

# the Ophthalmologist™

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**References**

<sup>1</sup>US Patent NO: US8647383. <sup>2</sup>Data on file, BVI, 2019.

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# Are We Nearly There Yet?

*Improving eye health of minority communities should be a priority, and one of the ways to do it is with a diverse ophthalmic workforce*

Editorial



“Change is happening, but it is far too slow. We need pressure from people in all industries – and not just people like me. For many years, the doors to ophthalmology were closed to underrepresented minorities; now they are opening, let’s keep it that way.” So writes Daniel Laroche, one of the authors of our cover feature, which is based on the story of Black ophthalmologist David K. McDonogh.

McDonogh, the first Black American ophthalmologist, was not allowed to obtain an official medical degree – something Columbia University attempted to rectify 170 years later (1).

Times have changed, but how far has the door opened? A recent paper exploring racial diversity in the ophthalmology workforce noted that the 6 percent of practicing ophthalmologists from underrepresented minority backgrounds is much lower than the percentage of minority-background physicians practicing in the US – 11.2 percent (2). And neither of these statistics reflects demographics of the entire nation, where 33 percent of people are from minority backgrounds (3).

Why does this matter? Representation at all levels helps address the wider issue of racial disparity in medicine; health professionals from minority ethnic backgrounds are more likely to practice in underserved communities, and have better communication and satisfaction rates among underrepresented minority patients (4). They are also more likely to speak their ethnic minority patients’ language, whether figuratively or literally, in the case of multilingual physicians.

Much has been said about various health conditions (including, most recently, COVID-19) disproportionately affecting non-white patients. Although there are some biological factors responsible for this disproportion, inequality in access to care needs to be clearly acknowledged and acted upon. In the US, the two main factors independently associated with inconsistent glaucoma follow-up visits were being Black or of Latino ethnicity, according to one study (5), which also noted that insurance status, ability to pay for medication, and transport inconvenience were not predictive of follow-up patterns.

What can we all do? A good start might be the list of steps towards eradicating racial injustice in medicine prepared by Randy A. Vince, Jr (6). As Laroche concludes, “Look at your leadership; does it reflect the diversity of your community, the country, the world? We all have a role to play when it comes to proposing solutions to these problems.”

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Aleksandra Jones  
Editor



# WORKING TO EMPOWER A NEW ERA OF PROACTIVE GLAUCOMA SURGERY

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We might see a day in which the subjective portion of surgery is minimal and **we have more objective ways of lowering IOP.**”

— Dr. Arsham Sheybani

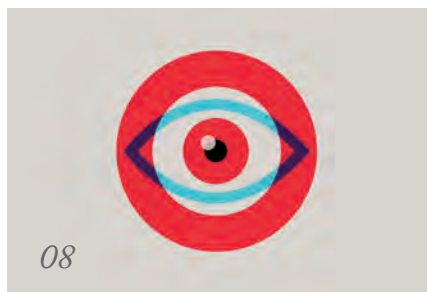


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State Institution, Moscow, Russia

Feel free to contact any one of us:  
first.lastname@texerepublishing.com

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Change of address info@theophthalmologist.com  
Hayley Atiz, The Ophthalmologist, Texere Publishing,  
175 Varick St, New York, NY 10014.

General enquiries  
www.texerepublishing.com | info@theophthalmologist.com  
+44 (0) 1565 745 200 | sales@texerepublishing.com

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## Expanding Tunnel Vision

**A single injection to reverse blindness – magic or a matter of time?**

Scheie Eye Institute researchers have shown that a single intraocular injection of antisense oligonucleotide (ASO) sepfarsen can lead to marked changes at the fovea in Leber congenital amaurosis (LCA) patients with the common CEP290 mutation (1). In a clinical trial, 11 participants received an injection of the short RNA molecule (which increases CEP290 protein levels in the eye's photoreceptors to improve retinal function). Ten of the participants were re-injected at intervals of three months. The current report is on the eleventh patient with reduced visual acuity, tunnel vision, and no night vision who received just a single dose. The researchers found substantial visual improvements, including expansion of the visual field, that were retained for more than 15 months.

"These improvements followed similar time courses [to the 10 other patients], peaking near three months post-injection, and many measures remained better than baseline at 15 months" explains Artur V. Cideciyan, Research Professor of Ophthalmology, and lead author of the

study. "The extended durability was very surprising considering that sepfarsen half-life in the retina had been previously estimated to be around two months. Different measures allowed us to locate the distribution of the improvements in the immediate foveal region. However, further from here, improvements did not match predictions, suggesting that ASO access to photoreceptors in extrafoveal regions with thicker retina may be more limited."

Why was the biological effect relatively slow to appear? Cideciyan hypothesised the delay could depend on diffusion and translocation of the ASO across the vitreous and retina into the foveal cone photoreceptor nucleus,

and on synthesis of additional normal CEP290 mRNA and protein – "but it is likely that these steps occur in a matter of hours or days so they do not fully explain the 'why'" he says. The team are now evaluating whether previously uninjected contralateral eyes demonstrate similar efficacy in an ongoing extension trial with nine of the original 11 study participants. They hope that, by better understanding the effect's durability, they can establish an appropriate frequency for future maintenance injections.

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## Upfront

Research  
Innovation  
Trends

## INFOGRAPHIC

### The Weight of Numbers

**Which countries have the highest and the lowest number of ophthalmologists?**

The number of ophthalmologists per million of population worldwide

31.7

Highest numbers of ophthalmologists per million of population

182.6  
Greece

127.9  
Latvia

121.9  
Lithuania

165  
Cuba

120.6  
Bulgaria



## BUSINESS IN BRIEF

### The latest industry news – in 60 words or less

The industry's contributions to the global fight against COVID-19

- Johnson & Johnson Vision entered into a global strategic collaboration with Menicon, a leading manufacturer of innovative contact lenses. The partnership is part of a broader commitment from the brand to create a novel portfolio of products (including therapeutic contact lenses) to manage the progression of childhood myopia.
- AcuFocus submitted a Premarket Approval application to the FDA for its IC-8 small aperture IOL. The lens, an aspheric monofocal featuring an embedded filter with a small central aperture, is designed to mitigate the harmful visual effects of unfocused peripheral light and deliver continuous extended depth of focus.
- Samsara Vision, an organization offering visual prosthetic devices to late-stage AMD patients, announced its partnership with Medevise Consulting, a European commercial and clinically focused ophthalmology company. The two businesses will collaborate to support the commercial growth of Samsara Vision's Tsert SI Implantable Miniature Telescope in Europe.
- Surface Ophthalmics announced the appointment of Preeya K. Gupta as Chief Medical Advisor. Gupta, a tenured Associate Professor of Ophthalmology at Duke University Eye Center, will use her expertise in dry eye disease and other areas to guide the future of the company's three clinical offerings.
- Ophthalmic medical product producer Iridex entered into a strategic alliance with Topcon, a Japanese-based manufacturer and distributor with approximately US\$1.3 billion in annual revenues. The transaction will provide multi-year funding for strategic growth initiatives, particularly those designed to drive expanded market penetration of Iridex's unique non-incisional glaucoma therapy products.



## Star Gazing

### How the combination of retinal implant electrodes and smart glasses partially restores vision

Researchers at EPFL's School of Engineering have developed an implant that uses electrodes to stimulate retinal cells, offering a form of artificial vision. Smart glasses capture images in the person's field of vision and send the data to a microcomputer that converts it into light signals, which are transmitted to the retinal implant's 10,500 electrodes. The electrodes stimulate the retina so that the wearer sees a black-and-white version of the image made up of dots of light. To make out the shapes, the user must learn to interpret the dots of light the way one would constellations in the night sky. Though the technology is currently not authorized for clinical trials, the engineers are hopeful approval will come soon.



