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Important information for AIR OPTIX® COLORS (micon B) contact lenses: For daily wear only for near/far-sightedness. Contact lenses, even if worn for cosmetic reasons, are prescription medical devices that must only be worn under the prescription, direction and supervision of an eye care professional. Serious eye health problems may occur as a result of sharing contact lenses. Although rare, serious eye problems can develop while wearing contact lenses. Side effects like discomfort, mild burning or stinging may occur. To help avoid these problems, patients must follow the wear and replacement schedule and the lens care instructions provided by their eye doctor.

See product instructions for complete wear, care and safety information.
Deep learning able to identify glaucoma, study shows

GLAUCOMA

Thirty years ago, in the summer of 1989, the U.S. Patent and Trademark Office granted a patent to a retinal surgeon Gholam Peyman, MD, for a “Method for Modifying Corneal Curvature.” The method came to be known as laser in-situ keratomileusis (LASIK). The patent represented a major landmark in evolution of eye care. It was the culmination of more than a century of innovations in science and technology. It also coincided with the start of a transformative practice model—the collective engagement of optometrists and ophthalmologists in the care of a patient. Eye care has come a long way since the summer of ’89. Correcting sphere and cylinder is no longer enough. Eyecare practitioners have advanced to treating higher order aberrations we couldn’t even detect thirty years ago. We now expect vision outcomes better than 20/20 for the majority of our patients. Today, both optometrists and ophthalmologists are advancing the field of spectacle independence. From prevention to treatment of refractive error, ODs and MDs are united by a common goal to help our patients lead healthy and productive lives.

LYME DISEASE

The 45-year silent epidemic

By Michael S. Cooper, OD

For many ODs, Lyme disease (Borrelia burgdorferi) and its 22+ variant cousins hit close to home. My father has been bitten by infected ticks with these spirochetes from the genus Ixodes (primarily Ixodes scapularis) over seven times. This narrative can be repeated with slightly different wrinkles by almost anyone who has been exposed to or knows of a family member or friend in kind. Incidence has more than doubled in the past 13 years with reported cases numbering 30,000 to 43,000 per year. Admittedly, the Centers for Disease Control (CDC) has said the figure is grossly underestimated by 10 fold coming in at 300,000 cases per year. This disease has been a silent epidemic in the United States—and now early stages in Canada—for the last 45 years.

Back in 1975, two desperate mothers from Old Lyme, CT, sought help after seeing an outbreak of Lyme disease on page 18

TECHNOLOGY

Artificial intelligence might be the future of practice management

By Chris Wroten, OD

While a hot topic of late, it is easy to forget that the concept of artificial intelligence (AI) is not new. Early philosophers and mathematicians theorized that mechanical reasoning could one day be taught to robots, automatons, and smart machines. However, AI advancements slowed over the next few decades due to competing funding priorities, moral/ethical concerns, and the limitations of computing technology and data storage. It was not until the late 1990s/early 2000s that most of these challenges and concerns were alleviated and come into play.

See Artificial Intelligence on page 12

CONTACT LENSES

Q&A | DR. EDWARD S. BENNETT ACADEMIA, CONTACT LENSES, BEER, CLIMBING A WATER TOWER
PUT YOUR PATIENTS WITH DIABETIC RETINOPATHY (DR) ON THE PATH TOWARD MANAGING THEIR DISEASE AND SET THE COURSE FOR SUCCESS IN DR
DIABETIC RETINOPATHY: A GROWING PROBLEM THAT YOU CAN HELP MANAGE\textsuperscript{1-4}

Through early detection, monitoring, and timely referral, you play a pivotal role in managing your DR patients’ vision\textsuperscript{2-4}

If you see or suspect DR:

Educate your patients about the severity of DR, especially when left untreated\textsuperscript{3,4}
- Your early and frequent discussions about disease progression, treatment options, and referral will empower patients, which could help them avoid significant vision loss\textsuperscript{3,4}

According to the AOA, you should refer patients with\textsuperscript{3}:
- Severe nonproliferative DR (NPDR) within 2 to 4 weeks
- Proliferative DR (PDR) within 2 to 4 weeks
- High-risk PDR with or without macular edema within 24 to 48 hours

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

Monitor your patients with DR\textsuperscript{3,4}

The AOA recommends frequent monitoring of patients\textsuperscript{3}
- At least every 6 to 8 months in patients with moderate NPDR and more frequently for patients with greater disease severity\textsuperscript{3}

Refer patients to a specialist who can treat DR\textsuperscript{3,4}

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

AOA = American Optometric Association.


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777 Old Saw Mill River Road, Tarrytown, NY 10591

09/2019

OPH.19.09.0030
I don’t like to read. I never did, and, still today, I’m more of a “wait until the movie comes out” kind of guy. I’m very fortunate in that our kids take after their mother in this regard (among others). I am a moderate myope, and I’m pretty sure that my contact lenses are a little stronger than they should be. This would account for my low degree of accommodative esophoria which becomes more manifest later in the day.

You are thinking, “Cycloplege yourself and find out your true degree of myopia!”

No. I’m not doing that, and you can’t make me. I’m not bothered by my vision. I just plain don’t like to read.

With this in mind, I saw a new patient the other day who reminded me why the patient history never ends. A seven-year-old presented with his mother and three siblings as new patients. The other three siblings checked out fine. The seven-year-old had no overt complaints. I asked him and his mother if there were problems with the board at school or with reading or concerns from the teacher. No one had any bad news to offer. Then his mother added, “Well, he doesn’t like reading, anyway.” I asked the child why not, and he said he just didn’t like reading. You can tell where this is headed. As it turned out, the child was a mild latent hyperope of around 1.50 D OU. Best corrected visual acuity was 20/20 OU, and I wasn’t able to elicit frank phoria. Ocular health was unremarkable, and I released him with a prescription for as-needed wear at near.

I asked the child’s mother to call me about a week after the glasses were dispensed, and she reported that she had noticed no changes in behavior but that he seemed to enjoy wearing them. That is one of those non-verbal cues that I pay attention to because it means I likely did something right.

I hope I have helped create a bookworm out of this child—or that he at least doesn’t continue an aversion to reading. Had his mother not casually mentioned that little factoid about reading, I may well have accepted the report of no concerns at near and moved on. Looking back, however, I see the reality implied within that response: How can there be concerns with reading if one doesn’t read to begin with?

How do you pry for such lurking variables within a patient’s (especially a younger patient’s) visual well-being? I’m eager to know; drop me a line. In the meantime, I’ll be waiting for the movie to come out.

Jeffrey Anshel, OD, FAAO
Ocular Nutrition Society
Encinitas, CA

Melissa Barnett, OD, FAAO, FLSL
UC Davis Medical Center
Sacramento, CA

Sherry J. Bass, OD, FAAO
SUNY College of Optometry
New York, NY

Justin Bazan, OD
Park Slope Eye
Brooklyn, NY

Ernest L. Bowling, OD, FAAO
Gadston, AL

Crystal Brimer, OD, FAAO
Crystal Vision Services
Wilmington, NC

Michael Brown, OD, MHS-CL, FAAO
U.S. Depart. of Veterans Affairs
Huntsville, AL

Mile Brujic, OD, FAAO
Premier Vision Group
Bowing Green, OH

Michael A. Chaglasian, OD, FAAO
Illinois Eye Institute
Chicago, IL

Clark V. Chang, OD, MSA, MSc, FAAO
Wills Eye Hospital
Philadelphia, PA

A. Paul Chous, OD, MA, FAAO
Chous Eye Care Associates
Tacoma, WA

Michael F. Cooper, OD
Solinsky Eye Care
West Hartford, CT

Melanie Benton, OD, MBA, FAAO
Salisbury Eyecare and Eyewear
Salisbury, NC

Marta Falygowski, OD, FAAO
Manhattan Eye, Ear and Throat Hospital Ophthalmology
New York, NY

Steven Fruoci, OD, FAAO
Sepulveda VA Ambulatory Care Center & Nursing Home
Sepulveda, CA

Barbara Fluder, OD
Williams Eye Institute
Merrillville, IN

Lisa Frye, ABOC, FAAO
EyeCare Associates
Birmingham, AL

Ben Gaddie, OD, FAAO
Gaddie Eye Centers
Lousiville, KY

David L. Geffen, OD, FAAO
Gordon Weiss Schanzlin Vision Institute
San Diego, CA

Jeffry D. Gerson, OD, FAAO
WestGlen Eyecare
Shawnee, KS

Alan Blazer, OD, FAAO
Shady Grove Eye and Vision Care
Rockville, MD

Whitney Hauser, OD
Southern College of Optometry
Memphis, TN

Scott G. Hauswright, OD, FAAO
University of Colorado School of Medicine
Aurora, CO

James Hill, OD, FAAO
Medical University of South Carolina
Charleston, SC

Milton M. Horn, OD, FAAO
Azusa, CA

David L. Kading, OD, FAAO
Specialty Eyecare Group
Kirkland, WA

Jennifer Lurky, OD
Triangle Visions Optometry
Cary, NC

Katherine M. Mastrolea, MS, OD, FAAO
Hotel Association of New York City Health Center
New York, NY

Pamela J. Miller, OD, FAAO, JD
Highland, CA

Andrew S. Morgenstern, OD, FAAO
Walter Reed National Military Hosp.
Bethesda, MD

Muhammad Rafieetary, OD, FAAO
Charles Retina Institute
Memphis, TN

Stuart Richer, OD, PhD, FAAO
James Lovell Federal HealthCare Facility
North Chicago, IL

John Rumpakis, OD, MBA, FAAO
Practice Resource Management
Lake Oswego, OR

Scott E. Schachter, OD
Advanced Eyecare
Pismo Beach, CA

Lee P. Semes, OD, FAAO
University of Alabama at Birmingham School of Optometry
Birmingham, AL

Diana L. Shechtman, OD, FAAO
Nova Southeastern University
Fort Lauderdale, FL

Joseph P. Shovlin, OD, FAAO, DPNAP
Advanced Eye Care
Canyon, TX

Andrew S. Morgenstern, OD, FAAO
Walter Reed National Military Hosp.
Bethesda, MD

Marc B. Taub, OD, MS, FAAO, FCVO
Southern College of Optometry
Memphis, TN

William D. Townsend, OD, FAAO
Advanced Eye Care
Canyon, TX

Diana Canto-Sims, OD
Buena Vista Optical
Chicago

Joseph Souka, OD, FAAO
Nova Southeastern University College of Optometry
Fort Lauderdale, FL

Tracy L. Schroeder Swartz, OD, FAAO
Madison Eye Care
Madison, AL

Marc E. Taub, OD, MS, FAAO, FCVO
Southern College of Optometry
Memphis, TN

Jeffrey P. Casella, OD, FAAO
Chief Optometric Editor
Practices in Augusta, GA

Ernest L. Bowling, OD, FAAO
Editor Emeritus 2012-2017

Benjamin P. Casella, OD, FAAO
Chief Optometric Editor
Practices in Augusta, GA, with his father in his grandfather’s practice
bpccasella@gmail.com
706-267-2972

I see the reality: How can there be concerns with reading if one doesn’t read to begin with?

Jeffrey P. Casella, OD, FAAO
Chief Optometric Editor
Practices in Augusta, GA, with his father in his grandfather’s practice
bpccasella@gmail.com
706-267-2972

Why taking patient history never ends
Think all progressive lenses are the same? Think again.

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How to diagnose a swollen optic nerve

Optic nerve swelling or edema can be an intimidating finding in the primary eye care clinic. The diagnosis of a swollen optic nerve is based on clinical diagnosis, but the importance of a comprehensive case history cannot be overstated.

