biofilm prevention or reduction. Research and development continues to be ongoing in an effort to create new solutions with improved antimicrobial efficacy, while other studies are addressing ways to add antimicrobial compounds into contact lens cases to limit cell adhesion. Still, continuing to teach new contact lens wearers and remind older ones about the importance of proper cleaning and replacement of not only their contact lenses but also their cases remains a priority.

Returning to the patient from the beginning, she reported that she had forgotten about cleaning the case, even though she admitted it looked rather dirty. She stated she would be compliant from now on for fear of another infection. Overall, however, it is hoped that it does not take an episode of infection for a patient to realize the importance of adequate care and replacement of contact lenses and cases.

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Onset of bacterial keratitis secondary to improper contact lens wear is a serious condition that may lead to potential blindness, especially in the absence of adequate patient care and education. Because contact lens wear alters the state of the ocular surface, corneal homeostasis is also disrupted, compromising the natural defenses that predispose patients to bacterial infections and sight-threatening complications. As such, eye care practitioners play a vital role in providing the best treatment possible to alleviate corneal compromise and ensure successful visual outcomes.

The release of daily disposable contact lenses and high-Dk soft contact lens materials, as well as more effective antimicrobial medications, has meant that practitioners as a whole are seeing a decline in the severity of patients presenting with contact lens-related bacterial infections. However, though the level of infection has decreased, the number of infections has actually increased, primarily due to poor patient hygiene and noncompliance with care regimens and the overnight wear of contact lenses.

Adopting more proactive measures may help prevent these potentially debilitating infections from occurring; thus, the prompt evaluation of contact lens-related infections is critical, as is the timely initiation of patient treatment.

Extended wear lenses manufactured with conventional hydrogel technology led many patients to develop corneal hypoxia. In response, silicone hydrogel lenses with high-Dk materials were created. These have since become the mainstay for patients requiring correction with soft lenses, though they interact no differently with the corneal epithelium than their predecessors did, especially in the case of overnight wear.

Independent of their level of oxygen transmissibility, however, contact lenses in general provide a surface for microbial adhesion while also disrupting the normal tear exchange process for removal of bacteria and debris from the ocular surface. Constant mechanical rubbing of the lens and eyelid against the corneal epithelium further disrupts the turnover of epithelial cells, weakening the cornea’s defense system against bacteria looking for an opportunity to enter and infect the cornea.

WEIGHING IN

Risk factors that predispose patients to corneal infections secondary to contact lens use include immunosuppression, smoking, overnight lens wear, misuse/overwear of lenses, inadequate disinfection practices and contamination of lens solutions and/or lens storage cases. Patients with diabetes and other uncommon systemic illnesses should limit contact lens wear as certain conditions experienced by diabetes patients can delay wound healing, further exacerbate onset or progression of an infection and decrease treatment efficacy (Table 1). Patients of a younger age, male gender and/or higher socioeconomic status are also at an increased risk of an infection related to contact lens wear.

Obtaining a detailed history is instrumental in ensuring proper management of bacterial infections. Patients should be asked about the initial onset of symptoms, type of contact lenses worn, wearing schedule, frequency of overnight wear, lens solution used and timing of lens case replacement. The presence of pain, redness, discharge or blurred vision can also provide clues as to the severity of the patient’s infection. A review of underlying medical problems, current systemic medications in use and any previous ocular history (including other infections, trauma, dry eye or ocular surgery) is also necessary to determine an appropriate care regimen.

To avert a possible infection, practitioners should train patients on proper techniques for lens insertion, removal, cleaning, storage and disinfection. Furthermore, clinicians should also counsel lens wearers on effective hygiene practices, including handwashing, the use of approved contact lens solutions, frequent

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Managing Contact Lens-Related Bacterial Infections

When a patient at risk presents, how do you keep them free of problems?

By Anar Maurya, OD
replacement of contact lens cases and avoidance of using tap water or saliva to lubricate their lenses. Additionally, instruct them to never reuse or “top off” the solution in their contact lens case. Rubbing the lens during cleaning also constitutes a vital step in the disinfection process. The FDA has outlined specific guidelines regarding proper patient handling and care of contact lenses. These are reproduced in a special patient education handout on page 21.

Visual aids and live demonstrations of proper contact lens handling methods can be effective as education tools. Counseling the patient regarding appropriate lens wear should occur at all follow-up examinations. Similarly, try to advise patients to contact a local eye care professional immediately should they experience any redness, pain, sensitivity or blurred vision associated with their contact lens wear.

Practitioner treatment patterns during an active infection should focus on minimizing pain, restoring corneal integrity and minimizing scarring, with the ultimate goal of restoring visual function. Most patients are looking to alleviate their symptoms as quickly and effectively as possible using the most judicious treatment plans available; as such, it is the responsibility of the eye care practitioner to identify the infection’s severity, determine whether it is sterile or non-sterile, understand when to obtain a culture and realize when a prompt referral to a corneal specialist is necessary. Corneal devastation can take place rapidly if left unchecked, so prompt recognition and treatment of the problem is imperative to prevent visual loss.

**CULTURE SHOCK**

The majority of cases of bacterial keratitis reflect the normal flora of the ocular surface and largely result from gram-positive organisms like coagulase-negative Staphylococci, Staphylococcus aureus and Streptococcus, as well as the gram-negative organisms Pseudomonas aeruginosa and Haemophilus influenzae. When contact lenses are introduced to the ocular surface, changes in the bacterial flora occur and may vary depending on patient age, sex, genetic makeup, climate and geographic location. *P. aeruginosa* is the most common pathogen present in contact lens-related infection cases due to its triggering of biofilm growth on both lenses and lens cases, and its ongoing acquired resistance to certain contact lens solutions and cleansers.

In any case of a suspected bacterial infection, prompt identification of the offending organism causing the issue is an important step towards selecting the appropriate treatment. Since the introduction of fluoroquinolones, the need for culturing to identify the infection has dropped off significantly, with the majority of cases of contact lens-related bacterial keratitis managed without smears or cultures; however, antibiotic resistance is also increasing, with approximately 80% of current MRSA strains now resistant to fluoroquinolones. As such, obtaining a culture with appropriate culture media will help practitioners both detect resistant strains and also

### Table 1. Systemic Conditions that Contraindicate Contact Lens Wear

- Diabetes mellitus
- Gonococcal infection with conjunctivitis
- Debilitating illnesses, especially those that cause malnourishment or require respirator dependence
- Vitamin A deficiency
- Connective tissue diseases
- Acoustic neuroma or a neurological surgery that causes damage to the 5th or 7th cranial nerves
- Dermatological/mucous membrane disorders (e.g., Stevens-Johnson syndrome or ocular cicatricial pemphigoid)
- Graft-versus-host disease
- Immunocompromised status
- Diphtheria
- Atopic dermatitis/blepharoconjunctivitis
- Chronic assisted ventilation
MANAGING CONTACT LENS-RELATED BACTERIAL INFECTIONS

identify specific fungal, herpetic and *Acanthamoeba* infections.

Culturing is also warranted in cases when the patient’s cornea exhibits delayed healing, especially when a large, deep ulcer may be present within the visual axis. Culturing may be the best method to determine the most appropriate antibiotic necessary for treatment and also to help prevent antibiotic resistance. Other key reasons to perform a culture include the presence of vegetative material, corneal thinning, satellite lesions and/or recent care received in a hospital environment. Patients who present to the clinic in an immunocompromised state also require prompt culturing; in general, if a patient does not respond as expected to initial therapy, a practitioner should proceed with culturing immediately and also consider contacting an outside specialist.

**FIRST RESPONDERS**

Regardless of the causative pathogen, first-line treatment for suspected bacterial infections should include broad-spectrum coverage against both gram-positive and gram-negative organisms.

Over the years, the choice of treatment for bacterial infections has changed with the introduction of fourth generation fluoroquinolones; with today's array of topical antibiotic options, many practitioners reach for these medications with good reason. Fluoroquinolones provide excellent coverage for both gram-positive and gram-negative pathogens, and are readily available at generic prices with good ocular penetration and less risk of ocular toxicity. The newest fourth-generation fluoroquinolone, Besivance (besifloxacin ophthalmic suspension 0.6%, Bausch + Lomb), stays at high concentration in the tear film for a longer duration once dosed, and is available in a suspension instead of the more typical solution form. In cases in which a patient’s bacterial infection does not respond to fluoroquinolones, older antibiotics like bacitracin, tobramycin or gentamicin can be used instead. Additionally, consider the use of compounded fortified vancomycin or a combination of a fortified aminoglycoside plus fortified cephalosporin in cases in which methicillin-resistant *Staphylococcus aureus* (MRSA) is suspected, as fortified antibiotics offer more complete coverage of both gram-positive and gram-negative organisms. These generally require access to a compounding pharmacy, however.