Lowest numbers of ophthalmologists per million of population

**0.4**  
Somalia

**0.5**  
Malawi

**0.6**  
Central African Republic

**0.6**  
Chad

**0.8**  
Tanzania

Countries with the most doctors performing refraction, per million of population

Greece

France

Argentina

Iceland

Italy

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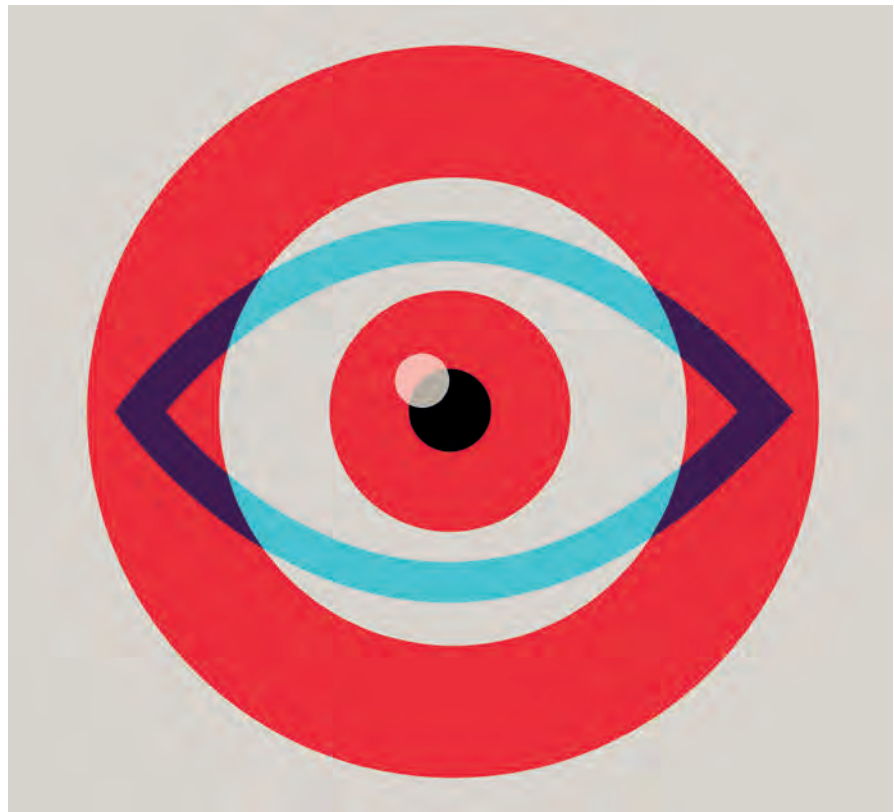


## 127 Genes Later

### Exploring the pathogenesis of primary open-angle glaucoma

The largest genome-wide, multi-ethnic meta-analysis of primary open-angle glaucoma (POAG) – one of the leading preventable causes of blindness – has published its findings (1). From analyzing 34,179 cases and 349,321 controls, the researchers identified 127 risk loci for POAG – 44 of which were previously unreported.

Using gene-based tests, they also highlighted additional risk loci and revealed genes that may contribute to POAG pathogenesis, including *SVEP1*, *RERE*, *VCAM1*, *ZNF638*, *CLIC5*, *SLC2A12*, *YAP1*, *MXRA5*, and *SMAD6*. “These new findings come out of the highest-powered genome-wide association study of glaucoma to date and show the power of [...] using big data to answer questions when research groups around the world join forces,” said co-senior author on the study, Janey L. Wiggs (2). “The number of genes identified will lead to the discovery of new biological pathways that can lead to glaucoma and, in turn, new targets for therapeutics.”



The meta-analysis stands out not only for its large size, but also for its inclusion of multiple ancestries. Most of the identified loci had consistent effects across European, Asian, and African ancestries – demonstrating a strong cross-ancestry association for POAG.

“Glaucoma rates are highest in African and Asian ancestry groups, but the largest genetic studies of glaucoma in the past focused on people of European ancestry,” said lead author Puya Gharahkhani (2). “Those studies showed

genetic tests could be used to help identify who would benefit from sight-saving early monitoring or treatment, but because of the narrow scope of the genetic data, we weren’t sure until now that the genetic indicators were true for people of different ancestries.”

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## Cloudy with a Chance of Cataracts

### New research contradicts the current understanding of cataract formation

What we do know: cataracts are extremely common; they can be present at birth in

genetically predisposed individuals or develop later in life – the result of damage accumulated over time. What we do not know with any certainty: how and why they form. Until recently, the consensus was that defective or damaged crystallin proteins in the eye reacted with one another to form light-scattering aggregates – with  $\alpha$ -crystallin proteins working against the process. However, while studying strains of mice with point mutations in  $\alpha$ -,  $\beta$ -, or  $\gamma$ -crystallin proteins, a team at the Technical University of Munich has shown that this may not be the case. First,

the investigation found that mutant proteins were unstable in vitro and appeared at lower levels in the lens than expected. What’s more, the healthy proteins in each mutant appeared to be the source of aggregates, leading the researchers to hypothesize that the ratio of crystallin proteins may be the key to cataract formation. Confirmation, perhaps, that balance is everything.

#### Reference

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IMAGE OF THE MONTH

*Starry Night*

This month's image from the National Eye Institute (NIH) shows intravenous fluorescein angiography (IVFA) of posterior White Dot Syndrome.

*Credit: Natasha Kesav, ophthalmology resident at the Case Western Reserve University/University Hospitals Cleveland Medical Center in Cleveland, Ohio, USA*

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QUOTE OF THE MONTH

*"What I love about surgery is its immediacy – the fact that somebody can come in acutely ill and you can fix them. It's gratifying to have that kind of impact on people's lives and to see medicine really work. What I don't like is the hours. I cannot work that many hours – and I don't believe surgical training programs need to abuse the residents the way they do. There are ways of teaching surgery that don't require so many hours of work or create so much mental and physical exhaustion."*

Judy Melinek, physician and writer, based in San Francisco, California, USA

## Riding the Acoustic Waves

Could smartphone-generated soundwaves be used to monitor IOP?



Glaucoma specialists are constantly looking for ways to accurately and noninvasively monitor patients' IOP for extended periods. Now, researchers from the UK's University of Birmingham have announced the successful detection of increasing IOP values with soundwaves emitted by a smartphone, using a model simulating an average human eye (1). Khamis Essa, study coauthor and Director of the Advanced Manufacturing Group at the University of Birmingham, explained that the team "discovered a relationship between the internal pressure of an object and its acoustic reflection coefficient. With further investigation into eye geometry and how this affects the interaction with soundwaves, it [could be] possible to use a smartphone to accurately measure IOP from the comfort of the user's home (2)."

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2. University of Birmingham (2021). Available at: <http://bit.ly/2P0AMF5>.

## Your Role in Vision Rehabilitation

**We must empower patients to make the most of their remaining vision and to live as independently as possible**

*By John Liu, Irfan N. Kherani, and Mark Bona*

Vision rehabilitation is a vital (but often underrecognized) service for those suffering visual impairment (1). As ophthalmologists, we often encounter patients who could benefit from earlier vision rehabilitation treatment without immediately realizing it ourselves. In addition to managing the medical and surgical needs of our patients, we must also prioritize vision rehabilitation and its role in empowering patients to make use of their remaining sight to function and live independently. Here, we present five key points to remember in visual impairment and vision rehabilitation:

i. Visual impairment is on the rise. The need for vision rehabilitation services is growing in response to age-related eye diseases (for example, age-related macular degeneration and glaucoma), which is coupled with the staggering growth of the world's aging population. In 2017, the global population of those aged 60 and over was around 962 million; by 2050, the number is projected to reach nearly 2.1 billion (2). In the US, roughly 3.22 million people were visually impaired in 2015. By 2050, this number is projected to double to 6.95 million people (3).

- ii. Visual impairment can result in a variety of negative health outcomes and significantly affects activities of daily living and exacerbates symptoms of depression and anxiety in older people (4). Studies have shown that decreased vision is also associated with an increased risk of falls, hindering safe and independent living, subsequently resulting in earlier than needed admission to long term care facilities (5). Furthermore, a study in Canada showed that individuals with lower income, diabetes, a history of smoking or memory problems are more likely to suffer visual impairment (6).
- iii. Vision rehabilitation is a service offered to people with low vision to optimize functional ability and independence (7). As part of the service, a formal assessment by an eye care professional will help characterize residual vision, which then informs a patient-centered rehabilitation



- plan. Strategies often include lighting techniques, magnifying devices, and adapting the home environment to optimize safety and navigation. Recent advances in technology have increased the types of assistive devices available; vision rehabilitation services also employ electronic and digital aids and smart devices to support patient care. Evidence suggests that vision rehabilitation services have a positive impact on patients' quality of life, independence, and emotional well-being (7).
- iv. Vision rehabilitation is part of the healthcare continuum with various providers involved in the circle of care, including optometrists, ophthalmologists, occupational therapists, social workers, and other rehabilitation specialists. Available resources vary by country. In Canada, for instance, Vision Loss Rehabilitation Canada (VLRC) is the primary provider of vision rehabilitation services nationally, and can help connect

primary care physicians and eye care practitioners with vision rehabilitation specialists in caring for their patients with low vision (8). In the US, roughly 60 percent of the service entities providing low-vision rehabilitation are private optometry or ophthalmology practices, with a smaller percentage offered through government (mostly state) agencies (9).