OptometryTimes.com/SwollenOpticNerve
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**Dr. Edward S. Bennett**

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**Harmful Blue Light is the blue-ultraviolet wavelengths between 415-455nm on the light spectrum believed most toxic to retinal cells. Eyezen+ lenses block at least 20% of Harmful Blue Light.
***[2018] Study conducted by independent third party and sponsored by Essilor of America, Inc. [n=40]. Based on results from Eyezen+ designs 1, 2, and 3. Wearers preference based on working/ playing with smartphones, tablets, and computers.
Toxoplasmosis shows varied diagnosis

Controversy surrounding treatment guidelines plays role in patient case

A 39-year-old male attended the clinic seeking a second opinion for a right-eye problem for which he had been treated elsewhere. The complaint that brought him initially was blurry vision centrally in the right eye. He reported being treated with oral clindamycin (150 mg, three times a day [tid]).

This treatment had been initiated along with an oral steroid approximately six weeks prior, but he had self-discontinued the steroid after three weeks because he claimed that he disliked the side effects.

He denied taking any prescription medications as well as systemic problems. On clinical examination, best-corrected visual acuity (BCVA) was 20/200 (OD) and 20/20(OS).

Remarkably, slit-lamp examination showed the absence of an anterior-chamber reaction in either eye, along with mild vitritis involving the right eye only. The fundus appearance (OD) is shown in Figure 1.

Diagnosis

A working diagnosis of ocular toxoplasmosis was made. Because the clindamycin appeared to be ineffective and the patient denied sulfon allergy, Bactrim DS (trimethoprim/sulfmethoxazole; Roche; 160/800 mg) was prescribed empirically, twice a day (tid), dosing orally. The patient was asked to return in two weeks.

The two-week fundus appearance is shown in Figure 2. While there appears to be little improvement, the emergence of subtle pigmentary changes can be seen with careful comparison with baseline. The patient was monitored biweekly for the next month. Following this course of the trimethoprim/sulfmethoxazole combination, the fundus appearance is shown in Figure 3.

Of note is that the central lesion, ascribed to ocular toxoplasmosis, showed an increased pigmentation—indicating further retinal pigment epithelium (RPE) remodeling secondary to the inflammatory process as well as communication of a retinal blood vessel with the choroid as another component of remodeling.

Treatment

There has been considerable controversy over the decades concerning the treatment of ocular toxoplasmosis. What has emerged is a general guideline for recommending treatment, broadly if the infectious nidus involves the posterior pole; that is, if the macula is involved or the optic nerve is threatened.1

tious nidus involves the posterior pole; that is, if the infec-

tion medications as well as systemic problems. On clinical examination, best-corrected visual acuity (BCVA) was 20/200 (OD) and 20/20(OS).

Remarkably, slit-lamp examination showed the absence of an ante-

rior-chamber reaction in either eye, along with mild vitritis involving

the right eye only. The fundus appearance (OD) is shown in Figure 1.

Of note is that the central lesion, ascribed to ocular toxoplasmosis, showed an increased pigmentation—indicating further retinal pigment epithelium (RPE) remodeling secondary to the inflammatory process as well as communication of a retinal blood vessel with the choroid as another component of remodeling.

This spectrum extends from the central lesion presenting initially as a primary retinitis with extension posteriorly (choroiditis) and anteriorly (vitritis). A variety of features consistent with a primary retinitis have also been reported from optical coherence tomography evaluations.4,5

While the diagnosis is typically made from clinical findings, laboratory investigations for systemic involvement can be undertaken.

Analysis

A number of vectors have been identified for the transmission of this obligate intracellular parasite (T. gondii). Those at risk include meatpacking workers, those consuming raw mollusks (oysters, clams, mussels) or locally cured meat, those who may be immunocompromised, or owning three-pluses kittens.7

This list is derived from the national toxoplasmosis clearinghouse laboratory at Stanford University. Its purpose it to alert clinicians of potential risks for susceptible patients.

Recurrences of ocular toxoplasmosis are possible. While this risk appears to decrease with age, increasing age makes continued surveillance for recurring vision-threatening recurrences a necessity.1

Finally, the consideration of prophylaxis against future infection must be addressed. One template has suggested that a discussion of a one-year antibiotic regimen should be proposed to any patient with an active lesion.

With frequent recurrences (<2 year), a one- to two-year antibiotic prophylaxis course should be recommended.8

Acknowledgement: The patient was also attended by K. Prezgaj, OD.

REFERENCES

ACUVUE™ RevitaLens MPDS: a solution for your patients

James Cook, Meredith Jansen-Bishop, Chantal Coles-Brennan and David Ruston

Functions

A multipurpose contact lens solution (MPS) has to perform a delicate balancing act: to deliver effective disinfection against pathogens while being gentle enough to be introduced directly to the eye. Further functions include enhancing on-eye contact lens comfort and wettability, ease of use, and being compatible with a wide range of contact lens materials. Formulating an MPS to meet all of these functions is truly a complex challenge.

Efficacy

Formulations of MPS vary, and clearly so does their performance in standard testing. Two categories exist. Multipurpose disinfecting solutions (MPDS) pass the more rigorous ‘stand-alone’ test, where numbers of test bacteria and fungi are significantly reduced without any cleaning intervention. In contrast, a MPS solution cannot achieve this level of disinfection under stand-alone conditions, and has to pass a second ‘regimen’ test that involves a contact lens undergoing the full recommended rub and rinse routine.

Real-world challenges

Beyond standard testing, contact lens solutions are further challenged by real-world conditions. These include exposure to a wide range of pathogens, including Acanthamoeba, and to wide-spread patient non-compliance of correct cleaning and safe wearing practices such as poor hygiene, incorrect case care and exposure to water. It is also important for a contact lens solution to be able to demonstrate efficacy in these situations.

Introducing ACUVUE™ RevitaLens MPDS

ACUVUE™ RevitaLens MPDS is a care solution which performs across these key functions. It has been shown to deliver peroxide-quality disinfection with the simplicity and all-day comfort of an advanced multipurpose solution.3-7

ACUVUE™ RevitaLens MPDS produces exceptional levels of disinfection in the rigorous stand-alone test. These results demonstrate a similar level of performance to hydrogen peroxide systems.3,5

Performance

DISINFECTION COMPARABLE TO PEROXIDE SYSTEMS

ACUVUE™ RevitaLens MPDS produces exceptional levels of disinfection in the rigorous stand-alone test. These results demonstrate a similar level of performance to hydrogen peroxide systems, 3,5 and enable the solution to be categorised as a multipurpose disinfecting solution (MPDS). ACUVUE™ RevitaLens MPDS also provides greater than 99.9% kill-rate against both active and cyst forms of Acanthamoeba.3,8

DELIVERS ALL-DAY COMFORT

After one month of use, ninety percent of wearers agreed that ACUVUE™ RevitaLens MPDS was effective in keeping their contact lenses feeling comfortable. More than 9 in 10 (94%) agreed that it also was effective in keeping their contact lenses feeling clean.6

COMPATIBLE WITH A WIDE-RANGE OF LEADING CONTACT LENSES

Use of ACUVUE™ RevitaLens MPDS resulted in positive comfort scores and all-day comfort across two studies with ACUVUE® Brand Contact Lenses.7,9 All day comfort has also been demonstrated with other leading reusable brand contact lenses.7

Summary

For a typical patient, wearing reusable contact lenses and leading a busy life, ACUVUE™ RevitaLens MPDS delivers a safe, simple and comfortable option. Truly a solution for your patients.

Mr. James Cook is Senior Manager Product Development, Dr. Meredith Jansen-Bishop is Senior Principal Research Optometrist, Dr. Chantal Coles-Brennan is Principal Research Optometrist and Mr. David Ruston is Director of Global Professional Education and Development at Johnson and Johnson Vision Care Inc.
Artificial intelligence might be the future of practice management

Continued from page 1

puter and data technologies advanced, becoming more affordable.

Today, significant investment can be seen in health care-related AI with well-known companies like Microsoft, Google, and IBM heavily involved in promoting AI solutions in eye care, and smaller startups even attaining FDA-approval as standalone diagnostic technology.  

Most of these AI platforms for eye care are focused on diagnosing diabetic retinopathy (DR), age-related macular degeneration (AMD), and glaucoma from retinal photos and “eye scans.”

Outside of eye care, AI is already used to better diagnose, genotype, and match cancer patients with treatment protocols and trials that maximize outcomes.

With technologies such as these, fears abound within healthcare provider communities that AI will one day replace the doctor in the doctor-patient relationship.

However, in light of recent revelations—that AI still has far to go in clinical settings to match its performance in controlled studies—and that AI in conjunction with a doctor is superior to diagnosing and grading diabetic retinopathy up to 98 percent,

Additionally, in April, Advanced Data Systems Corporation began offering an AI-based revenue cycle management platform called MedicsRCM to help practices and healthcare networks better manage and maximize cash flow.

Specifically, efficiencies are targeted in the preparation of clean claims to avoid insurance denials upfront, with the AI platform spontaneously adjusting claims errors prior to filing and automatically preparing supporting claims documents in advance.

Further, the integrated AI claims to fast-track patient eligibility verification as well as speed up the determination of co-pay and deductible amounts.

It then offers this information to patients prior to their visits to help them understand their insurance coverage and financial responsibility, thereby reducing unpaid balances.

On the EHR side, Nuance recently announced successful beta testing of a new AI platform to reduce time documenting exam details in the EHR with launch planned for next year.

This new offering—called Ambient Clinical Intelligence—utilizes voice recognition AI technology with 16 microphones strategically placed within the exam room to “listen” to conversations with patients, then document the interaction in the EHR without the doctor diverting attention from the patient.

Medication orders can also be completed using an embedded virtual assistant. It automatically captures patient responses to clinical questions, and can be used to sign the exam on the spot.

This is how changes can be difficult, but ignoring or disparaging AI as a whole would be a costly mistake.

More AI advances are in the works for eye care, so for patients’ health—as well as the health of practices—ODs need to stay abreast of developments in AI, oppose any that threaten patient safety, and adopt those which are appropriate.

As these platforms continue to advance and become more affordable, seek ways to make AI work for the good of patients and practices. By doing so, ODs may achieve “super intelligence.”

REFERENCES


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Fears abound within healthcare provider communities that AI will one day replace the doctor in the doctor-patient relationship (DR)—those concerns may be misguided, or at least highly premature.

Applications

Just like an autorefractor or the normative database in ocular coherence tomography (OCT), AI can enhance clinical care and improve patient outcomes when applied correctly.

But what about AI for practice management?

AI applications could offer opportunities to enhance clinic flow, simplify billing, expedite electronic health record (EHR) input, streamline claims, and enhance cash flow. And with today’s high-deductible health plans (HDHPs) becoming more popular with employers—and therefore more common with patients—revenue cycle management is a natural fit for AI as more patients are defaulting on their portion of medical bills.

How close is any of this to becoming reality?

Recent launches

Last summer, EHR vendor Compulink launched a new AI-integrated practice management system called Advantage SMART Practice that aims to reduce staff time required to work claims by 90 percent, improve patient throughput by 15 percent or more, and achieve net collections...
Dry eye signs may signal risk for diabetic foot ulcers

Consider a patient’s case history when conducting assessments for potential diagnosis.

I practice in a multidisciplinary setting where professional collaborative engagement of all medical specialties is highly valued and practiced on a daily basis.

I learned about a new test from podiatrists on staff in our health centers called the Semmes-Weinstein 5.07 (10-gram) monofilament test for loss of protective sensation of diabetic/neuropathic feet.

The Semmes-Weinstein monofilament test (SWM) is a nylon filament calibrated so that it takes 10 grams of force to bend it when touched on the skin of the foot. An inability of the patient to detect this degree of force indicates that the client has a loss of protective sensation in the foot.

In 2008, a task force was built to consider the elements of a comprehensive foot and risk assessment of the patient with diabetes.