Corticosteroids, in contrast, are primarily reserved for treatment of sterile, noninfectious infiltrates that present in the peripheral cornea; indeed, corneal infiltrates that are the product of an inflammatory response respond well to both topical steroids and antibiotic combinations. These medications work via the inhibition of the inflammatory response to reduce corneal scarring but can also be damaging to the eye if applied too liberally, and so should only be used to treat centrally-located corneal infections that exhibit significant levels of staining.

When the scope of infection is beyond a certain level of comfort, the patient should be referred to a corneal specialist, where they will likely appreciate the ability to consult with an outside source who is well-equipped to both treat and manage their condition effectively. Patients who continue to experience a reduction in visual acuity at subsequent visits or an increase in pain and/or nonresolution of any corneal defects warrant prompt referral as well.

To help instill good habits in patients and proper respect for their role in the success of lens wear, the FDA created the guidelines on the adjacent page. Please feel free to photocopy this page and use it as an educational handout with your contact lens patients.
How to Avoid Eye Infection or Injury

Contact lens users run the risk of pink eye (conjunctivitis), corneal abrasions and eye irritation. A common result of eye infection is corneal ulcers, which are open sores in the outer layer of the cornea (the clear part of the eye over the pupil). Many of these complications can be avoided through everyday care of the eye and contact lenses.

To reduce your chances of infection, the FDA recommends the following practices:

» In general, if you’re using multipurpose contact lens solution, replace your contact lens storage case at least every three months or as directed by your eye care provider. If you’re using contact lens solution that contains hydrogen peroxide, always use the new contact lens case that comes with each box—and follow all directions that are included on or inside the packaging.

» Clean and disinfect your lenses properly. When using contact lens solution, read and follow all instructions on the product label to avoid eye injury. This is particularly important if your eye care professional has recommended a solution with hydrogen peroxide, as these solutions require special care.

» Always remove contact lenses before swimming.

» Never reuse any lens solution. Always discard all of the used solution after each use, and add fresh solution to your lens case.

» Do not use any water (which includes distilled water, tap water, and homemade saline solution) on your lenses because it can be a source of microorganisms that may cause serious eye infections. (Contact lens solution is sold in “sterile” containers, which means it is free from living germs or microorganisms.)

» Never put your lenses in your mouth or put saliva on your lenses. Saliva is not sterile.

» Never transfer contact lens solutions into smaller travel size containers. These containers are not sterile, and unsterile solution can damage your eyes.

» Do not wear contact lenses overnight unless your eye care provider has prescribed them to be worn that way. Any lenses worn overnight increase your risk of infection. Wearing contact lenses overnight can stress the cornea by reducing the amount of oxygen to the eye. They can also cause microscopic damage to the surface of the cornea, making it more susceptible to infection.

» Never ignore symptoms of eye irritation or infection that may be associated with wearing contact lenses. These symptoms include discomfort, excess tearing or other discharge, unusual sensitivity to light, itching, burning, gritty feelings, unusual redness, blurred vision, swelling, or pain. If you experience any of these symptoms, remove your lenses immediately and keep them off. Contact your eye care professional immediately. Keep the lenses, because they may help your eye care professional determine the cause of your symptoms.

MANAGING CONTACT LENS-RELATED BACTERIAL INFECTIONS

to be unfit—either physically or psychologically—even at the cost of losing the patient from the practice’s population.

With 41 million contact lens wearers in the United States today, practitioners need to remain ahead of possible infections by keeping patients aware of potential contact lens-related complications and continually reiterating best practices for contact lens wear and care at each visit. Until a lens is designed that incorporates an optimum balance of surface wettability, biocompatibility and resistance to micro-organisms, practitioners and patients alike must strive to maintain a proper contact lens wear regimen.


OVERNIGHT SENSATION

A 27-year-old male presented to the clinic with an acute red eye following wear of his soft contact lenses overnight. His initial symptoms consisted of a red eye with intense pain, photophobia and blurred vision. The patient’s visual acuity was reduced five lines and a slit lamp examination revealed an excavated corneal defect 2mm in diameter located at six o’clock (see photos at right) on the right eye. The anterior chamber presented with trace cells, minimal flare and no hypopyon. The patient was directed to begin around-the-clock moxifloxacin, one drop administered every hour, and was also advised to discontinue wear of his contact lenses immediately.

During the next day follow-up, an improvement of two lines in the patient’s visual acuity was noted, while the patient’s level of comfort had improved considerably with a reduction in both pain and photophobia. Daily follow-up examinations continued to demonstrate remarkable improvement in physical signs with a healing corneal defect and quiet anterior chamber. The antibiotic was tapered on day three to every other hour and then to QID by day five.

At the 10-day follow-up appointment, the patient presented with an intact cornea and scarring in place of the presumed infectious ulcer. Visual acuity restored and the patient resumed contact lens wear in a daily disposable modality, with the recommendation that he limit lens wear and discontinue overnight wear. Refractive surgery options were also reviewed.
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Topical and oral antibiotics are the stock-in-trade of most health care professionals—workhorse drugs likely prescribed every day. For the most part, eye care practitioners traditionally prescribe topical forms, though systemic drugs are increasingly used in eye care. The release of new products and the ever-evolving resistance patterns of the microorganisms responsible for infections also mean that prescribing habits continue to change. Pick up any public health magazine and you’ll notice that one of the top concerns is the increase in resistance to our current armament of antibiotics, as well as the continuing absence of new drugs to counter this ever-present threat. These trends compel us to remain up-to-date on each drug’s properties, interactions, resistance patterns and clinical impact.

RESISTANCE AND R&D
The US Centers for Disease Control and Prevention continues to track reports of systemic methicillin-resistant Staphylococcus aureus (MRSA), noting that 72,000 patients in this country required treatment for a related infection in 2014.¹ Most individuals acquired their condition through the health-care system, though the number of cases with community-associated infections—i.e., those in which the patient had no inpatient contact with a medical facility prior to infection—is also on the rise.¹ Data from the recent Antibiotic Resistance Monitoring in Ocular Microorganisms (ARMOR) study reveals that methicillin-resistant organisms continue to remain common in ocular isolates and, when resistance is found, most organisms are discovered to be multidrug-resistant.² Interestingly, however, nationwide antibiotic resistance rates have not increased in the last five years and have in fact decreased in the case of some combinations of antibiotics and pathogens. The first case of a patient with a strain of E. coli resistant to the powerful antibiotic was reported in the United States was reported in May 2016.³ Antibiotic resistance is a big concern, particularly in light of the relatively few new drugs released in recent years.

Microorganisms have several ways to develop resistance to a drug, including the production of enzymes that render the antibiotic ineffective and the alteration or elimination of the antibiotic target site so that there is less affinity. The presence of microorganisms can also decrease antibiotic uptake and/or increase efflux of the drug, and lead to the development of bypass pathways around target sites, further rendering the administered drug ineffective. Furthermore, during the development of the bacteria’s resistance characteristics, the inappropriate use of antibiotics (e.g., if they are prescribed for viral infections, or if the wrong one is given in a case of misdiagnosis) in both human and veterinary medicine can have a negative effect, as does the widespread use of these drugs in the agricultural industry.⁴ As of May 2016, there were 33 antibiotics in clinical trials being studied.⁴ The majority seem to be variations of existing meds or additional members of already-existing group of drugs with few, if any, recently added classes of antibiotics. Overall, the success rate for clinical drug development is low, with many failing stringent clinical trials. With the expected return for a company to cover the post-trial development and market launch of a new antibiotic unlikely to exceed initial development costs, many companies have shut down their antibiotic research efforts entirely.⁵

KICKING KERATITIS
Considered an ocular emergency, microbial keratitis is of particular concern in contact lens wearers. Staph. aureus is a leading cause of keratitis worldwide, possessing a multitude of characteristics that enhance its adhesion to host tissues, evasion of the human immune system and destruction of host cells.⁶

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Patients who wear contact lenses and those who have suffered ocular trauma with damage to the corneal epithelium have an increased chance of developing ulceration as a result of infection by this organism, necessitating antibiotic therapy for adequate resolution.7