- v. Conversations about vision rehabilitation should be encouraged when ophthalmologists feel it may be helpful. Whether due to a lack of awareness or a lack of accessibility, vision rehabilitation can sometimes be overlooked in the overall care of a patient's visual health. As eye care professionals, it is our duty to ensure patients feel empowered to make use of their remaining vision and are referred appropriately to rehabilitation so that they may be able to live and function independently.

*John Liu is a Research fellow at the Department of Ophthalmology & Vision Sciences, University of Toronto, Ontario, Canada. Irfan N. Kherani is a Clinical Fellow at the University of Ottawa Eye Institute, The Ottawa Hospital, Ontario, Canada. Mark Bona is the Postgraduate Program Director and Assistant Professor of Ophthalmology at the Hotel Dieu Hospital, Queen's University, Ontario, Canada.*

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## Stress and Scarcity

### How the last 12 months will impact the year(s) ahead

*By Brian C. Joondeph, partner and retina surgeon at Colorado Retina Associates, Denver, USA*

For most physicians, the two common themes in 2020 were stress and scarcity – and they have continued into 2021. COVID-19 led to general stress – from both a personal and professional perspective, and scarcity – from PPE in the early days of the pandemic to fees and reimbursement going forward. But stress has always been a part of medicine – life



and death in many specialties, eyesight and blindness for ophthalmology. COVID-19 compounded the stress by making ophthalmologists fearful of becoming sick or, worse, becoming another statistic in the death count.

Practice survival was also at stake. Most practices had to slow or shut down, at least temporarily, as the world came to grips with living in a science fiction world of a

deadly virus. How could practices remain viable if running on limited capacity? What about patients not returning for injections or emergency eye care? How long would it go on?

Burnout also accelerated last year. Data from Medscape (1) presents a bleak picture: 35 percent of ophthalmologists felt burnt out; women significantly more frequent than men (51 percent of women to 36 percent of men.) Half of all ophthalmologists who experienced burnout said it had a severe impact on their life. And 34 percent of physicians were unhappy with their work life late last year compared with only 19 percent pre pandemic. Burnout had a negative effect on personal relationships in 65–75 percent of physicians, with younger doctors more likely to be affected. Even more startling: 14 percent of physicians felt suicidal during the pandemic.



Aside from the actual virus, gloom and doom, along with fear and blame, were a daily staple of the news. Government public health experts flip flopped on their recommendations, from masks and social distancing, lockdowns and closures, quarantines and off label therapeutics, turning a medical pandemic into a political hot potato on the eve of a presidential election. Battle lines were drawn, not based on science but instead on political preferences. Disagreement and even thoughtful discussion led to ridicule, harassment, and censure. Is it any wonder that physicians on the front lines, in the thick of the pandemic, were burning out at a record pace?

By scarcity, I mainly refer to dollars – not the reason most ophthalmologists chose their careers, but essential to keep the lights on in their workplace. Those employed might have received unpaid time off, making it challenging to keep the lights on at home while their families lived in front of a computer screen for school or entertainment. In private practice, rent, staff salaries, and overheads were omnipresent regardless of the latest case counts.

Ophthalmology was the hardest hit medical specialty, seeing the biggest drop in Medicare physician spending – a 29 percent drop in the first six months of 2020 (2). This is partially because ophthalmologists see a preponderance of older aged Medicare patients but also because it is primarily an outpatient specialty performing elective surgical procedures, all shut down during the early days of the pandemic.

Looking forward is the scarcity of Medicare dollars necessary to keep the US healthcare system afloat. Federal budget deficits are now measured in the trillions, not billions, with a national debt far larger than our GDP. We are in the danger zone. The needle on our collective car dashboard is in the red, warning of catastrophic engine failure.

Economist Herb Stein once wrote, “If it can’t go on forever, it will stop (3).” This applies to governments spending money they don’t have; a giant Ponzi scheme. Something must give.

Earlier this year, Medicare reimbursement for ophthalmology faced a 6–10 percent cut for 2021, with no commensurate reduction in rent, wages, utilities, and regulatory compliance costs. At the last minute, Congress blinked and offered a reprieve (4). The death row inmate’s execution was halted, but they are still on death row – a new execution date looming. Instead, the house of medicine received a 3.75 percent one time increase for 2021 to mitigate the financial buzzsaw of 2020. Later this year, the cuts will be back on the table, as Herb Stein would predict.

Sequestration is a result of Congress not agreeing on a past budget a decade ago, specifically a 2 percent across the board cut in Medicare provider payments (5). The sequester was briefly suspended to assist during the COVID-19 pandemic and was set to expire January 1 of this year. The ever-generous US Congress extended the suspension for three months, the 2 percent cut hitting in April. Note that members of Congress and their staffs received their full paychecks without interruption during COVID-19 – more than can be said for their constituents.

At the time of this writing, the Senate passed legislation extending the sequester moratorium until the end of the year. Now it is up to the House to also kick the sequestration can down the road (6). To pay for the sequester extension, the Senate bill would increase sequester cuts in 2030, a time when many members of Congress will be retired or working at K Street lobbying firms, leaving the mess for others to clean up. As Democrats control the executive and legislative branches of the federal government,

this might be their opportunity for “fixing” healthcare once and for all. Medicare is predicted to run out of money to pay hospitals and physicians within the next couple of years (7).

In typical government fashion, if a program is failing, their solution is to double down and expand it. Enter “Medicare for All”, sitting in a Congressional drawer for years, ready to be voted into law, even if on a party-line partisan basis. Costing over \$3 trillion a year, an amount almost equal to the entirety of federal government revenues (8), Medicare-for-All will blow a massive hole in the federal deficit and debt, with costs trickling down to physicians. An analysis by the Mercatus Center at George Mason University predicts that under Medicare-for-All, physicians “will be reimbursed at rates more than 40 percent lower than those currently paid by private health insurance (9).”

Given that such a bill has been the holy grail for the more progressive wing of the Democrat Party, it is likely that they will take advantage of their current control in Washington, DC, to enact such legislation. And that could spell the end for private practice medicine, replaced by something more like the UK National Health Service. Private insurance would go the way of the dodo bird. Medicare-for-All “would prohibit employers and private health insurers from offering coverage that duplicates Medicare-for-All covered benefits (10).” As Medicare covers most healthcare expenses, particularly in ophthalmology, this law would basically eliminate private insurance – a single fixed gear clunker bike replacing a 21-speed racer.

But this is just the tip of the iceberg. There is much happening in ophthalmology, including new surgical techniques and therapeutics. All will be expensive, and so the big question will

be: Can we afford them?

The bottom line remains the same: stress and scarcity are not going away. And big pharma has no innovations in the pipeline to eliminate either. Though still a wonderful profession and specialty, the COVID-19 pandemic has revealed the new challenges that will face ophthalmologists in the years ahead. I hope we are ready when the time comes.

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## The Other Side

### A response to Sandra Yeh's March op-ed



By Tamara R. Fountain, President of the American Academy of Ophthalmology, based in Chicago, Illinois, USA

In her opinion piece, “One Size Rarely Fits All,” Sandra Yeh commented on the American Academy of Ophthalmology’s March 2020 statement calling on American ophthalmologists to suspend non-urgent eye care, referring to it as an “Ivory Tower edict” and opining that “the AAO represents Ivory Tower ophthalmologists who enjoy the financial security of a university or publicly funded practice.”

As the President of the Academy and as a private practitioner in a four-person group, I appreciate Yeh’s candid expression of her views. I’d like to

respond with another perspective. My small practice was shuttered for six weeks to all but emergency care. Yeh may not realize that of the 21 ophthalmologists on the Academy Board of Trustees, only eight are paid by a university or publicly funded practice. This hardly constitutes an “Ivory Tower” group.

As for the March statement itself, the Board of Trustees considered it carefully and was ultimately unanimous in its decision. It is important to remember the context of those bewildering early days. Our nation was in the first wave of explosive growth of the pandemic. The two greatest public health priorities were to preserve personal protective equipment (PPE) that was in desperately short supply and to minimize transmission and death rates. The Surgeon General, the Centers for Disease Control and Prevention, numerous state governors, and many other national medical societies issued statements similar to the Academy’s. Nearly every national ophthalmology society, from the American Society of Cataract and Refractive Surgery to Women in Ophthalmology, issued statements in support of the Academy.

In retrospect, given what experts know now (and didn’t know then), could there have been a more nuanced approach? Absolutely. But no one had accurate information on transmissibility and viral testing then. No one could argue

that we did have a massive shortage of PPE and that the death rate associated with SARS-CoV-2 infection was much higher than it is now.

Yeh states that ophthalmologists were “ordered to obey” and that the statement was issued without allowing for individual physician judgment. First, the Academy does not have the power to “order” such action; we deliberately used the language “strongly recommends” for this reason. More importantly, the statement acknowledges regional nuance with this caveat: “The Academy recognizes that ‘urgency’ is determined by physician judgment and must always take into account individual patient medical and social circumstances.”