The task force was comprised of the Foot Care Interest Group of the American Diabetes Association (ADA), with endorsement by the American Association of Clinical Endocrinologists (AACE).1

Foot exam considerations
The lifetime risk of a person with diabetes developing a foot ulcer may be as high as 25 percent, whereas the annual incidence of foot ulcers is <2 percent.2

Noteworthy aspects of the patient history include previous foot ulceration or amputation. Other important assessments in the history include neuropathic or peripheral vascular symptoms, impaired vision, or renal replacement therapy.

Tobacco use should be recorded because cigarette smoking is a risk factor not only for vascular disease but also for neuropathy.4

Corneal neuropathy can lead to loss of corneal sensation and ultimately result in neurotrophic ulcers and significant visual morbidity.

The epithelial fragility and poor wound healing that result from reduced epithelial adherence to the underlying basement membrane in diabetes—together with corneal neuropathy—are thought to increase the susceptibility to dry eye disease (DED), persistent corneal erosions and infection, as well as to increase the risk of post-surgical complications.5

To parallel, loss of corneal sensation (corneal hypoesthesia) can be quantified by the use of the handheld Luneau Cochet-Bonnet Aesthesiometer. The device, akin to the monofilament foot test, contains a thin, retractable, nylon monofilament. Variable pressure can be applied to the cornea by the device—quantifying corneal sensation—by adjusting the length. The monofilament ranges from 60 mm to 5 mm. As the length is decreased, the pressure increases from 11 mm/gm to 200 mm/gm.

Eyecare providers know that beyond the associated retinal pathology, diabetes has been demonstrated to impact corneal nerve morphology and ocular surface integrity.

Corneal neuropathy

The most common triad of causes that interact and ultimately result in foot ulceration has been identified as:3

- Neuropathy
- Foot deformity
- Foot trauma

For the foot exam, case history is a pivotal component of risk assessment. A patient cannot be fully assessed for risk factors for foot ulceration based on history alone; a careful foot exam remains the key component of this process.

Ocular surface correlation
Eyecare providers know that beyond the associated retinal pathology, diabetes has been demonstrated to impact corneal nerve morphology and ocular surface integrity.

Diabetes is associated with progressive damage to corneal nerves and epithelial cells. Corneal nerve length and corneal nerve thickness changes are evident even in the early stages of diabetes mellitus (DM).5

Corneal nerve length is decreased, the pressure increases from 11 mm/gm to 200 mm/gm.

REFERENCES
Nutrition in the future of primary-care optometry

Advancements in mobile health technology are driving patient-driven care

While the science of nutrition has been evolving for years, its role in patient care has long remained elusive. Understanding the importance of food intake can have clinical implications for the modern practice of optometry and medicine.

The 21st-century movement toward patient-driven health care is driving the use of mobile health applications (apps), artificial intelligence (AI), and wearable technologies.

ODs are integral to the care of chronic diseases like diabetes, hypertension (HTN), age-related macular degeneration (AMD), and dry eye disease (DED). Primary-care ODs use innovative technologies to educate patients about their own health and use food and nutritional advice to improve their outcomes.

Furthermore, optometric practices that develop expertise in nutrition can differentiate themselves through the delivery of high-level, preventive eye care.

Benefits of apps/tech

Mobile apps and technology empower consumers with information to be more proactive in monitoring their own health.

One example includes the low FODMAP (fermentable oligosaccharide disaccharide mono-saccharide and polyols) app from Monash University, which makes consumers more conscious and self-aware of their behavior.

Proper awareness supports action, encourages positive health behavior and preventive measures (including the MyFitnessPal and Nike Training Club apps), and helps guide consumers to a better assessment and decision-making with particular health situations (MyGiHealth GI Symptom Tracker App).

Platforms for monitoring wellness include:

- Activity/exercise logs
- Nutrition and caloric intake
- Amount and quality of sleep
- Personalized food recommendations

Fitness and optometry

Optometrists in sports vision have taught the importance of advances in performance technology.

Additionally, the use of integrated mobile health technology and wearable AI technology is growing exponentially.

Elite athletes in sports such as tennis, basketball, and soccer train and recover with the aid of new technologies, improved diets, and proper sleep patterns.

ODs are finding lessons that can be translated to all patients who want to live longer, healthier, and more active lives. Smart watches, Fitbits, and other monitoring devices are technologies ODs should understand to better educate and care for patients.

Food as medicine

“Food as medicine” is a growing movement redefining views on the science of nutrition and medicine’s role in using dietary recommendations to manage chronic health conditions like diabetes, HTN, Crohn’s disease, colitis, irritable bowel syndrome (IBS), and small intestinal bacterial overgrowth (SIBO) syndrome.

Healthcare systems—such as Mount Sinai in New York City—are investing and partnering with healthcare companies like Epicured, a subscription meal delivery service specializing with healthcare companies like Epicured, a subscription meal delivery service specializing in low FODMAP and gluten-free prepared foods.

In 2017, Mount Sinai’s Division of Gastroenterology performed a clinical review of Epicured’s food product. It has since provided food services to deliver low FODMAP meals to the healthcare system’s patients.

A low FODMAP diet consists of meals without garlic, onions, milk, apples, and up to 10 mg of celery.

While there are other restrictions, the diet is 70 percent effective in reducing IBS.

Nutrition and chronic disease

A healthy diet and lifestyle promotes the prevention and reversal of chronic diseases.

Seven out of the 10 leading causes of death are directly related to dietary choices:

- Diabetes
- Heart disease
- Cancer
- Lung disease
- Cerebrovascular disease (CVD)
- Alzheimer’s disease
- Kidney disease

Eighty percent of chronic disease can be prevented with simple lifestyle habits and putting nutrition at the top of the list.
CVD
- Red and processed meat consumption are associated with an increased CV risk; those following a vegetarian diet have a decreased risk of mortality.24
- Fruits and vegetables lead to CV risk reduction

DIABETES
- Processed meat consumption is linked to an increased risk of diabetes
- Eating whole grains and fruit decreases risk of diabetes mellitus (DM), micro-, and macro-vascular complications
- Hyperglycemia impairs the regulation of retinal perfusion; it is important to manage glucose levels to avoid complications of retinal perfusion.25

CANCER
- Red meat increases risk of colorectal cancer.21
- Whole grains, fruits, and vegetables are associated with a significant reduction in total cancer risk

Chronic eye disease
Dietary antioxidants and anti-inflammatory help decrease the risk of age-related eye disease and help deter the progression of other chronic eye diseases.22

DRY EYE
Omega-3 rich diets result in neuroprotective effects, help with tear osmolarity, improve tear quality, and reduce meliobian gland dysfunction (MGD).23

Examples of omega-3 fatty acids in food include:
- Fish and shellfish (mackerel, salmon, cod liver oil, herring, oysters, sardines, anchovies, caviar)
- Seeds (flaxseeds, chia seeds)
- Nuts (walnuts)

AMD
Carotenoids: Certain antioxidants—carotenoids—reduce the effect of free radicals on the macular pigment and help with retinal pigment layer thickening. A diet high in carotenoids can also delay the advancement of AMD.24

Beta carotene: Carrots, sweet potato, dark leafy greens, red and yellow peppers.
Lutein: Dark, leafy veggies (spinach, collard greens, kale).
Zeaxanthin: Dark, leafy veggies (spinach, collard green, kale).

Vitamin C: Kiwi, citrus fruits, mango, papaya (also helps prevent cataracts)

Vitamin E: Vegetable oils, nuts, green vegetables. Should be taken in combination with other vitamins and minerals listed here; taken alone not beneficial for AMD.25

Zinc: Brings Vitamin A from liver to retina to produce melanin (meat, shellfish, legumes, eggs, whole grains, seeds).

Copper: Nuts, seeds, leafy greens, oysters, organ meats.

Patient education
Using diet to address underlying chronic disease can help with the management of chronic diseases and improve patient health outcomes.

Diabetic retinopathy/cataracts/glaucoma
Recommend a diabetic diet to manage blood sugar and minimize microvascular damage, such as dietary fiber, oily fish, a Mediterranean diet, and a reduced caloric intake; they are associated with lower risk of diabetic retinopathy (DR).26

Patients at risk for HTN retinopathy
Manage with a low-sodium diet to help decrease HTN retinopathy, pressure on blood vessels, retinal edema, and swelling of the optic nerve.27

Future of food
What is the future role of optometry in altering the nutritional patterns of diverse patient communities?

The rapid rise of diabetes and HTN in the nation’s population is considered to be tied to poor diet and lifestyle choices. Will the role of diet and nutrition become a more integral part of the optometric care of cataracts, glaucoma, and DED?28

REFERENCES

A healthy diet and lifestyle promotes the prevention and reversal of chronic diseases
BPI® Cut-Off tints block high energy light in minutes!

Newest protection and vision enhancement for color blind patients

Cut-Off tint helps patients with color blindness

BPI® 550/570nm Cut-Off tint

Newest protection and vision enhancement for color blind patients

BPI introduces another cut off tint, joining the ranks of BPI UV-Blue Barrier 440, BPI Winter Sun 450, BPI Diamond Dye 500/550, and BPI Deep Red Monochrome 600.

This red-orange to red tint is beneficial when the short wavelength end of the spectrum (violet, blue green) needs to be blocked. These uses include blue blocking for greater out-of-doors contrast against the blue sky and blocking of blue/violet for ARMD purposes. It may also provide a higher transmittance lens option for red-green color blind patients.

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Prevent cataracts, macular degeneration and retinal damage

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Sunlight contains UV and blue light. UV light is part of the non-visible light spectrum that we are exposed to every day. It can cause damage to our eyes, particularly the surface and deeper layers of the cornea and the crystalline lens of the eye by cataract formation as well as the increased potential for dry eyes, dystrophies, pinguecula and pterygium of the cornea. Blue light, which is part of the visible light spectrum, may also be a cause for concern. It reaches deeper into the eye than the UV and its cumulative energy effect can cause irreparable damage to the retina.

Blue light is one of the main causes of damage to our eyes as we age and is an important factor that can cause the worrisome loss of sight-enabling pigmentation in the back of the eye.

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Tint your own therapeutics or let BPI® do it for you

Reduce the scattered blue/violet light within the eye with BPI® Blue Filter Vision 450™. A saturated yellow tint that blocks blue/violet light with wavelengths shorter than 450nm. It blocks a minimum of the visible spectrum.

Macular Degeneration. BPI® Total Day™ is a tan colored tint that provides blue/violet attenuation with minimal color distortion.

Night driving. BPI® Total Night™, a light saturated yellow tint, is especially useful in blocking the blue/violet component of HID headlamps encountered in night driving.

Retinitis Pigmentosa, Macular Degeneration. BPI® Diamond Dye 500/550™ is an orange to red/orange tint, which blocks wavelengths shorter than the 500nm to 550nm range.

Blue light absorbing BPI® Blue Filter Vision 460™. A true sunglass brown with no color distortion that blocks still further into the visible spectrum.

Useful in bright light situations. BPI® Blue Filter Vision 540™. A dark amber brown tint that blocks wavelengths shorter than 540nm. A sunglass color that blocks violet and blue.

Red / Green color blindness. BPI® Deep Red Monochrome 600™ has long been used to allow those afflicted with red/green color blindness to differentiate between red and green.

Reduce photosensitive epilepsy seizures with BPI® Deep Blue Zoe™. This dark blue tint was found to reduce the number of seizures dramatically in about 95% of the patients using it (see a study in Epilepsia, 2006 Mar;47(3):529-33; “Suppressive efficacy by a commercially available blue lens on PPR in 610 photosensitive epilepsy patients.” by G. Capovilla, et al).

Reduce eye strain, blepharospasms and migraines! BPI® FL-41™, a rust red/pink tint, has proven useful in reducing the incidence of blepharospasms and migraines.

Helpful with brain trauma and also useful for patients with dyslexia, BPI® Omega™ is magenta in color.

May help patients with dyslexia, BPI® Mu™ needs to be applied to tintable prescription lenses. It is lime green in color.