One study, in which isolates were found to be susceptible to vancomycin and polymyxin, but also resistant to the second-generation fluoroquinolones ciprofloxacin and ofloxacin, identified approximately 31% of isolates taken from keratitis patients as MRSA.1 There was also an increase in the resistance of both MRSA and methicillin-susceptible Staphylococcus aureus (MSSA) to fourth-generation fluoroquinolones detected during the study period from 1993 to 2012.8

The latest ARMOR report noted the global prevalence of MRSA at 42% from Staphylococcus isolates, with the most effective treatment option being vancomycin.2 With respect to minimum inhibitory concentrations (MICs), large differences were still identified among the fluoroquinolone class of antibiotics—namely, the newer fluoroquinolones in the group had a lower MIC compared with the older ones.2 Additionally, the chlorofluoroquinolone Besivance (besifloxacin, Bausch + Lomb) exhibited the lowest MIC for gram-positive isolates and was as effective as moxifloxacin in treating bacterial conjunctivitis; it was also more effective than the same at eliminating bacteria from the ocular surface prior to cataract surgery.2,9

Besivance contains besifloxacin and the delivery vehicle DuraSite (Insite Vision), a mucoadhesive polymer designed to increase drug retention time on the ocular surface to 4.7 hours.5 This agent’s extended retention time and high concentration on the ocular surface, combined with the low associated MIC values for MRSA, may mark it as a possible first-line choice for patients suspected of having MRSA-related conjunctivitis or keratitis.

The ARMOR report also mentioned other commonly seen infectious isolates: Pseudomonas aeruginosa, Streptococcus pneumoniae and Haemophilus influenzae.2 Almost all S. pneumoniae isolates were susceptible to both chloramphenicol and the fluoroquinolones tested, with Besivance having the lowest MIC among all of latter considered.2 With respect to the P. aeruginosa isolates, their rates of resistance remained rather low in the face of the antibiotics tested, with good susceptibility to both fluoroquinolones and tobramycin. Additionally, the H. influenzae isolates proved susceptible to all antibiotics administered, while azithromycin showed the most resistance against it, with 42% of MSSA and 93% of MRSA isolates remaining unaffected.2 The ARMOR report noted that if an isolate was identified as MRSA, there was also a strong likelihood that it exhibited multidrug resistance.

Interestingly, the isolates in the study, regardless of origin, exhibited susceptibility to vancomycin. In this respect, if a clinician is treating a suspected MRSA-related infection—either the patient with the infection is in a hospital or personal care home, or the infection itself is not responding to initial antibiotic therapy—25mg/ml to 50mg/ml of topical fortified vancomycin is the recommended treatment to ensure appropriate coverage.2 This medication would have to be obtained through a compounding pharmacy.

Current antibiotics may not be enough to treat corneal infections such as this alpha-hemolytic Streptococcus presentation.
ANTIBIOTICS IN PRACTICE: USE, DON’T ABUSE

from a compounding pharmacy, where the pharmacist would reconstitute 500mg of vancomycin powder with 10ml sterile water sans-preservative. Alternatively, they can also use 10ml of artificial tears as a compounding ingredient, which would yield a concentration of 50mg/ml. This formulation should be dosed every hour for the first 24 hours with a re-evaluation and a decrease in dosage frequency if improvement is noted. The compounded vancomycin should be stored in the refrigerator for an additional four days before expiration. The compounded vancomycin should be stored in the refrigerator for an additional four days before expiration.10

MRSA infections are of particular concern when considering their relation to the periorbital tissues and adnexa. With Staphylococcus sp. being the most prevalent bacteria on the skin, there is also a higher risk of developing an external MRSA-related infection. A study reviewing the records of patients diagnosed with an ocu-

MRSA Makes Its Mark

A 50-year-old white male presented complaining of near vision issues. His medical history was unremarkable except for a possible mosquito or spider bite on the back of his neck. He reported going for a hike the day before and noticing a bump that had begun to form later that evening (Figure 1). He admitted taking two of three pills of oral ciprofloxacin “left over” from a previous Rx and the remaining pill the morning of the current exam. The patient reported no other serious skin conditions or infections, except that three years prior, he had been visiting a friend in the hospital and later developed an infection on his arm. Testing revealed it was MRSA, and the lesion was surgically drained and treated.

At the present exam, he reported some minor discomfort with the lesion and noted that it had a solid feel to it, much like a knot. It was recommended that he contact his primary care physician to have the lesion assessed, especially since he had had a previous MRSA infection.

Two weeks later, the patient returned to the clinic with an update: he had contacted his PCP and scheduled an appointment for the day after the exam; however, as the day proceeded, he had noticed an increase in pain and discomfort and decided to visit an urgent care clinic, where he was given Bactrim (trimethoprim-sulfamethoxazole, AR Scientific) to be taken as a single double-strength pill every 12 hours and also Vicodin (acetaminophen and hydrocodone, Abbott) for the pain. The patient was informed that what he initially believed to be a bite instead now appeared to be several pimples “combined” to form a super pimple.

The day after the urgent care consultation, the patient noted that the lesion in question was becoming increasingly larger and the level of pain was still rising despite his taking the medication as prescribed. Unable to wait for his scheduled PCP appointment, the patient instead went to the emergency room, where a physician attempted to drain the lesion. A
lar-centric MRSA infection over a four-year period at a busy hospital practice found that preseptal cellulitis was the most prevalent. Additional conditions that should also be looked for, however, included dacrocystitis, canaliculitis and other periobital lesions and/or abscesses.

A cotton wedge was ultimately left in the wound in an attempt to help it drain further, and the patient was directed to continue taking the Bactrim and Vicodin (Figure 2).

The following day, however, the patient indicated that the pain had increased to a point where it was affecting his sleep, and so he elected to return to the urgent care clinic and then ultimately to the ER, where his lesion was debrided and he was given Ancel (cefaclor, GlaxoSmithKline), a cephalosporin antibiotic given intravenously to treat severe soft tissue and skin infections secondary to MSSA. He was told to continue taking the Bactrim, was given oxycodone and told to return the next day for a follow-up appointment.

At this visit, it was found that his infection was secondary to MRSA, so he was switched from the Bactrim to doxycycline 100mg BID (Figure 3), a course of action confirmed as valid by susceptibility testing on the MRSA isolate. The patient continued to self-administer the doxycycline for 10 days, at which point the lesion finally healed (Figure 4).

Though this case doesn’t discuss an ocular infection, it highlights the importance of keeping MRSA as a differential when assessing a possible skin issue.

SKIN AND SOFT TISSUE INFECTIONS

High antibiotic tissue concentrations are achieved via frequent dosing and direct access to the affected tissue when treating ocular surface infections. However, when treating skin infections like preseptal cellulitis, systemic antibiotics must travel through the circulatory system to enter into the tissue, reducing their local concentration. As such, the use of topical antibiotics is unlikely to cause systemic antibiotic resistance, though the overuse of systemic antibiotics has contributed to systemic and also possibly topical antibiotic resistance.

Healthcare-associated methicillin-resistant Staphylococcus aureus (HA-MRSA) is especially correlated with severe, invasive disease in hospitalized patients, while community-associated methicillin-resistant S. aureus (CA-MRSA) is more often linked to young, healthy individuals exhibiting a skin or soft tissue infection with no recent exposure to the healthcare system. Athletes, daycare and school students, military personnel living in barracks and those who recently received inpatient medical care are at a higher chance for developing this condition; Additional risk factors for CA-MRSA infection include skin trauma (i.e., lacerations, abrasions, tattoos and injection drug use), cosmetic body shaving, incarceralation, HIV infection and sharing of uncleaned equipment between multiple users.

Two of the newest antibiotics for acute bacterial skin and skin structure infections (ABSSSI), a category that includes MRSA, are Dalvance (dalbavancin, Allergan) and Sivextro (tedizolid, Merck). The former inhibits cell wall synthesis and is delivered to the patient via intravenous infusion, typically as a single dose of 1500mg or a two-dose regimen of 1000mg initially followed by a 500mg dose one week later. Dalvance is supplied in 500mg vials at an approximate cost of $1,788 per vial. Sivextro, in contrast, inhibits protein synthesis, with its use as treatment for ABSSSI conditions being 200mg daily for six days administered either orally (priced at $2,230) or intravenously ($2,961).