Less than two months later, the Academy issued a follow-up statement urging ophthalmologists to consider carefully reopening their practices to non-urgent care. Most did. During that two-month period, some treatments were delayed and possibly some vision lost. As physicians, we all deeply regret that. The Academy is supporting several studies to try to better understand this. But, however unfortunate, it must also be weighed against the millions of routine visits foregone, the PPE conserved for more urgent uses, and the lives saved.

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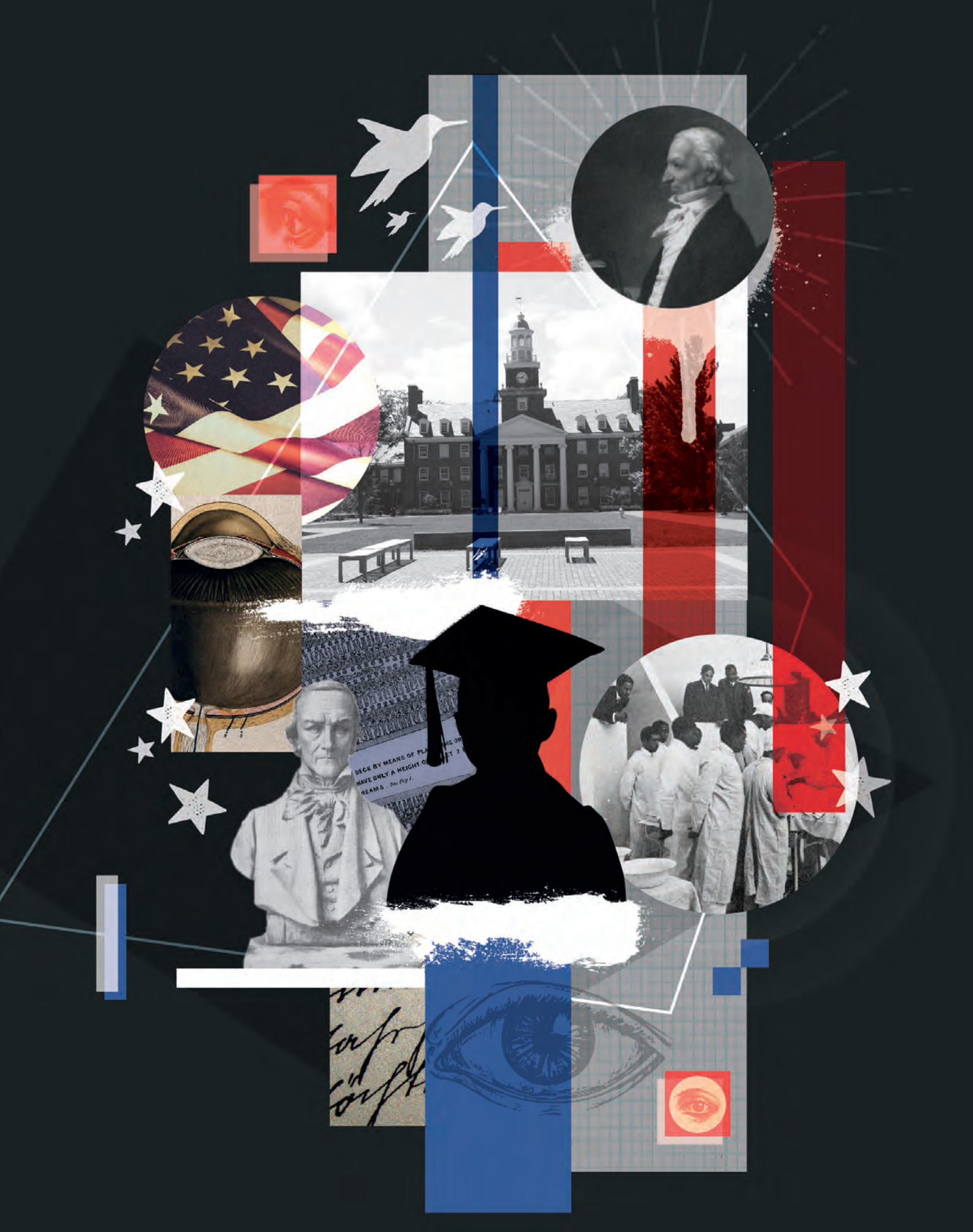
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# THIS *i s* AMERICA

From enslaved person to esteemed physician  
– this is the story of David K. McDonogh,  
America's first Black ophthalmologist

*By Richard Koplin*





# INTRODUCTION

More than 10 years ago, I began an initiative to re-invigorate the pre-med program at my alma mater, Lafayette College, intending to name it after an illustrious physician graduate of the college. Diane Shaw, the school's archivist, introduced me to the broad brushstrokes of the story of a New Orleans' slave named David K. McDonogh who became the first Black graduate of the college (1842) and who, it was claimed, became a physician in New York City in the mid 1800s. That very idea, a slave becoming a NYC physician in 1850, and a graduate of my alma mater, was captivating. I was hooked. Little did I know that this adventure would lead me to my own front door.

## *The complexities of historical research*

Over the following years, through financial and investigative contributions by me and the College – the latter giving us the ability to employ a bevy of professional researchers, including genealogists and historical experts – we gradually uncovered David's story. Students excited by David's life and times at their college signed on year after year as volunteer researchers. The quest took us far and wide: from visits to archives held by Tulane University, numerous historical societies, and a host of libraries to government historical repositories as far away as Liberia.

Time is a cunning enemy to researchers of history. Materials are lost to posterity; and truth is eroded as interpretation is often twisted or embellished or simply misrepresented out of ignorance. Finding "facts" that can be corroborated and originate via respectable and reliable primary sources becomes paramount.

## *Giving David his due*

After almost 200 years, there was still one wrong we considered might be righted on David's behalf. In 2017, we took the initiative to educate the administration of the Vagelos College of Physicians and Surgeons at Columbia University of his story. The goal was to impress upon them the importance of the school's historic failure based on the racism and hubris of the time, and get them to grant David a medical degree. We suggested that the degree could be provided to David's great-great granddaughter, who had been found by our researchers. After some procrastination on their part, the degree was finally conferred at the medical school's graduation ceremonies in 2018.

Remarkably, after seeming social advancements codified by American law (the 14th Amendment in 1868, and almost 100 years later The Civil Rights Act of 1964), the resistance to a fully integrated democracy has been on full display during the past four years. David's story resonates as a clear example of the struggle that people of color faced then, as well as now, as they aspired to enjoy the advantages of full political and economic parity with white America.

On a positive note, even in the face of overt racism – and even slavery – David did find allies among white individuals mindful of the inequities of life for Black Americans, and who took it upon themselves to rectify them; John Kearny - or Kearney - Rodgers (both versions are prevalent in the literature) and Walter Lowrie, among them. And, remarkably, the medical profession at the time did embrace David as one of their own. I am confident that after a particularly ugly and politically chaotic period in America, fair-minded and thoughtful citizens will step up to bring closure to a divisive period in our history, allowing us to move forward for all our citizenry and reignite this experiment known as American Democracy.

In 1838, David K. McDonogh, a 19-year-old slave, arrived at Lafayette College in Easton, Pennsylvania, along with a fellow enslaved person, Washington McDonogh. Both young men were sent to the college by iconoclastic New Orleans plantation owner and mercantilist, John McDonogh. With more than 500 slaves, he was arguably one of the wealthiest men and largest landowners in the south.

Both David and Washington were the beneficiaries of John's secret experiment, initiated in the mid-1820s. McDonogh provided his slaves an avenue to freedom by working an extra day a week for 10 to 15 years. But the experiment came with a non-negotiable caveat – under the auspices of the American Colonization Society, his freed slaves were obligated to emigrate

to the nascent Republic of Liberia. But John McDonogh was not content to free all his slaves to an unchartered destiny. Instead, he decided to educate several of his brightest slaves to serve as stewards of the newly formed Black democracy, still in its infancy. David and Washington, who both elected to take their master's surname, were examples of John McDonogh's odd relationship to slavery.