Parkinson’s Disease Tremors, BPI® Electric Blue™ has been beneficial to those suffering from tremors such as those sometimes associated with Parkinson’s disease.
Why your practice should have a BPI® Spectrometer

A must have instrument for Optometrists

Verify proper tinting densities for therapeutic tints

- Absolute Spectrum, the intensity of light received at each wavelength, plotted as a graph, and the basis for all other measurements.
- Illuminance, the human perception of the brightness of visible light received at the eye (lux).
- Chromaticity, the color of light based on the wavelengths and intensity that combine to make a color.
- Correlated Color Temperature, the temperature of a black body light source that would produce similar shade of white to the measurement-how blue or red a white light appears.
- Color Rendering, how truthfully a color is shown by the light measured compared to if the color was lit by bright sunlight.
- Flicker, the speed and characteristics of repeated changes in light intensity particularly noticeable with LED lighting or fluorescent.
- Equivalent Melanopic Lux, a measure of the light intensity in wavelengths that promote alertness (melanopic range), which can cause sleep and health problems.

BPI PC OT: 1122

Get accurate UV and blue light readings

Measure the total light energy passed by lenses.

Blue light, macular degeneration and the Wertheim Protection Factor™ (WPF)

Recently, the blue/violet wavelengths between 400nm and 500nm have been implicated in the development of macular degeneration. BPI® has developed a simple meter, the BPI® UV & Blue Light Analyzer™ (BPI# 119518), that is designed to check the transmittance of lenses for these wavelengths and provide a figure of merit, the Wertheim Protection Factor™, to use in comparing and producing lenses that protect patients from radiation in this wavelength range.

Air (no lens) affords no protection and has a Wertheim Protection Factor™ of “0”. A black lens passes no light and has a Wertheim Protection Factor™ of “0”. A lens with high luminous transmission and minimal high energy blue/violet transmission such as BPI® Total Day™ has a Wertheim Protection Factor™ of about “40”. For more information on therapeutic and blue light protection visit: www.colorlenses.com

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arthritis and juvenile arthritis around town.4,5 Staring down a litany of unexplainable symptoms and unsatisfying diagnoses, they contacted the Yale School of Medicine and Connecticut State Department of Health. This initial inquiry would spark a widespread investigation that would culminate in the characterization of what is now widely known as Lyme disease.

**First studies**
The initial study focused on the three contiguous towns of Old Lyme, Lyme, and East Haddam where 51 residents were diagnosed with juvenile arthritis or arthritis of unknown cause (39 children and 12 adults) out of a total population of 12,000.6

While early physical examinations and laboratory tests revealed nothing abnormal, the interview painted a different picture.1 A geographic and temporal element to these cases showed multiple family members infected along with a noted appearance in more wooded areas outside of city/town centers with heightened activity from June to September.

Additionally, approximately 25 percent of patients in the study reported a skin lesion with an expanding bull’s-eye pattern four or more weeks preceding the onset of arthritic symptoms.7

Researchers found this to be particularly intriguing because the lesion correlated in description to *erythema chronicum migrans* (ECM), or *erythema migrans* (EM), a lesion previously reported in Europe that was thought to be a result of an unknown infectious agent but had never before been associated with arthritis.8

They would dig further back in the annals of the literature finding EM first mentioned in a pre-1909 meeting of the Swedish Dermatological Society in Stockholm.4 EM was sometimes associated with a tick bite and was accompanied by nerve pain, paralysis, or meningitis. In European circles, doctors believed that EM might have been caused by an unknown bacterium, and penicillin and other antibiotics were moderately effective at treating it. This connection between ticks and EM led scientists to hypothesize that Lyme disease might be transmitted by a tick bite.

**Sneaking tick**
With working conditions in place, researchers would find in 1976 that 30 new patients were identified with the illness.7 The new data strengthened the connection between the initial presentation of EM and the later development of arthritis. The Yale team would officially declare EM as the initial mark of infection and as the diagnostic hallmark of “Lyme arthritis,” the initial name given for the disease by the investigators.8

Interestingly enough, EM would be found later to only be present in less than 50 percent of cases. Shifting backward from the disease presentation to the causative agent, the Yale team would hypothesize that a tick was a likely vector of Lyme arthritis as early as 1976.7,8 In 1978, the team showed epidemiological evidence for a tick vector by expanding its surveillance of the Lyme area across the Connecticut River.7 It found that the incidence of Lyme arthritis was 30 times greater on the east side of the river, where Lyme, CT, is located, than it was on the west side, similar to the difference in deer and deer tick distribution in the area.

Scientists later confirmed that ticks indeed are the transmission vector of the infectious agent in Lyme disease. In the U.S., Lyme disease (*Borrelia burgdorferi*), Babesiosis, Powassan Virus and Anaplasmosis are transmitted mostly by the deer tick, or *Ixodes scapularis*, member of the *Ixodes* family. Incidentally, Powassan Virus originating from a small town in Ontario, Canada, is a flaviviridae pathogen which shares genetic ties to Zika, West Nile, and further distant cousin Ebola (*filoviridae*).9,10

It is well established that deer play an important role in the tick life cycle by supplying a blood meal and potentially serving as a mating ground for adult ticks. Accordingly, the recent explosion of the United States deer population is thought to be responsible for the dramatic increase in the instances of Lyme disease, particularly in the Northeast by greater than 320 percent.11

As could be expected, an effort to decrease the prevalence of *Ixodes scapularis* ticks and Lyme disease by controlling of deer populations have been proven successful and is one of many possible Lyme disease prevention strategy.

Another emerging trend as an early surveillance system is observing hot spots where dogs test positive for the disease as a measure of when the infectious species may arrive in new geographic areas.12

**More than ‘Lyme arthritis’**
It became clear to the Yale team by the early 1980s that “Lyme arthritis” was nothing more than only a small piece of a larger puzzle.

Now that the EM skin lesion was confirmed as the initial sign of infection, researchers made a massive effort to inform and educate the area near Lyme. They would ask local healthcare providers to refer patients to them soon after infection, enabling them to further characterize the disease and onset.

As a result of these further studies, the team reported that Lyme disease can manifest in a variety of systemic ways, including those involving the nervous system plus the eyes, heart, and joints.9,10

By 1984, serology testing that had been in development was released for public use, and Lyme disease 1987 it became a reportable disease to the Connecticut State Department of Health. Escalation to the national media would occur the following year in 1988 when people started coming forward with severe cases.

**Systemic Lyme presentation**
Lyme disease is clinically described as “early” or “late.”

Early localization initially presents with the characteristic bull’s-eye patterned lesion, EM. This lesion can last anywhere from several days to several weeks and is most often accompanied by severe fatigue, myalgia, arthralgias, regional lymphadenopathy, and headaches or fever.12

The initial EM lesion can sometimes spread to produce smaller, secondary lesions three to five weeks after the primary lesion. As the spirochetes begins to spread throughout the body, early dissemination sets in, causing potential Neuroborreliosis which can best be described as a constellation of signs and symptoms including confusion and short term memory loss, headaches, insomnia, increased intracranial pressure communicating to papilledema along with additional satellite EM lesions, neck stiffness, facial palsy, severe neurolalia, and heart palpitations. The exact etiologies are still not fully understood.

Late dissemination and chronic disease presents in a more pervasive fashion in that the patient can experience concussion or dementia-like symptoms related to Lyme encephalopathy with subtle cognitive difficulties, general feeling of being unwell, and/or changes in personality.

In extension, flare-ups of encephalomyelitis may trigger progressive features such as “brain fog,” vertigo, intermittent facial paralysis, cerebellar balance and gait deficiency, urinary incontinence, and back pain. In rare cases, there have been reported instances of psychosis.

**Ocular Lyme presentation**
When describing this condition within the eye, the best characterization is the “great imitator.” Ocular symptoms and signs are wide and vast, affecting all structures from the anterior to posterior segment (see Table 1).
Similar to systemic phasing, three ocular stages break into what I refer to as acute, ramp up, and smoldering sections.

The acute stage most commonly appears as a follicular conjunctivitis, mirroring a viral infection, followed by episcleritis. The ramp up dives deeper into the tissue with presentation ranging from anterior to panuveitis, including a syphilitic/HIV mimicry of neuroretinitis paired with multiple cranial nerve bundle manifestations.

The smoldering stage looks similar to dry eye disease, viral conjunctivitis, or Thygeson’s superficial punctate keratitis with the appearance of multiple subepithelial infiltrates and bilateral keratitis. This stage can take months to years to become apparent to both the patient and the eyecare provider.

Treatment

Steere and Malawista reported in 1977 the presence of common antibodies extracted from patients experiencing an active EM lesion or active arthritis. Consequently, it was interpreted that there may have been a common origin for these two clinical symptoms. While it took several years before the infectious agent(s) that causes Lyme disease was isolated, the Yale team had growing evidence for the role of a bacterial infection in the disease.

In 1980, Steere and Malawista determined that antibiotic treatment “shortens the duration of ECM and may prevent or attenuate subsequent arthritis.” The study consisted of 113 patients who presented with the EM lesion. Half of the group did not receive treatment, while the other half was treated with antibiotics. In patients who did not receive antibiotics, the EM lesion and associated symptoms resolved within 10 days. Those patients receiving antibiotic treatment experienced faster resolution of ECM, within four days. Furthermore, fewer patients in the antibiotic group went on to develop arthritis or other concomitant symptoms/signs compared to patients in the control group.

Antibiotic therapy, specifically doxycycline, is the major line of treatment for Lyme disease. With this said, there is growing evidence that by antibiotic treatment “shortens the duration of ECM and may prevent or attenuate subsequent arthritis.”22 The study consisted of 113 patients who presented with the EM lesion. Half of the group did not receive treatment, while the other half was treated with antibiotics. In patients who did not receive antibiotics, the EM lesion and associated symptoms resolved within 10 days. Those patients receiving antibiotic treatment experienced faster resolution of ECM, within four days. Furthermore, fewer patients in the antibiotic group went on to develop arthritis or other concomitant symptoms/signs compared to patients in the control group.

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SmithKline Beecham (now GlaxoSmithKline) from 1998 to 2000 licensed LYMErix, a recombinant vaccination targeting OspA; it was 78 percent effective but failed overall.23-25 A permissive recommendation to the primary-care community lead to minimal usage compared to a requirement.26 In some respects, this cautionary tale is a double-edged sword. If there was more public distribution, the more serious side effects, including fatality of the product, might have scared off other pharmaceutical companies from pursuing any future endeavors. While it has taken many years to dissect the genomes of these pathogens, I am glad to report this has not been the case as New York State in 2018 commissioned Regeneron to perform research and development of potential new lines of Lyme disease treatment, including vaccination.27

What lies ahead

The future is promising for individuals who are newly infected or suffer from chronic Lyme disease. Moving forward, eyecare practitioners must step up their games in identifying and managing these cases with primary-care, infectious disease, and rheumatology colleagues.

As my father would always say while rifling through my hair as a child looking for ticks after playing outside, “awareness is preparedness.” A dose of reality never hurt anyone, especially in the presence of these real-life body snatchers.