Preseptal cellulitis is the most likely periorbital infection an optometrist would treat. This infection involves the eyelid and/or surrounding tissue anterior to the orbital septum. Signs and symptoms include tenderness, swelling, unusual warmth, redness and/or discoloration of the eyelid and fever, in some cases. Common causes of preseptal cellulitis include hordeolum/chalazion, sinusitis, upper respiratory infection and trauma. The most likely causative agent is S. aureus, with a recommended treatment of an oral antibiotic that covers the most common pathogens the cause sinusitis.

More specifically, the Infectious Disease Society of America (IDSA) advocates the use of amoxicillin-clavulanate 500mg every eight hours (or 875mg every 12 hours) in the treatment of uncomplicated sinusitis, but not the use of amoxicillin alone secondary to increased resistance. An alternative treatment is cephalexin 500mg every six hours; cephalosporin antibiotics have excellent soft tissue penetration and should be considered as first-line treatments for periorbital infections. The IDSA also recommends that treatment for uncomplicated infections in adults be administered for a period no longer than seven days, while in children it can be extended from 12 to 14 days. In unresponsive cases, MRSA should be considered and an antibiotic that has coverage for MRSA should be
**INTRODUCTION**

The use of topical antibiotics in the prevention of post-surgical endophthalmitis remains controversial. Although the latest guidelines support the use of postoperative prophylaxis, the lack of effectiveness of topical aminoglycosides as prophylactic agents has led to the recommendation of alternative agents. These agents include broad-spectrum antibiotics that can be administered as prophylaxis for infection. Post-surgical prophylaxis is given in the face of ongoing controversies and the desire to minimize the use of systemic antibiotics.

**TOPICAL ANTIBIOTICS**

Topical antibiotics are used in a variety of clinical settings. Commonly prescribed included include bacitracin, neomycin, polymyxin B, and sulfacetamide. The first-generation fluoroquinolones, ciprofloxacin and ofloxacin, are bactericidal and are often preferred in the prophylaxis of postinjury endophthalmitis. The second-generation fluoroquinolones, levofloxacin and moxifloxacin, are also preferred over older agents.

**DOXYCycline**

Doxycycline is another protein synthesis inhibitor option that binds to a different ribosomal subunit than clindamycin. It is not indicated for use in pregnant or nursing women, or in patients who are allergic to sulfonamide. It is contraindicated for patients with a known allergy to sulfonamide.

**CLINDAMYCIN**

Another medication option, clindamycin, is a protein synthesis inhibitor that has been demonstrated to have good activity against MRSA that can be administered at dosages of 300mg to 450mg every six to eight hours for seven to 14 days. Clindamycin exhibits excellent tissue penetration, particularly with respect to entering bone and abscesses; however, the drug also has an FDA black box warning, as it has been linked to onset of severe colitis, which may be fatal. Thus, it is reserved for serious infections for which less toxic antimicrobial agents are inappropriate. Furthermore, clindamycin is also not suitable for use in patients with nonbacterial infections, including most upper respiratory tract conditions.

Doxycycline is another protein synthesis inhibitor option that binds to a different ribosomal subunit than clindamycin. Its recommended dose of 100mg twice daily for seven to 14 days is a treatment option for MRSA, but only following performance of susceptibility testing. It should not be started empirically in suspected MRSA infections.

Additionally, doxycycline is a pregnancy category D medication and is not suitable for use in pregnant or nursing women, or in patients under the age of eight. Advise patients who are using this medication to take it more than two hours before going to bed, with food but without calcium, antacids or dairy products.

**POST-SURGICAL PROPHYLAXIS**

Topical antibiotics are routinely used following cataract surgery. The use of prophylactic agents for postoperative endophthalmitis remains controversial. Although the lack of effectiveness of topical aminoglycosides as prophylactic agents has led to the recommendation of alternative agents, the potential reduction in endophthalmitis, the use of dropless cataract surgery may have the potential to increase patient compliance of medication use post-surgery and also lead to cost savings.

The use of intravitreal injections has increased dramatically secondary to the beneficial effects of steroids and anti-VEGF medications in patients with conditions such as exudative macular degeneration and diabetic retinopathy. Traditionally, a topical antibiotic is used after (and sometimes prior to) the injection itself to prevent the development of endophthalmitis, as previously mentioned. One study that compared a 28-month period in which topical antibiotics were prescribed following intravitreal injections with a nine-month period in which they were not found that the incidence of endophthalmitis after intravitreal injection was low and that the use of postinjection topical antibiotic drops did not reduce the risk; in fact, it was associated with a trend towards higher incidence of the condition.

**ORAL ANTIBIOTICS FOR OSD/MGD**

Ocular surface disease (OSD) is one of the most common reasons initiated for a seven- to 14-day period. Bacitracin/Septra is a combination of sulfamethoxazole and trimethoprim available in two concentrations: either sulfamethoxazole 400mg and trimethoprim 80mg or a “double strength” (DS) dose of sulfamethoxazole 800mg and trimethoprim 160mg. One DS tablet taken twice daily for seven to 14 days is recommended for the treatment of skin and soft tissue infections due to MRSA. Monotherapy with DS trimethoprim-sulfamethoxazole for the treatment of an uncomplicated skin infection may be reasonable in relatively young patients in the absence of systemic manifestations or comorbid conditions. As this medication contains sulfamethoxazole, it is contraindicated for patients in the absence of systemic manifestations or comorbid conditions. Additionally, clindamycin is a protein synthesis inhibitor option that binds to a different ribosomal synthesis inhibitor option that binds to a different ribosomal

**At-risk patients may also include those with Pseudomonas infections.**
disturbances. Meibomian gland layer and often leading to ocular irritation, discomfort and visual disturbances. Melibomian gland dysfunction (MGD) is an often-underlying cause for the disruption to the tear film, with multiple therapies available including warm compresses, topical lubrication and immunomodulation, omega-3 supplementation, oral antibiotics, laser- and light-based therapies and surgical interventions.

Oral antibiotic use has also become a mainstay therapy for many patients suffering from MGD: oral doxycycline and azithromycin have both been used as part of treatment for MGD, as the condition is thought to occur in part due to increased production of inflammatory mediators such as matrix metalloproteinases and activated B-cells. The use of doxycycline and azithromycin is believed to act as anti-inflammatory medications, reducing the production of these inflammatory mediators to soothe the ocular surface. Recommended doxycycline dosages for MGD vary in the literature from 20mg to 100mg QD to BID, and for varying lengths of time with results including improved patient comfort, tear film break-up time, inflammatory signs and staining scores. Azithromycin, in contrast, is typically prescribed at 500mg/day for three days per week for three to four weeks, with expected improvements in tear film break-up time, patient comfort and staining scores.

Interestingly, a recent publication from the American Academy of Ophthalmology on the use of oral antibiotics for the treatment of MGD-related OSD indicated that although oral antibiotics are commonly used in the management of OSD, there is no Level I evidence (defined as three or more randomized clinical trials demonstrating similar results) to support their use in this fashion. As such, in reviewing the literature, the report further noted that there are few clinically meaningful studies that demonstrate the benefits of oral antibiotics in the treatment of MGD-associated ocular surface disease; however, the studies that do exist indicate their use may be effective. More randomized controlled trials are required in this area to further confirm this hypothesis, however.

An increase in therapeutic privileges for optometrists necessitates that they continue to educate themselves regarding the latest topical and oral treatments available for their patients. In particular, the increased presence of MRSA-related infections requires heightened vigilance in keeping track of the signs and symptoms of possible cases, as well as what options are available for resolution.