On February 1, 1838, John McDonogh wrote a letter of introduction to Walter Lowrie, an esteemed US Senator (and in 1821, a strong voice opposing slavery in the soon-to-be-minted state of Missouri). Lowrie was secretary of the Presbyterian Board of Foreign Missions and McDonogh, also a devout Calvinist, no doubt found fellowship with Lowrie:



*I beg leave to observe that among my Black family, I have two Youths, (Slaves) of great promise, of the age of nineteen and twenty years, who are remarkable at that early period of life for their intelligence, knowledge, and solidarity of judgment, their pious, and tractable dispositions, whom I offer to your Society, to be given a Religious Education, preparatory to their becoming missionaries of, the Gospel in the land of their forefathers.*

Lowrie was ultimately engaged by John to act as David and Washington's legal guardian while they attended Lafayette College. Washington left Lafayette prematurely with his family and 90 of John's other slaves to spend his life as an educator and government administrator in Settra Kroo, Liberia. Lowrie clearly found John McDonogh's description of David to be apt. David was a unique individual, so much so that even John, a slave owner and a racist, spoke enthusiastically about the then 19-year-old. David's understanding with his slave owner determined that he was to attend Lafayette College and upon graduation emigrate to Liberia where, John openly mused, he might become its President ("another Madison," he related to Lowrie).

David arrived at Lafayette in uniquely challenging conditions. There were, of course, the typical freshman concerns. In a very familial letter, having never experienced winter conditions in the North East, David wrote John asking him to forward a hat and clothing he had left in a drawer in his quarters and some funds to buy a watch, which his classmates wore openly as status symbols. (To this request, John asked Lowrie if there were no clocks on campus. Nonetheless, he did send funds to purchase the watch. Teenagers will be teenagers.)

More concerning, however, was David's status on campus. Although David had been technically freed when entering Pennsylvania, he was segregated when taking classes and meals. However, it was apparently difficult to keep the young students apart and, by all accounts, David was a popular figure on campus. Even the president of the college wrote that "no student in the College mingles more freely with the other students than he." David bristled at the college president's attempts to prevent him from integrating on campus or making social contacts in the college town. David taught Sunday school at a local Black church and quickly became popular with the children. The head clergy, in an apparent pique of jealousy, asked Lafayette's President to forbid his participation in church functions. This led to a show-down where David

lobbied the school's tutors and students for assistance in his cause. Eventually, David was forced to back down.

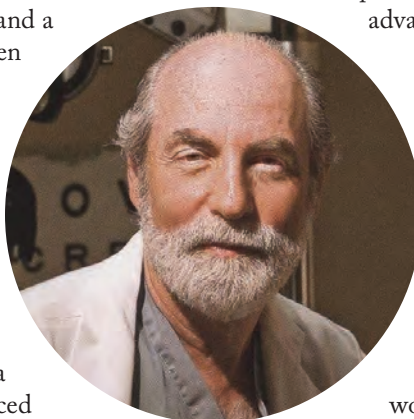
David spent two years at Lafayette in a basic preparatory education and then four more years in a more formalized college academic structure. David was a very capable student but was frustrated by the institutionalized racism he experienced and struggled without the promise of a tangible future. Though this is not unusual for any young adult, David's troubles were magnified by the challenges of being a Black man in antebellum America and the over-riding thought of eventually leaving for Liberia.

Despite his seeming disdain for his condition at Lafayette, he wrote to Lowrie that: "I am acquainted with, and possess the goodwill of, and am very kindly treated by all the students and professors." He went on to say that this was of great advantage to him.

By his junior year, David began to lobby for an opportunity to study medicine as part of his curriculum. His persistence paid off and, eventually, John gave grudging approval for David to apprentice himself to a local Easton physician. David could barely contain his enthusiasm. In one letter to John, he wrote: "I forgot to inform you in my last letter of my Practice of Medicine. I have bled three persons since I received my lancet. In one case, I stuck a woman and the blood flew up to the ceiling, over the bed, husband and everything else that was in its way..." The sincere words of a young man who had found his passion.

But complications soon arose. With graduation barely six months away – when David would become Lafayette's first Black graduate – he proclaimed that he would not honor his contract with John to emigrate until he completed a formal medical education. Frustrated and fully aware of David's implacable spirit, at first John attempted to threaten him by suggesting to Lowrie that he could have him forcibly brought back to New Orleans in bondage, and that he should relate this to David (memorialized in one dramatic passage in a letter to Lowrie). But John soon realized he had lost the battle of wills and wrote to Lowrie that he was washing his hands of David (although he would continue to pray for him):

*I advise you sir to see David at as early a day as your occupations and leisure will admit: and if you find his determination such, stop I pray you, Sir, instantly all further expense on account – even one cent! Notify the President of the College that you will not pay for one single hours' tuition or Board, more.*





Lowrie facilitated David's graduation but afterward, rudderless and without funds, David was seemingly without options. (Lowrie informed David that no credible medical institution was willing to admit a Black man, even with his academic record and his apprenticeship to a local physician.) David's anger and despair overflowed; his feelings apparent in this eloquent passage written to John and Walter – a letter that strikes at the heart of race relations of the time, and reverberates loudly still, nearly 200 years later.

*After waiting with the most sanguine of expectations, I received your letter of the 23rd. Nothing could be sadder or more disheartening to me – this devotion from moral rectitude on the part of the medical faculties.*

*There exists in the breast of the white man an inveterate hatred against the black man: and the very name negro – the very thought that he is endeavoring to raise himself above the groveling elements of brutality – draws that hatred into focus, which radiates that nefarious past called Prejudice.*

*Permit me to say that the Refusal on the part of the medical faculties, and the worse than slavish treatment which I have suffered here, and from those, too, who are looked upon by their Kind as saints on Earth, have given me the strongest Reasons to distrust the fidelity of the white man. Therefore sir – with due deference to your honor, I have resolved to cover my sable Brow with a cloud of despair and never more to look up to the White man, whatever may be his profession or condition in society, as a true friend. These concluding remarks are general and consequently liable to honorable exceptions.*

Perhaps the “honorable exceptions” that David alluded to materialized in the guise of two sympathetic individuals. Lowrie, stationed at the time in New York City, likely facilitated David's move to the City and introduced him to John Kearny Rodgers, an eminent New York physician and the co-founder of the New York Eye and Ear Infirmary – America's oldest specialty hospital. Rodgers, a lay minister, was stung by society's unwillingness to care for those less fortunate (as seen in his preamble to the founding of the Infirmary in 1820.)

Rodgers championed David's cause and mentored him through his medical studies at the College of Physicians and Surgeons (later Vagelos School of Medicine at Columbia University), in spite of objections from the dean of the medical college who, at the time of graduation, refused to award David a diploma. Nonetheless, David's peers embraced him as a colleague and Rodgers provided him a staff position at the New York Eye and Ear Infirmary, where he practiced ophthalmology for 11 years. It was said: “he did excellent work and was frequently in demand as a consultant.” When John Kearny Rodgers died in 1850, David took Kearny as his middle name.

David began a practice on Sullivan Street in the Greenwich Village, an area of the City that was remarkably integrated at the time, and practiced medicine until shortly before his death in 1893. He is buried beneath an impressive monolith in famed Woodlawn Cemetery in New York City's Bronx.

In league with Frederick Douglass, David became active in the abolitionist movement and a champion of workers' rights. David's commitment to social justice is reflected in his dedication to the progressive movements of the time. In 1890, he served as a delegate to the National Colored Convention in Washington, D.C., where he was elected one of its vice presidents.

David married Elizabeth Van Wagoner and of their three children, only one survived into adulthood. Our research has identified one surviving member of David's family and we have introduced her to her remarkable great, great grandfather's legacy. In 2018, with the assistance of Diane Windham Shaw (Lafayette College's legendary archivist), we presented our research to the Dean of Academic Affairs of Columbia University's Vagelos College of Physicians and Surgeons. After some temporizing on the College's part, they agreed to confer David with a posthumous medical degree, presented to his great, great, granddaughter at a graduation ceremony in 2018.

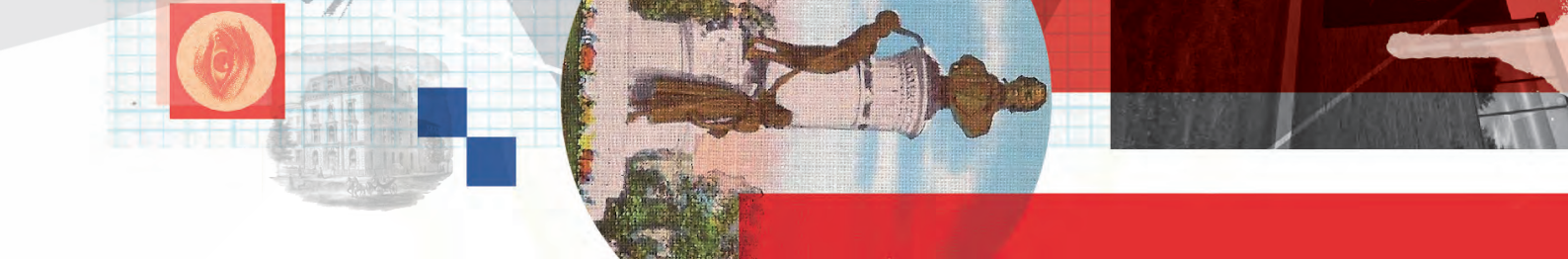
For his part, John Kearny Rodgers fulfilled his mission by providing David the opportunity to become the only slave to gain a medical education, to become America's first Black ophthalmologist, as well as the New York Eye and Ear Infirmary's first Black attending. It would take more than 100 years for the Infirmary to provide staff privileges to another Black physician, Harold Najac.