Table 1. Ocular signs and staging

<table>
<thead>
<tr>
<th>OCULAR SYMPTOMS AND SIGNS:</th>
<th>OCULAR STAGING:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conjunctivitis</td>
<td>STAGE 1 (ACUTE)</td>
</tr>
<tr>
<td>Photophobia</td>
<td>Most common is follicular conjunctivitis followed by episcleritis</td>
</tr>
<tr>
<td>Bell’s palsy</td>
<td>STAGE 2 (RAMP UP)</td>
</tr>
<tr>
<td>Cranial neuropathy/diplopia</td>
<td>Anterior to posterior uveitis, panuveitis; vitritis can be served with exudative RD, papillitis</td>
</tr>
<tr>
<td>Disc edema and blurred vision</td>
<td>Multiple cranial nerve manifestations bundles</td>
</tr>
<tr>
<td>Headache</td>
<td>STAGE 3 (SMOLDERING)</td>
</tr>
<tr>
<td>Episcleritis</td>
<td>Keratitis: Bilateral, focal + subepi to stromal, usually SEI present</td>
</tr>
<tr>
<td>Symphlepharon</td>
<td>Can take place years after initial presentation</td>
</tr>
<tr>
<td>Keratitis</td>
<td></td>
</tr>
</tbody>
</table>

References

A healthy corneal epithelium is fundamental to healthy vision, and several corneal epithelial diseases are associated with severe consequences to overall ocular health. Recurrent corneal erosion (RCE), which is characterized by a disturbance at the level of the corneal epithelial basement membrane and results in defective adhesions and recurrent breakdowns of the epithelium, is a primary culprit. RCE is never a one-and-done occurrence. The name says it all. Until an appropriate and effective treatment is implemented, the patient can expect recurrent breakdown of the corneal epithelium.

Optometrists’ goal in treating patients with RCE is to determine the best way to regenerate or repair the epithelial basement membrane to restore the bond between the epithelium and the anterior stroma and thereby put a stop to the destructive cycle and associated pain.

**Signs and symptoms**

RCE typically announces itself with sudden onset of pain that may last from minutes to several hours. In the most severe cases, which include persistent epithelial defects, patients can experience pain for several days. Associated symptoms of RCE include redness, photophobia, blurred vision, and tearing.

A detailed slit lamp examination should be performed with fluorescein staining and retro-illumination. Slit-lamp findings include conjunctival injection, fresh or healing epithelial defects, and/or epithelial basement membrane dystrophy (EBMD).

If the RCE episode is recent, optometrists should see no evidence of corneal infection. If, on the other hand, the patient has had several episodes of RCE, a corneal scar may be present.

While RCE typically presents as a unilateral condition, there are instances when both eyes may exhibit EBMD. Ocular pain is typically the motivating factor that prompts patients to seek help from their eye-care providers.

Once the patient is in my care, I reassure him that there are effective treatment options; then I take a detailed history so I can begin gathering the building blocks that will put me on the path to identifying the best strategy to manage his condition. The two primary therapeutic goals are to facilitate rapid re-epithelialization and relieve ocular pain.

**TAKE-HOME MESSAGE**

Recurrent corneal erosion may occur spontaneously or secondary to corneal trauma. A weak attachment between the epithelium and the basement membrane causes RCE, and patients with the condition often show increased levels of enzymes such as MMPs that dissolve the basement membrane and its anchoring components. In addition to treatment with antibiotic and preservative-free lubricating drops, nighttime lubricating or hypertonic saline ointments, cycloplegic drops, and bandage contact lenses, amniotic membrane may offer corneal protection while encouraging epithelial regrowth and adhesion.

*FIGURE 1. Patient with history of recurrent corneal erosion underwent debridement to remove loose epithelium.  FIGURE 2. Following placement of cryopreserved amniotic membrane, complete healing occurred within three days.*

Images courtesy Scheffer C.G. Tseng, MD, PhD

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**19-29%**

of reported cases of recurrent corneal erosion result from epithelial basement membrane dystrophy

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*See Recurrent corneal erosion on page 22*
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RCE is never a one-and-done occurrence. The name says it all. Until an appropriate and effective treatment is implemented, the patient can expect recurrent breakdown of the corneal epithelium

RCE results from mechanical trauma to the superficial cornea, with about 45 percent to 64 percent of reported cases being related to prior physical injury. The second most common cause is EBMD, which has been reported in 19 percent to 29 percent of cases.3

RCE differential diagnosis should include:
- Herpes simplex virus (HSV)
- Epithelial keratitis
- Exposure keratopathy
- Neurotrophic keratitis
- Conjunctival foreign body
- DED
- Infectious keratitis
- Ocular graft-versus-host disease (GVHD)
- Chemical and thermal burns
- Floppy eyelid syndrome
- Salzmann’s nodular degeneration

A weak attachment between the epithelium and the basement membrane—thought to be related to the epithelial adhesion network and associated filament—characterizes RCE.

Patients who are at higher risk for developing RCE have higher levels of matrix metalloproteinases (MMP)-9 and interleukin 1 (IL-1) in the tears, and studies show that patients with RCE have increased activity of MMP-2 and MMP-9.6,7

These enzymes can adversely affect the basement membrane and anchoring fibrils, thereby causing dysfunctional adhesion complexes.8,9

These factors influence my treatment choices.

Treatment options

Medications such as antibiotic drops and preservative-free lubricating drops used in conjunction with nighttime lubricating or hypertonic saline ointments were historically relied upon as first-line RCE treatment.

Take note: It is never appropriate to use bland petroleum-based ointment at night time—bland petroleum ointment will soften the epithelial tissue at night and make it susceptible to erosion.

Depending on the patient’s level of discomfort, a cycloplegic eye drop or a soft bandage contact lens might be added. Oral analgesics could also be administered if necessary.3

In my experience, traditional medical treatment almost always requires additional therapy to obtain relief from this very painful and often debilitating condition. This is among the reasons why it is so important to determine the underlying cause of the RCE.

If RCE is unilateral, a good case history will reveal whether or not trauma was involved, and a careful corneal evaluation determines if EBMD is present. This is important even if trauma was the underlying factor because the trauma may have been the exacerbating element that allowed the EMBD to turn into RCE.

It is also important for the practitioner to determine if exposure keratitis is present because a partial blink or nocturnal lagophthalmos could be an exacerbating factor that allowed the EMBD to transition into RCE.

Because of these underlying concerns, it is often necessary to go beyond medical treatment to more comprehensive interventions when managing patients with RCE.

For instance, cryopreserved amniotic membrane (AM) has become a staple RCE treatment in my practice. The membrane protects the cornea from eyelid trauma while encouraging epithelial regrowth and adhesion. In one study, Huang and coworkers placed amniotic membranes onto 11 eyes of nine RCE patients, and only one eye had an RCE recurrence that required retreatment; the other 10 eyes remained asymptomatic.9

Two types of AM are available for ophthalmic use: cryopreserved and dehydrated. Cryopreserved AM (Prokera, BioTissue) is kept frozen or refrigerated and brought to room temperature before application. Dehydrated AM, such as AmbioDisk (IOP Ophthalmics/Katena) and BioDOptix (Integra LifeSciences) is stored at room temperature and rehy-
In my clinical experience, I have found cryopreserved AM effective in managing and resolving RCE. My belief is that it is due to the anti-inflammatory properties of the biologic heavy chain-hyaluronic acid and pentraxin 3 (HC-HA/PTX3). Cryopreserved AM retains HC-PTX3, which is the specific biologic matrix that has been identified as being responsible for AM's anti-inflammatory and regenerative healing properties.

Research also suggests that HC-PTX3 helps reduce scar formation that can lead to impaired vision. Dehydrated AM tissue does not retain this critical biologic compound. Prokera cryopreserved AM is cleared and designated by the FDA for therapeutic properties, such as anti-inflammatory, protective, and wound healing effects, while dehydrated AM is not.

Cryopreserved AM may be used to treat RCE, EBMD, persistent epithelial defects, chemical burns that can pose a serious threat to visual health. RCE may occur spontaneously or secondary to corneal injury. Patients with RCE often show increased levels of enzymes such as MMPs that dissolve the basement membrane and its anchoring components.

Cryopreserved AM is an effective RCE solution because it contains inhibitors of MMPs and active matrix components including collagen type VII and laminin, essential for regenerative healing and prevention of RCE recurrence.

Traditional medical treatment almost always requires additional therapy to obtain relief from this very painful and often debilitating condition of the ocular surface, and corneal epithelial defects such as those associated with bullous or band keratopathy, among other conditions.

Research suggests that in addition to stimulating active healing, cryopreserved AM initiates corneal nerve regeneration.

As noted earlier, patients with RCE often show increased levels of MMPs enzymes. These enzymes dissolve the basement membrane and its anchoring components including integrins, laminin, and type VII collagen.

Cryopreserved AM contains inhibitors of MMPs and active matrix components including collagen type VII and laminin, essential for regenerative healing and prevention of recurrence.

First-line use of cryopreserved AM allows for the introduction of healing properties and prevents further corneal surface deterioration. If the RCE has an underlying disorder of EMBD that was caused by trauma—especially recent trauma—I find the best results emerge when I use cryopreserved AM to manage the condition.

There are instances when it is appropriate to refer an RCE patient for a cornea consult. I refer my patient to a corneal specialist if I believe the it requires a penetrating therapeutic keratotomy. However, even in those cases I will continue managing the patient medically because there is usually an underlying abnormality that will require monitoring and treatment to prevent reoccurrence.

In conclusion

RCE is a debilitating and painful corneal condition...
Epi-on cross-linking may speed visual recovery

Phase III clinical trial examines new ways to succeed with transepithelial procedure

By Jessica Heckman, OD

Our practice has been performing epi-off corneal collagen cross-linking (CXL) since it was approved by the U.S. Food & Drug Administration (FDA) for patients with progressive keratoconus or ectasia.

This has been such an exciting procedure for us to offer. For the first time, eye care practitioners have been able to provide a treatment that can slow or halt the progression of ectatic disease rather than just managing it until patients get to the point of needing a corneal transplant. I have also seen a number of patients treated early in the disease course who have continued to be successful in glasses or soft contact lenses without being dependent on specialty contact lens fits.

Despite these positive outcomes, there are potential improvements over the way the procedure is currently performed.

Because the surgeon creates a large epithelial defect, the first few days after the procedure can be uncomfortable for patients, and it can take several days for the epithelium to heal. Until the epithelium heals, the eye is more vulnerable to haze or infection, although the risk of these complications is low.3

Many people think transepithelial or “epi-on” CXL has the potential to speed visual recovery and improve the patient experience.

A challenging proposition

The challenge with epi-on, of course, is that the epithelium is specifically designed to protect the eye. An intact epithelium makes adequate penetration of the riboflavin into the stroma more difficult, the epithelium may absorb ultraviolet (UV) rays before they reach the stroma. Additionally, while the chemical reaction that takes place during cross-linking is dependent on oxygen, it also rapidly depletes stromal oxygen, which can make it less effective.

For these reasons, research of epi-on procedures have shown them to be less effective than epi-off.3

Researchers and clinicians have used several strategies to try to overcome the barriers to success with epi-on CXL.

One approach, for example, has been to add components to the riboflavin to enhance penetration. Currently, several new riboflavin formulations for epi-on CXL are under investigation, including one that uses nanotechnology and sustained-release riboflavin.4-7

In Europe, SOOFT Italia has been marketing an iontophoresis CXL (I-CXL) device that uses a positive electrical charge to help negatively-charged riboflavin solution penetrate into the stroma. A recent report on three-year follow-up in pediatric eyes found that I-CXL was less effective than standard epi-off CXL.8

It has been suggested that pulsing, or cycling the UV light off and on during treatment, could be beneficial because it allows oxygen to replenish during the “off” cycles. However, the latest data suggests that pulsing on its own does not restore enough oxygen to match the efficacy of epi-off.9

Supplementing the corneal environment with a higher concentration of oxygen has also been proposed as a way to promote greater efficacy. Research with animal eyes has shown that specialized oxygen goggles can increase the amount of oxygen available in the stroma10 and that eyes treated with a protocol that includes supplemental oxygen had more corneal collagen stiffening than those treated with a room-air protocol.1

U.S. clinical trial

Our practice is participating in a randomized, controlled Phase III clinical trial for epi-on CXL. The study, which is being conducted at 14 clinical sites around the U.S., incorporates a number of the approaches discussed above into the treatment protocol.

To be enrolled, patients must have documented progression of keratoconus, corneal thickness >325μm, and Kmax >47 D. Patients are randomized to epi-on CXL or a sham treatment; those in the sham group are eligible for treatment after 6 months of follow-up.