1. In May 2016, the first case of a patient with a strain of which organism resistant to powerful antibiotics administered was reported?
   a. Escherichia coli
   b. Mycobacterium tuberculosis
   c. Norovirus
   d. Morganella morgani

2. Which of the following is not an effect of the presence of antibiotic-resistant microorganisms?
   a. Decreased antibiotic uptake
   b. Production of enzymes that increase the antibiotic’s effectiveness
   c. Increased efflux of the antibiotic drug
   d. Development of bypass pathways around target sites

3. The latest ARMOR report noted the global prevalence of methicillin-susceptible Staphylococcus aureus at what percentage?
   a. 35%
   b. 80%
   c. 27%
   d. 42%

4. Which organism is most often linked to young, healthy individuals exhibiting a skin or soft tissue infection that is not responding to initial treatment with no recent exposure to the healthcare system?
   a. CA-MRSA
   b. CA-MSSA
   c. HA-MRSA
   d. HA-MSSA

5. Which of the following is a new antibiotic for treatment of acute bacterial skin and skin structure infections?
   a. Voriconazole
   b. Dosycycline
   c. Delavancin
   d. Gentamicin

6. Hordeolum/chalazion, sinusitis, upper respiratory infection and trauma are all common causes of which condition?
   a. Blepharitis
   b. Preseptal cellulitis
   c. Dacryocystitis
   d. Canaliculitis

7. Which of the following is not recommended as a treatment for skin and soft tissue infections attributed to MRSA?
   a. Augmentin
   b. Clineamycin
   c. Dosycycline
   d. Sulfamethoxazole and trimethoprim

8. Which of the following is the most prevalent organism on the skin?
   a. Pseudomonas aeruginosa
   b. Staphylococcus pneumonia
   c. Staphylococcus sp.
   d. Fusarium

9. Which of the following oral antibiotics are most commonly used to treat MGD?
   a. Tobramycin and ofloxacin
   b. Ciproflaxacin and vancomycin
   c. Befloxacin and gatifloxacin
   d. Dosycycline and azithromycin

10. Topical antibiotics are prescribed following cataract surgery and/or intravitreal injections as a means to prevent which of the following?
    a. Corneal edema
    b. Endophthalmitis
    c. Vitreous hemorrhage
    d. Retinal detachment

Antibiotics in Practice: Use, Don’t Abuse
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2. A B C D
3. A B C D
4. A B C D
5. A B C D
6. A B C D
7. A B C D
8. A B C D
9. A B C D
10. A B C D

Evaluation questions (1 = Excellent, 2 = Very Good, 3 = Good, 4 = Fair, 5 = Poor)
Rate the effectiveness of how well the activity:

11. Met the goal statement:     
12. Related to your practice needs:     
13. Will help improve patient care:     
14. Avoided commercial bias/influence:     
15. How do you rate the overall quality of the material?:     
16. Your knowledge of the subject increased:     
17. The difficulty of the course was:     
18. How long did it take to complete this course?:     
19. Comments on this course:     
20. Suggested topics for future CE articles:     

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As the emphasis in healthcare continues to shift toward prevention and early detection of disease, eye care practitioners have seen technological innovations emerge that are designed to streamline diagnosis and patient management. Real-time data collection during the patient encounter, called point-of-care testing (POCT), is performed near or at the site of a patient visit, with results available quickly enough to influence the course of care right at the outset, allowing for faster clinical decision-making. Empowering providers to make decisions chairside may have a huge impact in quality of care while also reducing costs to patients and payers.

Ocular surface disease (OSD) is one area of eye care that has recently seen a boom in point-of-care diagnostics. Noting the comorbidity associated with OSD, the prevalence data is extremely telling: an estimated 20.7 million Americans exhibit clinically significant signs or symptoms of dry eye, with more recent studies on the prevalence of meibomian gland dysfunction (MGD) suggesting this number may in fact be significantly higher.1

When one accounts for patients with other forms of ocular surface compromise, the need for greater vigilance for OSD grows even more. Fifty million Americans have allergies, with three million of those individuals suffering from seasonal forms.2 An estimated 38 to 40 million contact lens wearers exist in the United States, while 700,000 individuals undergo LASIK annually across the country.

Data from a 2015 report notes that 68% of US adults own a smartphone and 45% also own a tablet computer; both of these devices have been shown to decrease blink rate and increase the risk of MGD and evaporative dry eye. Symptoms consistent with dry eye are increasing among individuals under the age of 40, who spend on average about two hours per day more on their digital devices than their over-40 counterparts.3 Additionally, Sjögren’s syndrome, a systemic autoimmune disease in which immune cells attack and destroy host exocrine glands that produce tears and saliva, affects about four million people in the United States.4

Given this huge potential population base, it can be said that the eye care profession has seen remarkable advancements in POCT over the last decade that have given practitioners the ability to better differentially diagnose underlying causes of ocular surface disease, and therefore make treatments more targeted, timely and cost effective. In this article, several experts on dry eye and ocular surface disease will discuss point-of-care testing and its impact on their dry eye practices.

MY FAVORITE THINGS
Our panelists begin by sharing their impressions of the POC tests for dry eye they find most essential.

Point-of-care tests and advanced diagnostic imaging are helping doctors tackle it faster and more precisely than ever before.

Targeted and Timely: The New Model of Dry Eye Care
By Richard B. Mangan, OD

Richard Mangan, OD, Moderator. We have come a long way in recent years in our understanding of the underlying cause of both aqueous-deficient and evaporative dry eye, as well as the allergic, infectious and environmental factors that can influence the ocular surface in other ways. The addition of certain point-of-care tests to the subspecialty of ocular surface disease has only broadened our understanding of this multifactorial disease; however, before we get into how POCT has personally impacted your practice, I would like to ask each of you to share your favorite POC tests for dry eye.
you the following question: of the available point-of-care diagnostic tests used in ocular surface disease, if you could only pick one to use in your clinical practice, which one would it be and why?

Scott Schachter, OD. InflammaDry (Rapid Pathogen Screening) is the POC test I rely on and use the most, for several reasons. It measures matrix metalloproteinase 9, or MMP-9, a nonspecific biomarker for inflammation. Studies have shown that desiccating stress, which most all of our patients are exposed to through device use, causes corneal epithelial cells to produce MMP-9. Other studies demonstrate a strong correlation between certain levels of MMP-9 and dry eye symptoms, low contrast visual acuity and tear film break-up time. MMP-9 is a gelatinase, which weakens epithelial barrier function. If it is present in large enough quantities, the patient essentially has a toxic tear film.

We screen all our patients using the SPEED questionnaire (Standard Patient Evaluation of Eye Dryness), and if they score seven or higher, the staff at the clinic automatically knows to perform this test during pretesting. They write the patient’s initials on the test, and the time that the sample was taken. The test is quick and easy to administer, is reimburised by most insurers and has results ready in 10 minutes. If positive, I know to start anti-inflammatory therapy; however, if negative, inflammation related to elevated MMP-9 cannot necessarily be ruled out, as false negatives can still occur with this test. If the clinical signs and symptoms suggest a high probability for inflammation, having the patient back another day to repeat the test may be a good idea.

Regarding the test itself, sensitivity is estimated at 81% to 85% and specificity is 94% to 98%. According to another study, other common tests exhibited either poorer sensitivity (i.e., corneal staining at 54%, conjunctival staining at 60% and meibomian gland grading at 61%) or poorer specificity (tear film break-up time at 45% and Schirmer test at 51%) in contrast to this test. It’s a single-use test that requires no capital outlay and no volume-based contract, and requires that the tear sample be absorbed from the palpebral conjunctiva, rather than scraped, which can cause additional inflammation or irritation. Practitioners should also keep in mind that test results can take longer than 10 minutes to achieve. Typically, a negative test should be checked again right before the patient leaves the office, just in case it simply has not developed yet.

Scott Hauswirth, OD. I agree with Dr. Schachter. Given the choice of only one, InflammaDry is also my selection for the reasons he has already listed. Though it does not give a complete picture of the inflammatory process, it is probably the most useful tool regarding the

### Table 1. Biomarkers Measured in the Sjö Test Diagnostic Panel

<table>
<thead>
<tr>
<th>Biomarker</th>
<th>Diagnostic Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novel, proprietary</td>
<td>Salivary protein-1 (SP-1, IgA, IgC, IgM)</td>
</tr>
<tr>
<td></td>
<td>Carbonic anhydrase (CA-6, IgA, IgC, IgM)</td>
</tr>
<tr>
<td></td>
<td>Parotid secretory protein (PSP, IgA, IgC, IgM)</td>
</tr>
<tr>
<td>Traditional</td>
<td>SS-A (Ro)</td>
</tr>
<tr>
<td></td>
<td>SS-B (La)</td>
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<tr>
<td></td>
<td>Antinuclear antibody (ANA) by HEP-2</td>
</tr>
<tr>
<td></td>
<td>Rheumatoid factor (RF) levels (IgA, IgC, IgM)</td>
</tr>
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TARGETED AND TIMELY: THE NEW MODEL OF DRY EYE CARE

Scalloped lid margins are indicative of the inflammation patterns associated with MGD onset.

Obstructed meibomian glands with telangiectasia also indicate the possible presence of MGD.

Guidance of treatment and management. Where I think it has been most helpful is in identification of our more chronic dry eye patients’ MMP-9 levels, which—when taken as an indicator for the overall level of inflammation present on the ocular surface—is often much more elevated than what we may initially think. This helps practitioners determine the success of both the acute control of inflammation with an initial anti-inflammatory pulse and our ongoing maintenance and protective treatments, and allows us the ability to tailor our treatments to gain control of the disease more efficiently and effectively.