As a testament to David K. McDonogh's legacy – appreciated by both Black and white members of society – the McDonough (sic) Memorial Hospital opened on West 41st Street in 1898. It was New York's first interracial hospital. The hospital survived just six years but in 1918, plans for a second McDonough Hospital at 133rd Street and Fifth Ave in Harlem were celebrated. Unfortunately, even with tremendous expectations and community support, the hospital never materialized.

As testament to David's legacy, there are now McDonough Societies at Lafayette College, New York Eye and Ear Infirmary of Mt. Sinai, and the David K. McDonogh Society, under the auspices of the National Medical Association, as well as a Scholarship program at the Vagelos College of Physicians and Surgeons.

Despite all we've discovered about the life of this extraordinary man, one piece of the puzzle has remained elusive – no portrait or photo survives to put a face to his remarkable achievements.

*Richard Koplin is Co-Director of the Cataract Service at the New York Eye and Ear Infirmary of Mt. Sinai, NY, USA.*



## UNCOVERING THE PAST

An archivist's role in restoring Black pioneers to their true place in college history

*By Diane Windham Shaw, Director Emerita of Special Collections and College Archives, Lafayette College, USA*

### ADDRESSING THE PAST

Higher education has worked hard in recent years to document its involvement with slavery, with Georgetown University famously revealing that it sold slaves. These institutions have tried to figure out a way to make retribution, or at least commemorate and make public these stories, through monuments or scholarships to the descendants of the slaves. Lafayette does not have the same stigma as some other institutions as it did not ever own slaves or profit from slavery, but its relationship to the subject is complex. While the college admitted slaves, its motives were not strictly altruistic; the college was new and struggling financially, and not in a position to turn away money. Still, David McDonogh talks about his Lafayette education in glowing terms, even though it was fraught with discrimination. When David and Washington came to Lafayette in 1838, they were segregated in every area. Their classes were separate; they ate separately; they even lived in a separate building from the rest of the students. It was hard for David, a man with pride and ambition, to be treated that way. Interestingly, a couple of years later, a free Black student who was also associated with John McDonogh came to Lafayette and was treated more favorably, undoubtedly because he had never been enslaved.

Lafayette's willingness to admit African Americans changed in 1847, when a Black student requested admission, but was turned down; no other Black students were documented to have attended until 1947. I call it the "100-year gap." Our students – particularly our Black students – often ask what happened. Again, it is worth remembering that our admission of those early students was not necessarily benevolent. Several of the college's early presidents – all white, all male – were supporters of the American colonization movement, which aimed to send freed African Americans to Liberia as an alternative to emancipation in the United States.

Lafayette continued to have quotas on Black (and Jewish) students until 1958. By the late 1960s – a period of profound social change

– there were enough Black students to start making demands and have those demands listened to. They asked for more Black students and faculty, more courses devoted to Black history, a Black house to host the Association of Black Collegians, and a commitment to anti-racism on campus. In response, the college stepped up recruitment of Black students, hired more Black faculty members, instituted a two-semester course called "The Black Man in America," and gave the students their house. The only demand they didn't, or couldn't, meet was an end to racism on campus.

### FORGOTTEN NO LONGER



An academic institution is supposed to be committed to the truth. The discovery of David and Washington McDonogh's story has been markedly influential at Lafayette College. This new connection to our past has offered numerous opportunities for pedagogy and opened doors to alumni outreach. For our current students, it has been incredibly meaningful to be able to see the history of those who came before them. One of the things we always wanted so desperately is a photograph, but that has yet to appear. We remain hopeful though, as David was a prominent physician and lived in during a time when photography was common, so there is a chance one exists. Fortunately, he is remembered in other ways.

In 2005, Daniel Weiss – now President and CEO of the Metropolitan Museum of Art – became the president of Lafayette College. Weiss mentioned McDonogh in his inauguration speech. He touched on his story only briefly, but it was enough to catch the attention of Curlee Raven Holton, Professor of Art, who successfully sought to have the College commission a sculpture in McDonogh's memory. The resulting artwork, *Transcendence* (2008), by the distinguished African American artist, Melvin Edwards, himself descended from slaves from Louisiana and Mississippi, is a monumental abstract piece, incorporating broken chains.

Lafayette has also created an exhibition about the McDonogh story and its early Black students on campus in the College's largest classroom building. The exhibit traces the journeys of David and Washington from New Orleans to Lafayette College to New York and Liberia. Images include the manifest of the ship that brought the young men north, listing them both as chattel, as well as a photograph of the huge crowd gathered in New York City for the ground-breaking of a second McDonough (sic) Memorial Hospital in 1917, named in honor of David, which was never built. The exhibition ends with a walkway of silhouettes of Lafayette College's early Black students with their biographies. Ironically, it is now two silhouettes short, as new students have recently been discovered. And it is entirely possible that there may be more.



*Daniel Laroche first learned of David K. McDonogh from Richard Koplin in 2015. He decided to memorialize McDonogh's legacy through a creative scholarship, with the hope of sharing his story with the next generation of medical students, ophthalmologists, as well as the wider African American community and the rest of America. Working in partnership with the National Medical Fellowship, Laroche and nine other ophthalmology colleagues chipped in \$500 to form the first \$5,000 scholarship for African American, Afro Latino and Native American students – three of the most severely underrepresented groups in medicine. "We wanted McDonogh's legacy to inspire students to pursue ophthalmology with academic excellence, research, innovation and leadership" says Laroche. "We are now able to endow the scholarship every year and I recently commissioned a portrait of McDonogh, which we donated to New York Eye and Ear's Infirmary of Mount Sinai's patient waiting area, so even more people could know his story."*

## **BLACK AND WHITE**

For too long, artificial barriers have kept Blacks out of medicine. It is time to dismantle racist hierarchies – the David Kearny McDonogh Scholarship is only the beginning

*By Daniel Laroche*

Even in 2021, we are a long way from achieving equality in medicine. The number of Black ophthalmologists in the United States has remained unchanged since the 1970s – why is that? In part, the problem lies in the standardized testing used to screen applicants. These tests have cultural biases that discriminate against Black students – students who are otherwise highly qualified with grades and research. This screening criteria has absolutely no correlation with how good an ophthalmologist or surgeon someone will become – and has discouraged applicants from choosing our specialty for decades. Interestingly, the test does not add points for speaking a second language fluently, an incredibly valuable skill for a doctor in today's America. It seems unfair that applicants can be penalised for not coming in the top tenth percentile of a test, but not rewarded for being able to communicate with a patient in their mother tongue. These are just a few of the biases we continue to fight against. Fortunately, the board is replacing the existing system with a



pass/fail examination.

We are making progress in other areas too. The American Academy of Ophthalmology subsequently launched a Minority Ophthalmology Mentoring (MOM) Program. The National Medical Association has had a long history of addressing health disparities since its inception in 1895, both by strengthening the pipeline for students from underrepresented backgrounds and more recently, with the Rabb Venable Ophthalmology research competition. The David Kearny McDonogh Ophthalmology/ENT Scholarship also provides additional opportunities for mentoring, guidance and encouragement to students so they continue to follow their passion. If there are any perceived weaknesses, these can be strengthened with additional resources and exposure to the profession. These students are incredibly bright, and the fact that they did not score in the top percentile of the class does not mean that they won't make great surgeons. We need to remove artificial barriers that have been instrumental in keeping Black students out of ophthalmology.

I also was discouraged from applying ophthalmology, I was told to consider another profession. But I have a very determined personality and once I set my mind on something, I do it no matter what. I even took an additional year off between my third and fourth years of training to do clinical research and graduated with honors from Cornell University Medical College. It was very competitive but it allowed me to immerse myself more fully in the field of ophthalmology and publish my own research. That extra year made me a super-strong candidate, more so than my contemporaries. But I could only do that by standing on the shoulders of those who have gone before me, including David Kearny McDonogh.

McDonogh was not the only person who has been written out of history. Unfortunately, global White supremacy has distorted our understanding of the past. Did you know that the first ophthalmologist was an African named Iry in 2,500 BC? These stories should be celebrated. I like to think that if people were taught a broader view of history, we would all have a greater respect for different cultures – particularly African cultures, which have had the origin of culture, spirituality, science, and medicine, for thousands of years.