A new two-part riboflavin formulation, which includes a higher concentration of riboflavin, is used. The light source is a high intensity, pulsed, 30mW/cm² 365-nm UVA light.

The overall procedure is also faster than an epi-off procedure. Additionally, specially designed oxygen-delivery gog...
goggles, which are open in the front, are placed over the patient’s eyes after instilling riboflavin drops. When sensors in the goggles indicate that oxygen concentration on the corneal surface is >90 percent, UV irradiation can begin.

Enrollment of all 275 patients in the multicenter study has been completed. We and other study centers are conducting follow-up visits, after which the data will be analyzed with the intention to present to the FDA as a drug/device combination treatment.

This is an important step to evaluate the safety and efficacy of epi-on CXL. Currently, epi-off CXL with FDA-approved solutions and device is a covered service for more than 95 percent of patients insured by commercial health plans in the U.S., but epi-on CXL can be performed only as part of a clinical trial.

We hope this technique will prove to be beneficial for patients. We are looking forward to seeing the final safety and efficacy data gathered from all centers participating in the trial.

Comanaging care

Cross-linking is a great procedure for optometrists and cornea surgical practices to comanage because patients need both our services. Although CXL can lead to some changes in refraction, patients will still need to continue in some form of vision correction after the procedure and will need to be monitored at least annually to ensure that there is no more progression.

Postoperatively, comanaging optometrists can expect to see their patients back around the one-month mark. At this time, as long as the epithelium is fully healed, patients can also start wearing their previous contact lens prescription again. However, the contact lens may ultimately need to be refit because the cornea changes postoperatively.

Because this procedure is an opportunity to preserve vision in these patients, I strongly encourage optometrists to watch for rapid prescription changes and high or rapidly changing astigmatism, particularly in young patients.

For those optometrists who don’t have topography to help confirm a keratoconus diagnosis, it is a good idea to refer keratoconus suspects to another doctor for topography. When needed, they can be referred to a cornea practice for CXL, either epi-off, or in the future possibly an epi-on procedure.

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Dr. Heckman is in practice at Chu Vision Institute in Bloomington, Minn. She is a consultant to Avedro.

jessica.heckman@chuvision.com
More than a yellow lesion?

Ocular coherence tomography, dark adaptation, and genetic testing lead to two diagnoses

By Justin Kwan, OD, FAAO

A 64-year-old Caucasian male presented for a comprehensive eye exam with chief complaint of mild blur at distance and near with his progressive addition lenses as well as a peeling anti-reflective coating.

Seems innocent, right? Let’s take a deeper look as the case unfolds.

Case history

The patient’s medical history was significant for hypertension, high cholesterol, and generalized anxiety for which he was taking amlopidine and simvastatin (Zocor, Merck), while alprazolam (Xanax, Pfizer) was administered as needed.

Remarkable surgical history was pertinent for a hernia repair. He reported an allergy to aspirin, therefore, clopidogrel (Plavix, Bristol-Myers Squibb) and simvastatin (Zocor, Merck), while alprazolam (Xanax, Pfizer) was administered as needed.

Clinical findings and management

His blood pressure was measured as 102/70 mm Hg at 2:31 p.m. with a height of 5’10” and weight of 165 pounds, resulting in a normal BMI of 23.7. Color vision was normal in each eye as well as stereopsis along with all other entrance testing.

Of note, there was a small hyperopic and astigmatic shift in each eye, resulting in best corrected vision of 20/20.

Intraocular pressure and anterior segment were unremarkable other than mild cortical cataracts. The posterior segment was also unremarkable except for a 0.25 disc diameter-sized yellow lesion that happened to be inferotemporal parafoveal in the left eye at 3.46 minutes.

The posterior segment was also unremarkable, except for a 0.25 disc diameter-sized yellow lesion that happened to be inferotemporal parafoveal in the left eye at 3.46 minutes.

Macular OCT revealed a sub-retinal pigment epithelium (RPE) elevation in each eye as well as classic subtle deflections evident of drusen and vitreomacular adhesions (Figures 3 and 4).

The patient then underwent Macula Risk (ArcticDx) genetic testing via cheek swab.

Results noted nine out of 15 genetic markers as high risk, classifying the patient as MR4 with a 6 percent, 16 percent, and 32 percent likelihood of developing advanced age-related macular degeneration (AMD) in two, five, and 10 years, respectively (Figure 6).

The patient was asked to return to discuss the results, which also specified which supplement he should be taking to reduce his risk of progressing to advanced AMD. There was no family history of AMD, which can increase the odds of a patient having AMD by 27.8 times with an affected parent or 12 times with an affected sibling.

Discussion

Differential diagnoses of yellow lesions in the macular area include large drusen, epiretinal membranes, pseudohole, lamellar macular hole, Stargardt disease, chronic central serous chorioretinopathy, and Best’s vitelliform macular dystrophy. In this case, focal presentation and clinical signs via OCT suggest drusenoid pigment epithelial detachment (PED) or adult-onset vitelliform macular dystrophy (AVMD).

AVMD is an early-onset autosomal dominant disorder in which accumulation of lipofuscin-like material within and beneath the RPE is associated with progressive loss of central vision.1

The timing of AVMD usually begins after age 40, leading me to believe this patient’s presentation is an early-stage lesion.

The findings are highly autofluorescent and will become larger in later stages, with central clearing of the yellowish substance along with deposition of autofluorescent subretinal material at the outer borders of the lesion.2

AVMD is an early-onset autosomal dominant disorder in which lipofuscin-like material in the RPE is linked with loss of central vision

AVMD is an early-onset autosomal dominant disorder in which lipofuscin-like material in the RPE is linked with loss of central vision

brane, pseudohole, lamellar macular hole, Stargardt disease, chronic central serous chorioretinopathy, and Best’s vitelliform macular dystrophy. In this case, focal presentation and clinical signs via OCT suggest drusenoid pigment epithelial detachment (PED) or adult-onset vitelliform macular dystrophy (AVMD).

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As review, Macula Risk PGx tests 15 genetic markers across 12 AMD associated genes. It has shown a predictive accuracy of 89.5 percent with sensitivity and specificity >80 percent.4

Taking into account that this patient has a high likelihood of converting to advanced AMD, clinical monitoring every six months and home monitoring with Amsler grid is prudent. Other home monitoring technologies include ForeseeHome (Notal Vision).

Additionally, a baseline threshold central 10-2 visual field to establish the sensitivity of the AVMD lesions and the mean deviation would be valuable to perform. Micropereimetry may also be relevant in the future, but it is not medically necessary at this stage.

Conclusion

While this patient had AVMD and early-stage dry AMD, it cannot be understated that the loss of photoreceptor function secondary to AMD can be evaluated by dark adaptation and may precede obvious signs of drusen by up to three years.●

REFERENCES


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More than 100 years ago, Hermann Snellen introduced the concept of surgically altering cornea to reduce refractive error. Initially, refractive surgery developed along two paths—radial keratotomy (RK) and lamellar surgery, called keratomileusis. The invention of excimer laser in the early ’80s made RK obsolete and transformed keratomileusis into the LASIK of today.

The initial years of excimer laser work brought together scientists and clinicians with diverse backgrounds and expertise. Initially, a trio of IBM scientists discovered an ability of the newly invented excimer laser to accurately reshape biological tissue without damage to the surrounding tissue. The connection between the laser and the eye was made by Stephen Trokel, MD.4

Thousands of plastic test blocks, cadaver eyes, and animal eyes later, the first laser vision correction, photorefractive keratectomy (PRK), was performed on a sighted eye in 1988. A year later, Gholam Peyman, MD, patented a method that combined excimer laser of the ’80s and keratomileusis of the ’60s into the procedure that became known as LASIK.

Since then, more than 40 million LASIK procedures have been performed worldwide with success rates of 99.5 percent as measured by visual acuity and patient satisfaction. A recent collaborative study among the U.S. Food & Drug Administration (FDA), the National Eye Institute (NEI), and the Department of Defense confirmed the high rate of patient satisfaction after LASIK.6

LASIK has come a long way
The first LASIK procedure was performed in 1990. It was FDA approved in 1999. The year 2019 marks a double anniversary for LASIK—30 years since it was patented and 20 years since it was FDA approved.

In the initial years of LASIK, advancements were focused on fine-tuning the accuracy of correcting refractive error—myopia, astigmatism, and hyperopia. In the early 2000s, attention was turned to improving LASIK safety with the introduction of the femtosecond laser, which replaced the mechanical microkeratome for LASIK flap creation.

Subsequent work in LASIK vision correction has been directed at improving procedure customization to achieve correction of both refractive error and higher-order aberrations, aiming for the goal of improving day and night quality of vision, and achieving vision beyond 20/20 for most patients.

The customization of LASIK began in the mid-2000s with the advent of wavefront-guided ablation. Initially, 200 data points were measured and attempts were made to reduce the aberrations. Over the past 15 years with the evolution of customization technology, precise detection and mapping of aberrations has become possible.

Three custom LASIK systems are currently available:
- MODERN WAVEFRONT-GUIDED LASIK (iDesign Advanced Wave Scan, Johnson & Johnson Vision) targets 1,200 aberration data points in the optical system.
- WAVEFRONT-OPTIMIZED LASIK (WaveLight, Alcon) uses laser beam application techniques that optimize corneal asphericity to maintain good quality of vision day and night.
- TOPOGRAPHY-GUIDED LASIK (Contoura Vision, WaveLight, Alcon) aims at correcting corneal aberrations by mapping 22,000 elevation and depression points on the corneal surface.

With custom LASIK, eyecare practitioners can offer patients better vision than ever. For example, in the recent FDA studies of topography-guided Contoura Vision LASIK and wavefront-guided iDesign LASIK, nearly two thirds of patients achieved better than 20/16 uncorrected vision. Today, “better than 20/20” is the new 20/20.

As LASIK evolved, so did the relationship between optometrists and ophthalmologists. Proper patient selection, counseling, and thorough pre- and post-LASIK exams are as crucial to successful outcomes as surgical skill, nomenclature, and laser technology.

The role of the optometrist
Optometrists are the leaders in diagnosing ametropias. At the conclusion of an eye exam, the optometrist will inevitably discuss ametropia correction.

Since its inception, more than 40 million LASIK procedures have been performed worldwide with success rates of 99.5 percent as measured by visual acuity and patient satisfaction outcomes.

### TABLE 1 Results: UVCA 1 year after LASIK

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FDA studies conclude that nearly two thirds of patients achieve 20/16 or better uncorrected vision after modern custom LASIK.
In a post-teenage young adult with a healthy ocular system and clear natural lens, glasses, contact lenses (both soft and gas permeable lenses), and refractive surgery should all be considered. For patients, LASIK is the noun that loosely, albeit incorrectly, is used to cover all refractive surgeries, including PRK, small incision lenticular extraction (SMILE), implantable collamer lens (ICL), and refractive lens exchange (RLE).

In pre-op management, optometry’s first role is to educate the patient about refractive surgery options and counsel the patient about the procedure(s) he may benefit from the most. The optometrist is also well positioned to leverage her long-term relationship with the patient to determine what procedure will best fit the patient’s lifestyle and vision needs. If LASIK is the best choice, the OD can communicate to the surgeon whether full distance, monovision, or undercorrection OU will be best as well as the post-op refractive goal.

The initial surgery work-up in the modern optometric office can supply the patient with a near total representation of LASIK candidacy:

- **REFRACTION:** Both dry (non-cycloplegic) and wet (cycloplegic) will provide a baseline numerical starting point to guide the laser treatment. The wet refraction will aid in preventing over-minusing. Based on refraction alone, the optometrist can counsel the patient whether he is within the range for laser vision correction, including LASIK, or whether ICL or RLE would be better.