Whitney Hauser, OD. Obtaining an osmolarity measurement is my go-to choice. It’s been well-established that tear film osmolarity is accurate for both the diagnosis and classification of dry eye disease; however, research has also shown that its utility goes beyond a conventional dry eye POC diagnostic. In contact lens wear, osmolarity can be influenced by the lenses themselves as well as the specific type of solution used. Interestingly, scleral contact lenses, often used to treat some of the most symptomatic dry eye patents, can also cause a statistically significant increase in osmolarity after one month of wear; in a study, tear osmolarity measurements were found to increase at a statistically significant level after one month of scleral contact lens wear. Reduced basal tear production and the disruption of the tear film layer is believed to contribute to this increase in tear osmolarity.

From a practice management perspective, osmolarity is billable (CPT 83861, Microfluidic analysis utilizing an integrated collection and analysis device) and data can be gathered by a trained staff member.

Dr. Mangan. I have quite a bit of experience using both the RPS InflammaDry test and the Tearlab osmolarity system. Both have been true POC tests for me in that results can be obtained by a trained staff member.

Dr. Hauswirth. The Sjő test (Bausch + Lomb) has been an extremely useful addition to our tool chest. First, the potential implications of hastening the diagnosis and early intervention of a life-altering condition that we know can lead to severe inflammatory dry eye is Sjögren’s syndrome (SS). According to the DEWS report, SS is a chronic systemic inflammatory disorder characterized by lymphocytic infiltration of exocrine glands. This often results in xerophthalmia (dry eyes), and xerostomia (dry mouth), and parotid gland enlargement. Primary Sjögren’s syndrome occurs in the absence of another underlying rheumatic disorder, whereas secondary Sjögren’s syndrome is associated with another underlying rheumatic disease, such as systemic lupus erythematosus (SLE), rheumatoid arthritis (RA) or scleroderma.

Traditionally, clinicians adhere to one of a number of classification systems in attempting to diagnose SS in the absence of biopsy results (see “Classification Systems for Sjögren’s Syndrome,” p. 37). Serology is ordered looking for inflammatory markers like anti-nuclear antibody (ANA) with instructions for the lab to run an SS-A (Ro) and SS-B (La) if the patient’s ANA was elevated. Rheumatoid factor levels should also be measured. Note, research indicates that ANA is expressed in only 60% of patients with Sjögren’s syndrome, and the disease process can be active for years before traditional biomarkers like Ro and La become evident or positive.

Dr. Hauswirth. The Sjő test (Bausch + Lomb) has been an extremely useful addition to our tool chest. First, the potential implications of hastening the diagnosis and early intervention of a life-altering condition that we know can lead to severe inflammatory dry eye is Sjögren’s syndrome (SS).
disease are tremendous. Use of this test to identify patients with Sjögren’s syndrome earlier on in their disease state and help them begin to establish relationships with rheumatology is critical in staying ahead of the condition’s progression. In my own practice, we have been able to identify many individuals as early-stage Sjögren’s patients who are now collaborating with rheumatology in their care.

This has potentially life-altering implications, as the 15-year risk for a Sjögren’s patient to develop non-Hodgkin’s B-cell lymphoma is nearly 10%, and the site of lymphoma is often the marginal zone histological type, and aggregate to the mucosa-associated lymphoid tissue where Sjögren’s inflammation is most active. This in addition to the extraglandular involvement of organ systems found in 75% of primary SS patients. I think this justifies our efforts to identify the disease as early as possible, and allows our colleagues in rheumatology and other subspecialties to collaborate to our patient’s benefit.

The following case helps to demonstrate the value of incorporating Sjö into an eye care practice: A 36-year-old Caucasian female presented via referral for symptoms of dry eye following laser vision correction more than two years ago. She reported a positive family history of rheumatoid arthritis. After attempting compliance with treatments including warm compresses, artificial tears PRN, Restasis (cyclosporine 0.05%, Allergan) BID and Lastacaft (alcaftadine 0.25%, Allergan) QD OU, she presented with the feeling that her eyes are worsening, with significant burning, pain and visual fluctuation. Additionally, though the patient reports no joint or back pain, she does note that her mouth has been drier than normal during the last year.

Entrance acuities of 20/40 and 20/50, respectively, were recorded, while a slit lamp exam revealed 3+ PEK with filaments, scant tear film and rapid TBUT OU. Treatment was modified to include insertion of Freeman-style punctal plugs in the lower lids OU and use of preservative-free artificial tears QID OU, Restasis BID OU and FML (flurorometholone) QID OU. Additionally, a Sjö test was ordered and the patient was directed to return in one month for follow-up.

Upon return, the patient reported that her symptoms were still present, yet improved. BCVA was 20/30 and 20/50, respectively. Slit lamp exam demonstrated a 2+ central PEK OD, 3+ OS but no filaments. Treatment was once again modified to include same-day punctal occlusion of the upper lids and she was switched from FML to Lotemax gel (loteprednol etabonate 0.5%, Bausch + Lomb) QID OU. Sjö was performed and it was revealed that both traditional and novel biomarkers were abnormal, suggesting this patient had Sjögren’s syndrome. A rheumatology consult was scheduled, and the patient was formally diagnosed with primary Sjögren’s based on the reported symptoms, physical signs and Sjö test findings.

She was given patient education materials on SS and advised to discuss resuming Restasis, as it could preserve remaining lacrimal glands from further destruction. A recommendation of Biotene products for the dryness of mouth was made, as the symptom was not severe enough to warrant treatment with cholinergic drugs like Evoxac (cevimeline hydrochloride, Daiichi-Sankyo). She was informed that patients with +SSA/SSB have a 1% chance of having a child with congenital heart block, so cardiac monitoring with weekly fetal echocardiogram is warranted during any future pregnancy.

Dr. Hauser. Sjögren’s is a frequently misdiagnosed and underdiagnosed disease. Just over one million people in the United States are diagnosed with it, and it’s estimated that as many as four million...
individuals are suffering from it. Considering that ocular surface complaints are extremely common and may be some of the earliest and most compelling signs and symptoms to present, eye care providers have a distinct opportunity to act as the gatekeepers for this elusive autoimmune disease. As such, the Sjögren test acts as an ideal screener. As Dr. Hauswirth said, working closely with rheumatology is critical.

The American-European Consensus Criteria for Sjögren’s Syndrome found only one sign and one symptom commonly associated with dry eye disease in combination with oral signs and symptoms warrants additional investigation. As such, histological and antibody testing for anti-SSA (Ro) anti-SSB (La) or both are essential for completing the diagnosis. While convention relies on the traditional biomarkers, these often fall short in early diagnosis, as Dr. Mangan recognized. The Sjögren test includes three traditional biomarkers and four novel ones, which may be expressed earlier in the disease process (Table 1).

**LOOKING AT THE GLANDS**

Moving on to pathophysiology evaluation, panelists consider the role of the relevant ocular anatomy and how to evaluate it noninvasively.

**Dr. Mangan.** I would like to now turn our attention to meibomian gland dysfunction (MGD). According to the executive summary from the International Workshop on Meibomian Gland Dysfunction, MGD is a chronic, diffuse abnormality of the meibomian glands that is commonly characterized by terminal duct obstruction and/or qualitative/quantitative changes in the glandular secretion. It may result in alteration of the tear film, symptoms of eye irritation, clinically apparent inflammation and ocular surface disease. The MGD work-shop additionally proposed that MGD may well be the leading cause of dry eye throughout the world.

Like aqueous-deficient dry eye, MGD is a multifactorial disease. To date, epidemiology and prevalence data is inconsistent, with possible risk factors still being researched. With that being said, we know that MGD can affect a wide range of age groups. We are seeing more reports of how excessive use of digital devices is adversely affecting blink rate and lid mechanics, secondarily causing meibomian gland dropout and evaporative dry eye symptoms at a much earlier age.

Given all of this information, how has meibography influenced your approach to managing MGD?

**Dr. Schachter.** Meibography has had a significant impact on how we diagnose and treat MGD. As we have looked more, we have found more. This has led us to image younger and younger patients. Teens and young adults spend the majority of their day looking at electronic devices, and most of us believe that this is leading to meibomian gland atrophy. In fact, in my practice we are approaching a “screen everyone” protocol for the lower glands only, and we can now intervene sooner as we find atrophy sooner. The new Lipiscan (TearScience) should allow us to image quickly.