We've made a tremendous amount of progress in America but there are some who want to turn the clock back. The recent attack on the Capitol, where the Confederate flag was flown, did not even occur during the American Civil War. This remains a deadly reminder that right-wing groups are attempting to re-establish White supremacy.

We all want to live in peace, be successful, raise our families and have a good life and provide great health care to the community. It is only when you introduce artificial barriers of supremacy that there is discord. I am hopeful that things will improve with proper



information, truth, and education.

Sharing stories (modern and historical) is a critical part of repairing past wrongs – but we cannot progress without support from everyone, including industry. Pharma companies make millions of dollars globally from the Black community in America, the Caribbean, and Africa, from equipment and drugs to pharmaceuticals and surgical supplies. But, unfortunately, there is a lack of diversity at the leadership level in these companies. To have excellent health outcomes globally, you need a diverse global cultural leadership. The industry needs to recruit talented people from diverse backgrounds and show financial commitment by investing in pipeline training programs and scholarships to support the next generation of Black ophthalmologists and medical and pharmaceutical industry leaders. Large hospitals would also do well to invest a good portion of their budget towards inclusive educational

pathways and leadership diversity.

Change is happening but it is far too slow. We need pressure from people in all industries – and not just people like me. Look at your leadership; does it reflect the diversity of your community, the country, the world? We all have a role to play when it comes to proposing solutions to these problems. For many years, the doors to ophthalmology were closed to underrepresented minorities; now they are opening, let's keep it that way. We have to remember it should not be about white and black but about one race – the human race.

*Daniel Laroche is the Director of Glaucoma Services and President of Advanced Eyecare of New York and Clinical Assistant Professor of Ophthalmology at The New York Eye and Ear Infirmary of Mount Sinai, New York, USA.*

## REPRESENTATION MATTERS

If we want a more diverse subspecialty, we need to level the playing field

*By Jacqueline Busingye*

Of the 20,000 ophthalmologists in the United States, approximately 400 are Black or of African American descent. This is a huge problem, not only because studies show lack of representation affects patient care, but also because of the effect on the potential for growth and diversity within the specialty. The lack of diversity is not limited by race/ethnicity but also sex, with a lack of female leadership in academia especially.

Ophthalmology has historically been an insular specialty with practices handed down within families (usually among the men) and some academic institutions preferring legacy or “connected” applicants. How can a strong candidate without connections even begin to tap into that?

This lack of exposure is a major hindrance to entry into ophthalmology as it is not traditionally a core rotation, so students must opt in – problematic if they don't even know what the specialty is. Even if students do choose to do an ophthalmology rotation, not all medical schools have a program so they have to travel to another institution willing to host them. Without mentorship to guide and encourage you through the path becomes very difficult for medical students who otherwise have limited or non-existent knowledge of the specialty.

The David K. McDonogh scholarship fund was started as a way to not only share David's amazing story, but to address the racial



and ethnic disparities in ophthalmology and otolaryngology. When I walked into my first meeting with the original founder, I met six extremely accomplished ophthalmologists of different subspecialties. I realized that I had never been in a room with more than one other ophthalmologists who looked like me. If this was inspiring for me, already an attending ophthalmologist, I could only imagine the potential good that would be accomplished for the medical students we set out to help.

David is the inspiration for the work our organization does to help mentor students in their chosen career paths from early rotations and research, through the point of matriculation. Those who do receive the scholarship are given a financial gift that they can use to help cover costs associated with the application process, such as fees and travel costs. As many have told us this has allowed them to take advantage of opportunities, they otherwise would have needed to take out loans for (or missed altogether).

As word of our scholarship fund and network grows, we hope to expose more students to ophthalmology/ENT at an earlier stage in their medical school training. Exposure in the first rather than fourth year allows better mentorship and exposure to the clinical and research aspects of the specialties so that they make more informed decisions about their future in medicine. If students don't choose to become ophthalmologists or otolaryngologists – whether they from an underrepresented minority group or not – it should be because they have found a passion elsewhere, not because they don't know these subspecialties exist.

*Jacqueline Busingye is a Founding Member of the David K. McDonogh Scholarship, Chief of Ophthalmology at Albany Stratton VA, and Associate Professor of Ophthalmology at Albany Medical College, New York, USA.*

# THE LIGHT FANTASTIC

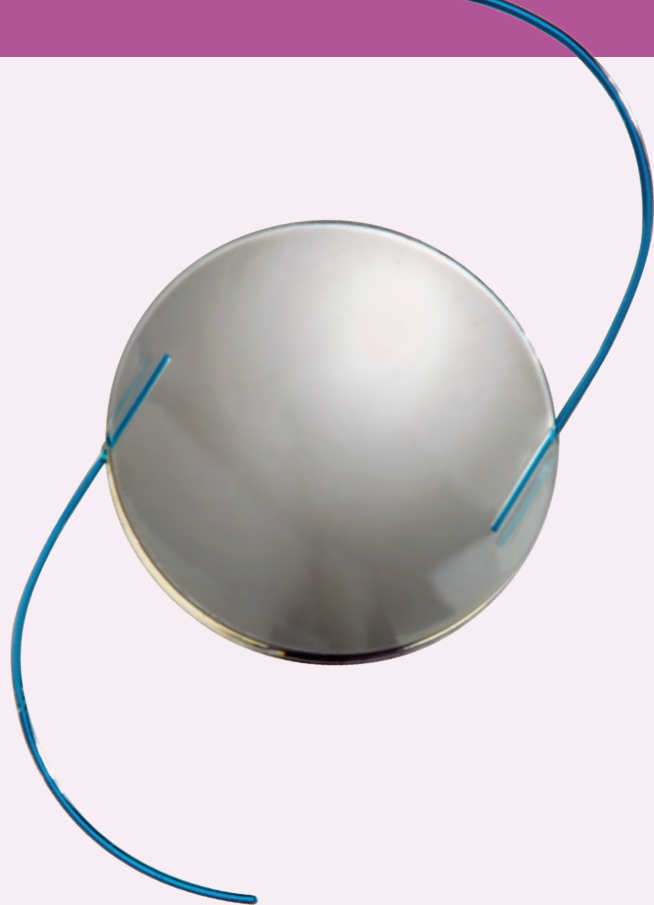
The first and only FDA-approved IOL that can be adjusted postoperatively is delivering superior visual outcomes

Despite recent developments in cataract surgery technology, residual refractive error is still common – the result of variables in incision healing and the final effective lens position. In fact, research has found only 6 out of 10 cataract patients achieve their targeted vision, and an even smaller percentage achieve excellent vision at all distances (1). Clinicians have long sought an alternative, and RxSight® has answered this need with the Light Adjustable Lens™ (LAL). The LAL is the first and only FDA-approved IOL that can be adjusted postoperatively to improve uncorrected visual acuity. Unlike other lenses, visual outcomes with the LAL are not dependent on the prediction of SIA, ELP, individual healing, or the use of sophisticated equipment before surgery. Instead, vision optimization takes place after the LAL is in its final position (implanted during a standard cataract procedure) and the patient's eye has healed, overcoming the limitations of preoperative and intraoperative prediction processes.

Put simply, surgeons now have the ability to customize their patient's vision *after* cataract surgery. Optimization

is achieved through a series of office-based light treatment procedures that take no more than a few minutes. By adjusting the lens this way, patients have the option to “test drive” different visual outcomes until they find an option that meets their personal desires and lifestyle requirements before the final adjustment is locked in. RxSight's technology is unique in allowing surgeons and patients to work together in this way, ultimately resulting in improved patient satisfaction.

Though not labeled as a presbyopic lens, the majority of LAL patients achieve some form of monovision or mini-monovision because near and distance can be adjusted precisely after implantation. The LAL also offers a reduction in monovision intolerance as patients





have the benefit of test driving and refining different amounts of anisometropia. As Hunter Newsom, Founder and Medical Director of Newsom Eye, Florida, USA, attests: "Eighty percent of our first 200 LAL patients saw 20/20 or better at both distance and near without glasses. As the LAL is a monofocal lens and does not split light, it has lower rates of glare and halos compared to a multifocal lens, making it the most accurate and best quality premium IOL in the world today."