- **SLIT-LAMP EXAM:** This will help to define any abnormal anterior segment pathology. Slit lamp combined with corneal staining (sodium fluorescein and lissamine green) is a great way to assess dry eye. In the presence of dry eye, aggressively starting treatment can pave the way for successful and accurate laser refractive surgery. In the time period between the optometrist’s visit and refractive surgery evaluation, dry eye can be successfully managed. Today, there are many options for successful dry eye management before and after LASIK. Epithelial basement membrane dystrophy and significant corneal scars detected on slit-lamp exam would steer the patient toward PRK rather than LASIK.

- **CORNEAL TOPOGRAPHY/TOMOGRAPHY:** Such imaging is an important tool in assessing corneal shape and symmetry as a screener for ectasia risk. If a topography/tomography is unavailable, measuring keratometry (K) values with an automated device or manual keratometer will provide the Ks and show the quality of the mires.

- **PACHYMETRY:** This measurement is also a useful guideline because it will help guide tissue ablation abilities for corneal laser surgery.

**How Thanksgiving turkey advanced LASIK**

In the early 1980s, a trio of scientists were brought together by IBM to investigate what could be done with the newly invented excimer laser.

The team consisted of material scientist Samuel Blum, photochemist Rangaswamy Srinivasan, and physicist James J. Wynn. Srinivasan discovered that the laser can etch polymer materials accurately. He hypothesized that it could also work on biological tissue because it shared properties with polymers.

Sitting at the table with his family on Thanksgiving in 1981, Srinivasan looked at his turkey dinner and a brilliant thought occurred to him: a leftover bone with cartilage would provide the perfect test subject to see if the laser would be able etch human tissue as well as it did other materials. He brought his leftover turkey leg to the lab the next day.

That day—Friday, November 27, 1981—the team “operated” on the turkey cartilage and confirmed that excimer laser ablation of a biological tissue results in a precisely reshaped area without damage to surrounding tissue.

Years later, President Barack Obama honored the researchers with National Medal of Technology and Innovation. At the ceremony, Wynne says his daughter asked President Obama if he knew anyone who had undergone laser refractive surgery. The President replied, “Yes, my wife Michelle.”

Figure 1A and B. OD workshop on topography-guided Contoura Vision LASIK. A. Preoperative mapping of corneal aberrations with Vario scan technology. B. Topography-guided excimer laser corneal reshaping. Images courtesy Ella Faktorovich, MD

See 30 years of LASIK on page 30
30 years of LASIK
Continued from page 29

months after LASIK is dryness, which can be successfully managed with effective treatment options.

From immunomodulators such as Xiidra (lifitegrast, Novartis) that reduces inflammation and helps produce better quality tears, to the reformulated Restasis Multidose (cyclosporine, Allergan) that enhances patient compliance, to intranasal neurostimulators such as TrueTear (Allergan) that triggers patient’s own tear production, we can help our patients heal faster.

The efficacy of modern dry eye management is supported by recent research.

At the 2019 American Society of Cataract and Refractive Surgery (ASCRS) meeting, a study by Schallhorn et al dispelled many dry eye myths. Preop dry eye did not translate to post-op dry eye, and in fact, some patients with moderate to severe dry eye experienced less ocular surface disease symptoms after LASIK.

The results of the Patient-Reported Outcomes with LASIK (PROWL) studies launched by the FDA, the National Eye Institute, and the Department of Defense have also concluded that with modern pre- and post-LASIK dry eye management patients experience excellent outcomes.

These studies revealed that in most patients, preoperative dry eye symptoms decreased after LASIK. Even though some patients experienced new dry eye symptoms at three months, these were categorized as mild and improved with time and ocular surface management.

What’s next?
Advances in surgical customization are likely to continue with more patients able to achieve vision beyond 20/20.

The SMILE procedure is promising, but it needs to incorporate treatment of higher-order aberrations to achieve the same level of customization as modern LASIK surgery.

The concept of presbyLASIK may continue to be explored to improve both distance and near vision in presbyopic patients while minimizing side effects of a multifocal cornea.

Novel therapeutic approaches to stimulating corneal nerve regeneration and restoring corneal nerve function and sensitivity are being investigated. Nerve growth factor, Cenegermin-containing eye drops (Oxervate, Dompé) have been FDA approved for the treatment of neurotrophic keratitis. Further investigation could help determine if such types of medications could enhance healing after LASIK.

We have come a long way in the past 30 years.

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Dr. Faktorovich is founder and chair of the San Francisco Cornea, Cataract, and Refractive Surgery Symposium. She has been recognized in Best Doctors in America and Top 100 Health Professionals in the World. Dr. Faktorovich enjoys creating large-installation glass sculpture. Dr. Faktorovich has no financial interests in the subject matter or materials discussed.

dr.faktorovich@pacificvision.org

Dr. Ibach is a cornea, glaucoma, cataract, and refractive surgery specialist. His practice was a clinical trial site for the FDA trial leading to approval of epi-off CXL and ongoing studies of epi-on CXL. He is a consultant for Avedro. Dr. Ibach enjoys spending as many days as possible at the lake with his family.
mitch.ibach@vancothompsonvision.com
Deep learning able to identify glaucoma, study shows

New research highlights how data is processed to detect glaucomatous optic neuropathy

By Benjamin P. Casella, OD, FAAO
Chief Optometric Editor

Over this past summer, I was fortunate enough to be given the opportunity to deliver a speech to the State University of New York (SUNY) College of Optometry residency class of 2019.

During this 20 minutes (which they likely perceived as just over an hour), I recommended that residents take a few moments and conduct a search of the world’s literature using the key words “deep learning” with the disease of their choice.

Conducting such a search myself gave me a better understanding of the likely direction of health care in my clinical lifetime.

A study recently published in JAMA Ophthalmology describes a deep learning system which appears to show high sensitivity and specificity for the detection of glaucoma.

Deep learning

So, just what exactly is deep learning?

In the arena of artificial intelligence, this subset of machine learning is based on so-called “neural networks” that process data into concepts.

For instance, a clinician may instantly process all the pixels in a fundus photograph into what he judges as a diseased or healthy eye.

Deep learning systems are meant to conceptualize such data through complex set of algorithms and other analysis formulas.

These results show a propensity to enhance our current glaucoma screening modalities and approaches through a time- and cost-efficient means

Study design

As for the deep learning system described in the aforementioned study, fundus photographs were, indeed, the medium for testing the system.

The nature of the study was cross-sectional, and 241,032 images from 68,013 patients were ultimately included for the training of the system. The images came from the Chinese Glaucoma Study Alliance, the Handan Eye Study, and other databases.

Several “validation datasets” were also used in order to reflect the number of glaucoma patients within a population based on the known epidemiology of glaucoma as well as to provide an ethnically diverse cohort.

The images were entered into the various databases in 2009, and they were obtained and subsequently tested in 2018.

The optic nerve heads in the fundus photographs for the purpose of training the deep learning system were divided up into three categories:

- Definite glaucomatous optic neuropathy (12.4 percent)
- Probable glaucomatous optic neuropathy (4.6 percent)
- Unlikely glaucomatous optic neuropathy (83 percent)

A remaining 28,569 images were used in the validation testing and evaluation of the system.

The sensitivity (identifying glaucoma) and specificity (identifying “not glaucoma”) of the deep learning system, through its use of fundus photographs and “glaucoma diagnosis with convoluted neural networks” or GD-CNN, were measured against professional graders.

Study results

As it turned out, the deep learning system performed quite well. The sensitivity and specificity of the system was 96.2 percent and 97.7 percent, respectively.

The most common cause for false positives and false negatives by both the deep learning system and the graders was high or pathologic myopia.

The authors state that these results show a propensity to enhance our current glaucoma screening modalities through time and cost efficiencies.

What this means

The potential implications of this concept are far-reaching.

One is increasingly less likely to have a conversation regarding the diagnosis of any disease without mention of technology. The eye and visual system are no strangers to this notion.

I would argue that the advent and subsequent bettering of technology has made our clinical lives easier—still challenging, but much easier.

The effective use of normative databases and progression algorithms with respect to spectral-domain optical coherence tomography (OCT) has given us highly reliable objective data which ODs can use as metrics for therapeutic efficacy (or to help ensure that no therapy is needed).

Deep learning systems will expand the horizon of how technology can aid in the diagnosis and staging of disease states. What an incredible time it is for ODs to be practicing.

It should be noted, however, that it is likely no mundane detail that the authors of this paper use the word “screening” in their description of potential applications for this deep-learning system.

The definitive diagnosis is the clinician’s to make.

One implication here is that clinicians will continue to make decisions more so than gather data. In the meantime, I, for one, salute our new computer overlords.

REFERENCE

For the fourth consecutive year, Guess and the Marcolin Group are supporting breast cancer awareness by partnering with the nonprofit Get In Touch Foundation to create a capsule collection of eyewear.

The capsule collection features a pair of sunglasses and eyeglasses embellished with the iconic ribbon in rose gold metal—a symbol of the fight against breast cancer—on the temples.

Both models come in a pink case and will be available in stores beginning October, Breast Cancer Awareness month.
Zyloware kicks off autumn season with new launches

Zyloware Eyewear is beginning the fall season with new releases for Stetson, Randy Jackson, and Sophia Loren.

**STETSON XL 38** is designed with a zyl frame available in two colors: black and grey. Black exhibits a black front over crystal zyl with black as well as crystal temples featuring a gun metal foil logo. Grey includes a translucent grey front and translucent grey temples with gun metal foil logo. These frames also come with spring hinges.

**SOPHIA LOREN M302** features a thin profile and crystal accents. This semi-rimless metal frame comes in two colors: burgundy and rose. Burgundy showcases a shiny burgundy frame with marble burgundy temple tips and crystal décor. Rose includes a shiny pink frame with mauve pearl horn temple tips and crystal décor. Spring hinges and snap-in nose pads are also featured on the frames.

**RANDY JACKSON 3046** features a full-rim zyl frame available in two colors: olive and navy. Olive exhibits a shiny back front over olive camo with a gunmetal top-bar and an olive camo temple with gun metal décor. Navy includes a shiny navy front over a matte navy camo with a gunmetal top bar and navy camo temples with gunmetal décor.
Blackfin debuts fall collection of optical frames

The latest fall collection of Blackfin One optical frames features classic and subtle designs in all styles: men’s, unisex, and women’s.

**VALDEZ**
The rounded silhouette of Valdez is offset by a straight bridge and two slightly angled points that interrupt the circular continuity. Color options available include shades of midnight blue/gunmetal gray, bright blue/gunmetal gray or black/champagne gold.

**BAYSIDE**
Exhibits an elongated, squared top frame rim. A bold pastel color palette emphasizes the contrasting inner and outer frame in colors Venetian red/plum, dark blue/turquoise, midnight blue/pink, magenta/plum, or all black.
InDispensable

**LYNN HAVEN**
features a range of styles with bas-relief front as well as rounded rims and a contrasting, slightly elongated top rim. Color options for these frames include matte mocha/magenta, polished silver/champagne gold, pink blush/blue-green, polished silver/black, or dark blue/burgundy red.

**WINTER HARBOR**
showcases technical detail on a titanium-welded bridge. Sculpted lines and bold depth of the frame are emphasized by black outlined in lime green as well as dark blue outlined in bright red, midnight blue, olive green, or black colors.