Imaging technology is also an excellent patient education tool, as we can now show patients their ocular anatomy and also any meibomian gland dropout. This helps to drive patient compliance with our recommendations, which typically include some combination of blink exercises, warm compresses, debriding, Lipiflow, nutraceuticals, artificial tears, lid hygiene and Blephex.

**Dr. Hauswirth.** Considering that 86% of dry eye disease is evaporative in nature, evaluation of the glands in an essential diagnostic procedure. While I enjoy the use of both the LipiView and Oculus Keratograph technology in my office, performing a simple transillumination of the meibomian glands offers a more basic view as well. Determining the structure, number and level of atrophy is valuable in creating a treatment plan and setting the patient’s expectations. Many eye care providers recommend the use of warm compresses without ever visualizing the glands. However, a patient with virtually no glands will be disappointed by their failure to significantly improve from warm compresses. On the other hand, however, while the majority of patients have evaporative dry eye disease, a patient with ideal meibography and lipid layer thickness may suggest another etiology.

**Dr. Hauswirth.** Meibography has been an incredible asset, though we are still in the early stages of knowing exactly what the causative factors are regarding several aspects to alterations in meibomian gland morphology. Still, it is an incredibly helpful tool from a prognostic and diagnostic standpoint—being able to capture images and display them for patients to illustrate their pathophysiology is a powerful thing. No other test we perform commands a patient’s attention as well as an image of their own glands. In our practice, we have the Oculus Keratograph, Lipiview II and LipiScan. I think all are excellent in performing meibography, although I find the images in the TearScience technology platforms to be sharper.

**Dr. Mangan.** I currently use the Oculus Keratograph in one of my primary offices, and I find it very useful in both diagnosis of MGD and in determining the location and severity of gland atrophy in my evaporative dry eye patients. We now know that the location of gland atrophy is very important due
to the work of Blackie and Korb, as well as Pflugfelder et al. and other teams.\textsuperscript{20,21} The glands that offer the greatest amount of meibum secretion are the nasal ones, which are responsible for 70% of total secretive volume. Thus, it stands to reason that if there is significant gland fallout nasally, patients are more apt to have more significant disease.

I agree with Dr. Hauser that lid transillumination works well when advanced meibography systems are not available. Transillumination of the lids is part of my general work-up regardless. I find that I can predict the Keratograph results through transillumination. Still, Keratograph images do allow me to hammer the point home when educating my patients about their condition.

**FUTURE ADVANCES**

In this rapidly evolving category of eye care, where might the technology be heading?

\textbf{Dr. Mangan.} Next question: Where would you most like to see POC testing improve or advance in the field of ocular surface disease?

\textbf{Dr. Schachter.} Though MMP-9 is very useful when looking for inflammation, there are also other mediators and biomarkers. While a positive result means inflammation of some kind is likely present, a negative result doesn’t necessarily rule it out, as MMP-9 is a non-specific biomarker. Interestingly, it would be helpful if we could take a tear sample and test for other inflammatory biomarkers, such as IFN-gamma—however, we can’t at this time.

Osmolarity is also meaningful and can help direct treatment, allowing us to monitor for efficacy. The problem is, however, that osmolarity can vary over the surface of the eye. Also, InflammaDry and TearLab require some level of skill in sample collection. InflammaDry test results can be difficult to interpret when MMP-9 levels are just above the cutoff for a positive test, 40ng/ml. Sample collection is also difficult on patients who are very dry. Regardless, as new tests are developed, high sensitivity and specificity are critical, in addition to positive and negative predictive values.

\textbf{Dr. Hauswirth.} I believe the direction we’re heading—toward broader spectrum panels of inflammatory markers, as well as improved

### Classification Systems for Sjögren’s Syndrome

**American-European Consensus Group.** These criteria allow for a diagnosis in patients without sicca symptoms or who have not undergone biopsy.\textsuperscript{22} Diagnosis of primary Sjögren’s requires at least one of the four criteria below to be present and either criterion #5 or #6 must also be included. Sjögren’s can be diagnosed in patients who have no sicca symptoms if three of the four objective criteria are fulfilled. These criteria are:

1. Ocular symptoms, specifically dry eye present for more than three months, foreign body sensation and/or use of artificial tears more than three times daily.
2. Oral symptoms, including dry mouth, reoccurring swelling of the salivary glands and/or frequent use of liquids to aid in swallowing.
3. Ocular signs, specifically results from the Schirmer test performed without anesthesia less than 5mm in five minutes and/or positive vital dye staining results.
4. Oral signs, including abnormal salivary scintigraphy, abnormal parotid sialography, abnormal salivometry (i.e., unstimulated salivary flow <1.5mL in 15 min).
5. Positive minor salivary gland biopsy findings.
6. Positive anti-SSA or anti-SSB antibody results.

Secondary Sjögren’s syndrome is diagnosed when symptoms of oral or ocular dryness exist in addition to criterion three, four or five above in the presence of a connective-tissue disease. Application of these criteria has yielded a sensitivity of 97.2% and a specificity of 48.6% for the diagnosis of primary Sjögren’s syndrome, while in the case of secondary Sjögren’s syndrome, the specificity is 97.2% and the sensitivity is 64.7%.\textsuperscript{23}

**American College of Rheumatology.** The ACR classification criteria were developed to improve the specificity of the criteria used for entry into clinical trials, especially following the emergence of biologic agents as potential treatments for Sjögren’s syndrome and their associated comorbidities. This high specificity makes the ACR criteria more suitable for application in situations in which misclassification can pose a risk to the patient’s health. These guidelines were accepted by the ACR as a provisional criteria set in 2012.\textsuperscript{24}

According to the ACR criteria, the diagnosis of Sjögren’s syndrome requires presence of at least two of the following three findings:

- positive serum anti-SSA and/or anti-SSB antibodies, or positive rheumatoid factor and antinuclear antibody titer of at least 1:320;
- ocular staining score of at least three; and
- the presence of focal lymphocytic sialadenitis with a focus score of at least one focus/4mm² in labial salivary gland biopsy samples.

Compared with commonly used AECG criteria, the ACR criteria is based entirely on a combination of objective tests that assess the three main components of Sjögren’s syndrome (serologic, ocular and salivary) and do not include criteria based on subjective symptoms of ocular and oral dryness. The application of these criteria has yielded a sensitivity of 93% and a specificity of 95% for the diagnosis of Sjögren’s syndrome; however, they cannot be used to distinguish between the primary and secondary forms of the disease.
imaging of the glands and other important ocular surface structures down to the cellular level—can help us become more accurate in setting treatment strategies. We are in what I call the Model T phase of diagnostic technology for dry eye: benefiting greatly from its existence while recognizing limitations this early in its development. However, understanding those limitations allows us to remodel and refine our tools, making them increasingly helpful and clinically relevant.

Another tool that I believe can be quite helpful is the confocal microscope, which allows us to image through corneal and conjunctival tissue to view active dendritic cells in the cornea, activated keratocytes and corneal nerve morphology, which gives us an image on the actual mechanics of disease in vivo. This is not necessarily practical to implement in a standard eye care practice yet, but the technology is improving, and it has great potential for diagnosis and management.

**Dr. Hauser.** The greatest potential in POC testing, in my opinion, is the use of multiple tests in concert. We have several useful, but often underused, tests available today. Ideally in the future, practitioners will be able to perform multiple objective tests to better address the multifactorial nature of the condition and to objectively monitor improvement or progression.

**Dr. Mangan.** Thank you. I think we can all agree that each POCT mentioned in this article brings some amount of value and information to the overall picture of patient ocular surface health. With that in mind, however, each of these tests also has certain limitations regarding the information it can reveal.

I personally have had patients who were diagnosed with primary Sjögren’s display a normal osmolarity reading in both eyes. Another patient tested negative in the InflammaDry test during one visit but positive a month later, without any change in how they were being treated in between the two visits. As such, I definitely agree with Dr. Hauswirth that we are only in the beginning stages of where POCT may eventually progress to. However, the POCT tests discussed here may provide some information that can influence chairside treatment decisions in today’s practices.

In closing, I would like to thank the panel for sharing their thoughts regarding how they use point-of-care technology in their dry eye clinics. I, for one, am encouraged by the industry’s continuing interest in this area and am excited to see it progress. I hope that eye care practitioners across the country understand not only the need but also the opportunity that is available to them to become more focused in the diagnosis and management of ocular surface disease.


2017 MEETINGS

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Contact lens wear is not without its dangers. Individuals who present to the clinic with a case of a red, swollen or otherwise compromised ocular surface are capable of developing an infection from poor lens hygiene, lens overwear, ingress of foreign material or one of any number of other compliance issues. However, aggressive treatment of the issue can turn this negative situation around, regardless of whether it’s possible to identify the underlying cause. Doing so successfully can improve your practice’s standing in the eyes of patients, as most, if not a majority, of them are unaware that the eye care practice is the first place to go when faced with contact lens irritation, rather than the primary care physician, emergency room or urgent care center.

Even more concerning is the realization that many patients who go elsewhere for conjunctival or corneal infections often receive incorrect treatment, resulting in either more healing time, recurrence of the problem or even increased adverse effects such as the loss of visual clarity following resolution. As such, these scenarios represent a chance to build your medical model business and provide patients with targeted treatments their general PCP may not have the expertise or means to give them, increasing the patient’s trust and loyalty to the practice. But, how does one pass the message on to them?

UNDERSTANDING THE CAUSE
Educating the patient on the practice’s abilities is key, either during the patient exam or with other in-office marketing efforts. Consider incorporating a recording that plays on a loop in the reception area or when the patient is on hold on the phone to remind them that the practice they’re calling or visiting is their primary eye care provider and thus the place to go if they have any contact lens–related issues. Additionally, consider mentioning in the practice’s voicemail recording that infections associated with contact lens wear are also handled at the practice, and to contact the practice’s staff immediately if any concerns arise.

Depending on the problem that the patient presents to the clinic with, different origins are likely and so must be addressed differently with each patient to prevent recurrence of the same issue. Here are some possible problems that a contact lens patient may present with and how to handle them so as not to lose the patient to lens dropout:

**Bacterial conjunctivitis (Figure 1a).** Lens hygiene may be to blame for this infection if present in association with contact lens wear. Though rare in comparison to other types of conjunctivitis, this issue needs to be addressed as soon as possible. In addition to treatment, patients must be re-educated on proper lens care and cleaning habits to prevent reoccurrence. In the case of bacterial conjunctivitis, generally there is no visible corneal involvement, though discharge, lash matting and contact lens irritation are often present.

Following resolution of the infection, patients should dispose of their current pair of contact lenses to reduce risk of further problems. Custom specialty lenses, however, may need to be kept out of cost concerns, and must be disinfected well. Bacterial conjunctivitis is typically treated with topical antibiotic therapy, and patients should abstain...
from contact lens wear until the infection has been cleared and they have finished the entire course of prescribed medication.

**Viral conjunctivitis** (Figure 1b). This form of conjunctivitis is commonly confused with bacterial conjunctivitis at presentation; in fact, research shows that eye care practitioners only diagnose this problem correctly approximately 50% of the time due to the many overlapping signs and symptoms between it and bacterial conjunctivitis.1 As such, in the case of a suspected viral conjunctival infection, it is important to evaluate the patient for traces of upper respiratory infection or lymphadenopathy, the latter of which is most closely related to viral origins. Other signs to look for include differences in the types of discharge present (watery indicates viral while mucous or purulent typically indicates bacterial), or the hallmark presence of follicles.

**Allergic conjunctivitis** (Figure 1c). Though non-infectious in origin (in that it is caused by pollen, pet dander or dust mites rather than a pathogen), this condition is still often misdiagnosed by both primary care providers and urgent care facilities. Allergic conjunctivitis can make contact lens wear more difficult due to the presence of irritating foreign material on the ocular surface, so consider recommending daily disposable contact lens wear to the patient. Signs and symptoms of allergic conjunctivitis include burning and itching and can be treated using topical anti-histamine/mast-cell stabilizer drug combinations.

**Giant papillary conjunctivitis** (Figure 2). A more chronic form of allergic response strongly correlated with contact lens wear, giant papillary conjunctivitis (GPC) is similarly non-infectious. Large papillae—the hallmark sign—are located on the superior tarsal plate, so evert the upper eyelid to ascertain whether GPC is indeed the patient’s diagnosis. GPC itself is sometimes treated using topical corticosteroids; temporary discontinuation of contact lens wear during treatment helps with resolution.

**Infiltrative keratitis** (Figure 3). Contact lens-associated corneal infiltrates can occur from either noninfectious or infectious processes. The former appears as multiple infiltrates located across the surface of the cornea with minimal or no fluorescein staining, and the latter appears as a single larger infiltrate that stains positively with fluorescein.2 Noninfectious corneal infiltrates may be associated with contact lens non-compliance, extended lens wear and/or wear of silicone hydrogel contact lenses versus other lens materials. In the case of infectious infiltrates, the bacterial organism invades the corneal tissue through a single area.3-5 Treatment in both cases involves the removal of the patient’s contact lenses and the use of either topical corticosteroids or topical antibiotics.

*Fig. 2. Large papillae on the underside of the eyelid are hallmark signs of giant papillary conjunctivitis.*

*Fig. 3. Infectious infiltrates are generally more painful than their noninfectious counterparts.*

Accurately diagnosing and treating a variety of contact lens-related complications—the ones above and others unmentioned—is key to getting patients back into their contact lenses safely and keeping them coming to the practice. Proactively discussing potential concerns of noncompliance and hygiene are integral in preventing complications, as is ensuring that patients understand they can contact the office should any of these conditions occur.

Keeping Contact Lens Care In-House

There’s no substitute for your clinical expertise—so don’t let patients find one. Make sure they know to contact you any time questions arise.

During a recent trip to the pharmacy to pick up some medication for my daughter, I overheard an interesting conversation between the person in line in front of me and the pharmacy technician behind the counter:

*Do you know if I can use this drop with my contact lenses?,* the patient asked the technician.

*It should say so right on the bottle,* the technician responded. Grabbing the bottle, she took a closer look and added, *No, you can’t—it says right here. Go over to aisle four instead, that’s where all the contact lens stuff is. You should be able to find something for your needs there. What do you need it for, anyway?*

*My right contact lens has been bothering me for the last few days,* the patient admitted.

*Oh. Aisle four should have something for that,* the technician directed.

**SILENT PARTNERS**

Though only two are present in this chapter, this story in fact has four main characters: the patient, the pharmacy technician, the patient’s doctor and the doctor’s staff. Assuming for a moment that there actually is something wrong with the previous exchange, the question to ask is: Which of the four participants is most at fault for the problem?

Most individuals may agree that it is not the patient. Though the pharmacy technician possibly overstepped her boundaries in a few areas, she is also not the culprit. She deserves points for instructing the patient to read the label, but she really should not have recommended a drop to decrease the patient’s problem, or at least she should have added that if the patient experienced further problems, then he should contact his doctor.

Considering the patient’s doctor and the doctor’s staff, the first thought is possibly to blame the presumed lack of patient education: that is, if someone at the practice had told the patient that if his contact lenses ever bothered him, he should remove them and call the practice immediately to avert the need to visit the pharmacy for eye drops entirely. However, based on the data from consultations conducted for hundreds of practices, nearly all practices out there mention this as part of their general contact lens fitting appointment. So, then, why didn’t this patient call his eye care provider?

**MAKING AN IMPRESSION**

First and foremost, it may be that stating to the patient that he should call you if he ever has a problem with his lenses is not a strong enough method to stick in the patient’s mind long-term.

Instead, consider what would happen if you called each of your patients every day and reinforced the message that they should contact you if they have a problem. Nonsensical though it may be, it would drive the point home and indicate that some amount of repetition can ensure each patient knows what directions to follow and how to combat a problem.

However, it’s more than likely that the patient also didn’t call for another reason. Assuming that he was already in the pharmacy to pick up something else, it’s more convenient to pick up something to use for his issue right then and there, rather than first calling the practice to see if it’s even a good idea to do so in the first place.

**CHANGING THE THOUGHT PROCESS**

After instituting some form of repetitive education at the practice for contact lens care, informing patients that the practice has resources available for other aspects of lens wear—including ways to satisfy interest in other lens designs, alleviate concerns regarding infections or clear up confusion with regards to the selection of lens solution—is also a good idea.

Stress to them that they are more than welcome to call, email, text or visit the practice’s website to look for information at any time; however, also make sure you have the information readily available, accurate and up-to-date for when they do come looking. Additionally, make sure that the practice’s staff is capable of quickly and accurately addressing any questions or concerns they may receive.

Finally, keep in mind that, unfortunately, convenience will probably trump loyalty every time. But, knowing this, we should still educate patients regarding clinical concerns and also that the practice is available to help them however they need.
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