**BAYOU**
exhibits an almost-round frame and ultra-flexible beta titanium bridge and temples. The color palette ranges from dark blue paired with bright red, black, or midnight blue to shades of blush pink or midnight blue combined with magenta.
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1. Publication Title: Optometry Times
2. Publication Number: 0890-7080
3. Filing Date: 9/30/19
4. Issue Frequency: Monthly
5. Number of Issues Published Annually: 12
6. Annual Subscription Price (if any): $51.40
7. Complete Mailing Address of Known Office of Publication:
   325 West First Street STE 300, Duluth, St. Louis County, Minnesota 55802-2065
   Contact Person: Kelly Kemper
   Telephone: 218-491-6482
8. Complete Mailing Address of Headquarters or General Business Office of Publisher:
   2 Clarke Drive Suite 100, Cranbury NJ 08512
9. Full Names and Complete Mailing Addresses of:
   Group Publisher: Leonardo Avila, 485F US Highway 1 S, Suite 210, Iselin, NJ 08830
   Group Content Director: Erin Schlussel, 485F US Highway 1 S, Suite 210, Iselin, NJ 08830
   Content Channel Director: Gretchyn Bailey, 24950 Country Club Blvd., No Olmsted, OH 44070
10. This publication is owned by: MJH Life Sciences LLC - 2 Clarke Drive Suite 100, Cranbury NJ 08512
11. Known Bondholders, Mortgages, and Other Security Holders Owning or Holding 1 Percent or More of Total Amounts of Bonds, Mortgages, or Other Securities.
   If none, check box: R None
12. Does Not Apply
13. Publication Title: Optometry Times
14. Issue Date for Circulation Data Below: August 2019
15. Extent and Nature of Circulation

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Italian manufacturer Thema Optical has announced its 2019 Fall collections of handcrafted designs now manufactured in the United States at its Miami-based facility.

**Thema Optical** announces latest fall collection

Thema Optical’s first-ever private label collection that features handcrafted acetate frames.

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Responsibilities:
- Ocular disease management including glaucoma
- Comprehensive eye exams
- Pre and post-operative care
- Establish a working relationship with referral sources to ensure continuity of patient care.

Requirements:
- Indiana license
- Fellowship training preferred or 5 years experience with pre and post-operative care.
- Strong interpersonal skills with the ability to effectively communicate with other providers and staff members.

What we offer:
- Competitive pay
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Why contact lenses? I’m a third-year optometry student taking Contact Lens I course. The instructor started going through his hard laser design philosophy. Bells went off, it was just an “ah-ha” moment for me. At the end of the semester, a contact lens research rotation externship started under the guidance of Dr. Irvin Borish. I really wanted that externship. My contact lens instructor said, “Ed, you have to be in the top 20 percent of your class.” But he knew how much I loved contact lenses. He bumped somebody and put me in there. That was a tremendous life-changer. I was involved in five clinical studies. I got to look at the first extended-wear lenses before they were FDA approved, the first soft lenses to correct for astigmatism, the first gas-permeable lens which turned out to be very, very important to me. And from that point on I was hooked. That whole year I did research for Dr. Borish and Dr. Sarita Soni, and it ultimately opened the door for a faculty position at IUP.

Why stay in academia for 40 years? I had looked at a couple of practices when I was a fourth-year optometry student. One was a contact lens practice in Indianapolis. As I recall, they offered $15,000 or $14,000. If they would have offered $17,000, I would be there today. Because of that, I didn’t know what to do the next year. Dr. Soni whom I worked under arranged for me to have a faculty position at Indiana. When you’re in academia a while, it’s hard to switch gears and go half time or full time into a practice. I love teaching, I love students. You lose something when you’re not involved in clinical practice, but I did the next best thing. One of my study patients when I was a fourth-year student was a second-year student who seemed to be real nice. So I ended up marrying her. She owns a private practice, so I live it out through her.

What is something your colleagues don’t know about you? I’ve always been somebody who has been fearful of failure. I always worry about disappointing people. When I made the transition recently to retire from UMSL, there was an incredible amount of relief when I woke up and knew I wasn’t going to be disappointing students, I wouldn’t have to worry about anything happening to a student, or worry about what speech I’m going to give. I think all these years it’s been a tremendous motivator, but at the same time I feel better about not having to worry about as much as I always have.

Why did you get involved with the GPLI? At a meeting in 1984, Dr. Frank Fontanta, a friend of mine from St. Louis, was talking to people setting up an organization that was going to be the Gas Permeable Lens Institute and he did later come to me to be in charge of workshops. In 1987, Carl Moore was taking me to the airport and he goes, “Ed, how would you like to be executive director of the GPLI?” I said, “Carl, I don’t think I’m qualified to do it.” He said, “I don’t think you understand. If you don’t take this position, I’m going to drop you off at the side of the highway and you’re going to have to find a ride to the airport.” [Laughs] It’s been the love of my life. My passion is GP lenses and what a perfect match and what a great blessing it’s been for me.

How did the videos with you dressing up get started? I think some of us are just frustrated actors. [Laughs] When you’re in front of a class, and that’s where a lot of it comes from, you don’t want to be boring. I started pre-recording myself dressed up in a wig and an outfit or costume and then I would work it out so that I would indicate to the class, “I’m going to talk to Leonardo Da Vinci now.” Then he pops up, and I’m talking to him. It’s a lot of fun to get the students more engaged and portray different people.

What is your guilty pleasure food? It’s beer. [Laughs] Which should be no surprise to anybody. No one loves a good pale ale more than I do.

What are your retirement plans? I’m learning how to play golf. I want to put more time into the GPLI. A journal and the Global Specialty Lens Symposium keep me busy. I think there might be something out there and I don’t know what it is.

What’s the craziest thing you’ve ever done? [Laughs] When I was growing up, I was like a lot of young people, no fear of heights. In high school one summer, every night three of us climbed up to a water tower in our community. Never got caught. I don’t know how high it was, but there was a ladder about 10 or 15 feet from the top and we would sit there and dangle our legs. One day, we decided we were going to go to the top. The top of the water tower is round, but there was a ladder attached. One of the three of us almost missed the swinging ladder to get us back to the ledge—we almost lost him. I look back at that, and you couldn’t pay me enough to do that today. No way. [Laughs]

—Vernon Trollinger

Academia, contact lenses, beer, climbing a water tower

Executive director of Gas Permeable Lens Institute

To hear the full interview with Ed Bennett, listen online: optometrytimes.com/EdBennett

Edward S. Bennett, OD, MSEd, FSLS, FAAO
BRIEF SUMMARY:
Consult the Full Prescribing Information for complete product information.

INDICATIONS AND USAGE
Xiidra® (lifitegrast ophthalmic solution) 5% is indicated for the treatment of the signs and symptoms of dry eye disease (DED).

DOSE AND ADMINISTRATION
Instill one drop of Xiidra twice daily (approximately 12 hours apart) into each eye using a single-use container. Discard the single-use container immediately after using in each eye. Contact lenses should be removed prior to the administration of Xiidra and may be reinserted 15 minutes following administration.

CONTRAINDICATIONS
Xiidra is contraindicated in patients with known hypersensitivity to lifitegrast or to any of the other ingredients in the formulation.

ADVERSE REACTIONS
Clinical Trials Experience
Because clinical studies are conducted under widely varying conditions, adverse reaction rates observed in clinical studies of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice. In five clinical studies of dry eye disease conducted with lifitegrast ophthalmic solution, 1401 patients received at least 1 dose of lifitegrast (1287 of which received lifitegrast 5%). The majority of patients (84%) had ≤3 months of treatment exposure. 170 patients were exposed to lifitegrast for approximately 12 months. The majority of the treated patients were female (77%). The most common adverse reactions reported in 5-25% of patients were instillation site irritation, dysgeusia and reduced visual acuity. Other adverse reactions reported in 1% to 5% of the patients were blurred vision, conjunctival hyperemia, eye irritation, headache, increased lacrimation, eye discharge, eye discomfort, eye pruritus and sinusitis.

Postmarketing Experience
The following adverse reactions have been identified during postapproval use of Xiidra. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.
Rare cases of hypersensitivity, including anaphylactic reaction, bronchospasm, respiratory distress, pharyngeal edema, swollen tongue, and urticaria have been reported. Eye swelling and rash have also been reported.

USE IN SPECIFIC POPULATIONS
Pregnancy
There are no available data on Xiidra use in pregnant women to inform any drug associated risks. Intravenous (IV) administration of lifitegrast to pregnant rats, from pre-mating through gestation day 17, did not produce teratogenicity at clinically relevant systemic exposures. Intravenous administration of lifitegrast to pregnant rabbits during organogenesis produced an increased incidence of omphalocele at the lowest dose tested, 3 mg/kg/day (400-fold the human plasma exposure at the recommended human ophthalmic dose [RHOD], based on the area under the curve [AUC] level). Since human systemic exposure to lifitegrast following ocular administration of Xiidra at the RHOD is low, the applicability of animal findings to the risk of Xiidra use in humans during pregnancy is unclear.

Animal Data
Lifitegrast administered daily by intravenous (IV) injection to rats, from pre-mating through gestation day 17, caused an increase in mean preimplantation loss and an increased incidence of several minor skeletal anomalies at 30 mg/kg/day, representing 5,400-fold the human plasma exposure at the RHOD of Xiidra, based on AUC. No teratogenicity was observed in the rat at 10 mg/kg/day (460-fold the human plasma exposure at the RHOD, based on AUC). In the rabbit, an increased incidence of omphalocele was observed at the lowest dose tested, 3 mg/kg/day (400-fold the human plasma exposure at the RHOD, based on AUC), when administered by IV injection daily from gestation days 7 through 19. A fetal No Observed Adverse Effect Level (NOAEL) was not identified in the rabbit.

Lactation
There are no data on the presence of lifitegrast in human milk, the effects on the breastfed infant, or the effects on milk production. However, systemic exposure to lifitegrast from ocular administration is low. The developmental and health benefits of breastfeeding should be considered, along with the mother’s clinical need for Xiidra and any potential adverse effects on the breastfed child.

Pediatric Use
Safety and efficacy in pediatric patients below the age of 17 years have not been established.

Geriatric Use
No overall differences in safety or effectiveness have been observed between elderly and younger adult patients.

NONCLINICAL TOXICOLOGY
Carcinogenesis, Mutagenesis, Impairment of Fertility
Carcinogenesis: Animal studies have not been conducted to determine the carcinogenic potential of lifitegrast. Mutagenesis: Lifitegrast was not mutagenic in the in vitro Ames assay. Lifitegrast was not clastogenic in the in vivo mouse micronucleus assay. In an in vitro chromosomal aberration assay using mammalian cells (Chinese hamster ovary cells), lifitegrast was positive at the highest concentration tested, without metabolic activation. Impairment of fertility: Lifitegrast administered at intravenous (IV) doses of up to 30 mg/kg/day (5400-fold the human plasma exposure at the recommended human ophthalmic dose [RHOD] of lifitegrast ophthalmic solution, 5%) had no effect on fertility and reproductive performance in male and female treated rats.
THERE’S NO SWITCHING THIS

Xiidra is the only lymphocyte function-associated antigen-1 (LFA-1) antagonist treatment for Dry Eye Disease¹,²

Xiidra, the first in a class of LFA-1 antagonists for Dry Eye Disease, is a prescription eye drop FDA-approved to treat both signs and symptoms of the disease.¹,³

There’s no substitute.²,⁴
Check out patient resources, insurance coverage, and more at Xiidra-ECP.com

References:
1. Xiidra [Prescribing Information]. Lexington, MA: Shire US.

Indication
Xiidra® (lifitegrast ophthalmic solution) 5% is indicated for the treatment of signs and symptoms of dry eye disease (DED).

Important Safety Information
Xiidra is contraindicated in patients with known hypersensitivity to lifitegrast or to any of the other ingredients.

In clinical trials, the most common adverse reactions reported in 5-25% of patients were instillation site irritation, dysgeusia and reduced visual acuity. Other adverse reactions reported in 1% to 5% of the patients were blurred vision, conjunctival hyperemia, eye irritation, headache, increased lacrimation, eye discharge, eye discomfort, eye pruritus and sinusitis.

To avoid the potential for eye injury or contamination of the solution, patients should not touch the tip of the single-use container to their eye or to any surface.

Contact lenses should be removed prior to the administration of Xiidra and may be reinserted 15 minutes following administration.

Safety and efficacy in pediatric patients below the age of 17 years have not been established.