Without a doubt, the LAL delivers superior visual outcomes that simply cannot be matched by non-adjustable IOLs – and the data prove this. In a study of 600 subjects, those who received the LAL followed by adjustments were twice as likely to achieve 20/20 distance vision at six months without glasses as those who received a standard monofocal IOL (2). Incorporating the LAL into your practice isn't just common sense, it is better business. The LAL can help increase your premium channel penetration, and differentiate your practice

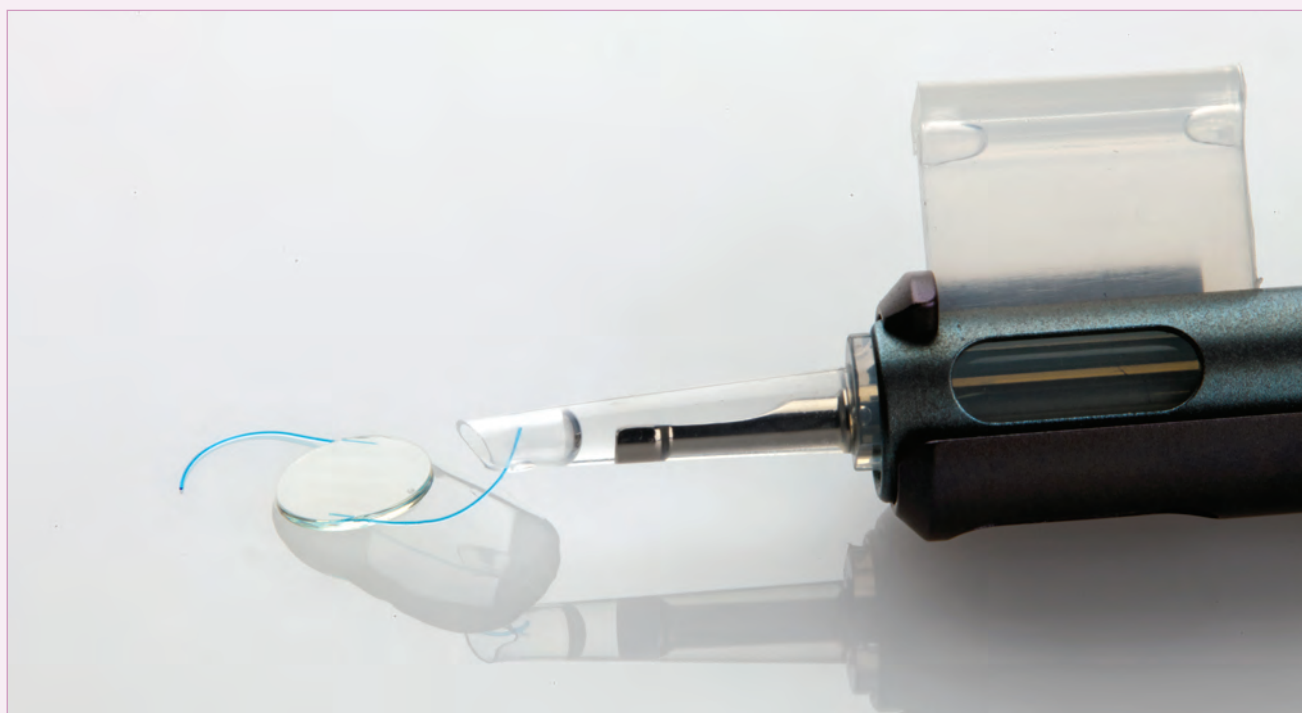
in your region. Newsom agrees: "While there is more work [with the LAL], there is also more reward. The LAL has not only increased our volume in the premium channel, but also our net profitability. Patients are getting better vision, and our practice is doing better because of our confidence in these visual results."

So why rely on preop predictions or postop LASIK enhancements? It's time to adjust stabilized postop refraction with the LAL and start benefiting from better patient outcomes.

*The Light Adjustable Lens is currently only available in the US.*

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**In Practice***Surgical Procedures  
Diagnosis  
New Drugs*

# Crystal Clear

Simplifying implantation in a world increasingly hungry for implantable contact lenses

*By Sheraz Daya*

Current trends in refractive surgery point to the use of implantable contact lens (ICL) rising steadily above all others. I believe the option of “additive” technology, using a small incision along with reliable visual outcomes, makes the procedure highly attractive for those seeking vision correction procedures.

## ICLs and their role today

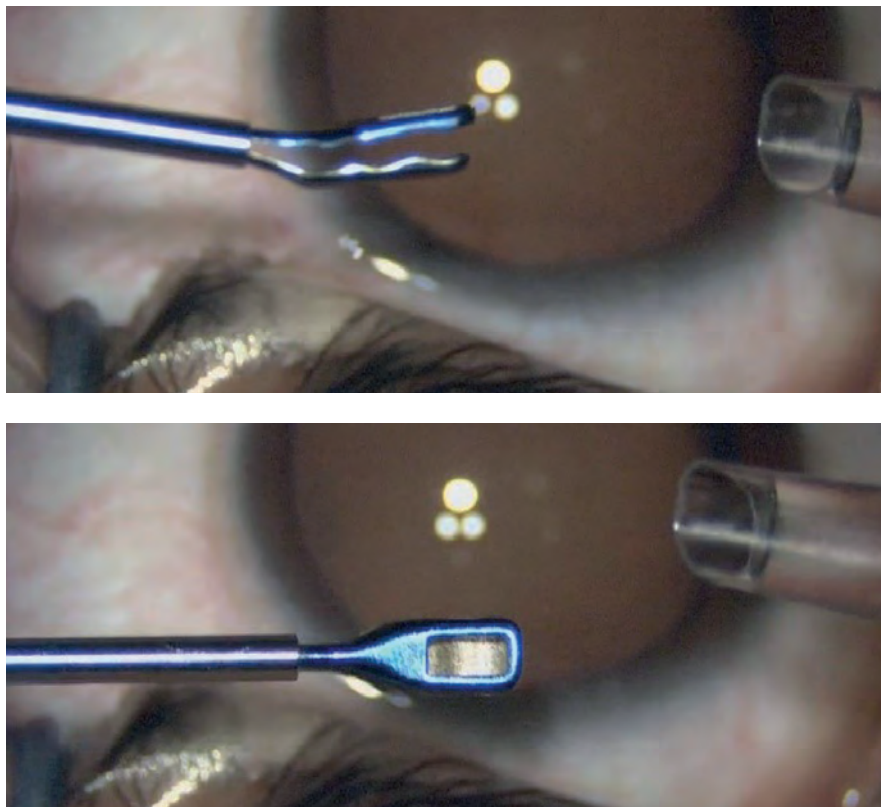
For many moderately to highly myopic patients who want to be spectacle-free, ICLs may well be the only safe option; corneal refractive surgery and refractive lens exchange are the alternatives, but they

both carry risks and disadvantages. Corneal refractive surgery is not always possible for high refractive errors because it involves removal of corneal tissue beyond the safety limit to achieve full correction. Refractive lens exchange or lens replacement carries a higher risk of retinal detachment in younger myopic eyes, especially in males

and eyes with axial lengths of greater than 25.00 mm. The presence of any peripheral retinal pathology, such as lattice retinal degeneration, is also a risk factor. Additionally, in younger patients, the loss of the crystalline lens results in a complete loss of accommodation, and therefore, the need for a multifocal lens to provide some

*“Corneal refractive surgery is not always possible for high refractive errors because it involves removal of corneal tissue beyond the safety limit to achieve full correction.”*





Figures 1a and 1b. Daya ICL Forceps featuring undulated graspers with rounded edges, viewing window, and a clear distinction of the blue anterior portion of the forceps. Figures courtesy of Sheraz Daya.

near vision. However, this can result in an unsatisfactory visual quality and, in the case of a monofocal or extended depth of focus lens, loss of near vision.

As an additive option with low adverse incidents, ICLs are a good and safe refractive option for patients.

#### Key preoperative considerations

The ICL is a viable option for patients between the ages of 21 and 60 with a stable refraction (less than 0.5 D change for one year) and a clear crystalline lens. Anterior chamber depth (ACD) must be  $\geq 2.8$  mm, as measured from the corneal endothelium to the anterior lens capsule to avoid angle compromise. ACD is best evaluated by either Scheimpflug, ultrasound biomicroscopy, or anterior segment OCT (1).

Ideally, patients must also meet

minimum endothelial cell count (ECC) criteria and have no ocular pathology, such as compromised corneal endothelium, iritis, iris atrophy, rubeosis iridis, cataract, glaucoma, or retinal disorders (2).

#### Eight-point guide for a simpler surgical procedure

1. Good pupil dilation is vital to facilitate implantation.
2. The lens will be implanted through a 3-mm clear cornea or limbal, self-sealing incision, usually under topical anesthesia.
3. After the incision is made, the anterior chamber is filled with a viscoelastic device, preferably Ocucoat (Bausch + Lomb, Bridgewater, NJ).

## ICL Choice

With the novel V4C new generation myopic ICL, the midpoint of the lens has a small opening that allows equalization of pressure between the anterior and posterior chambers thus eliminating the risk of pupil block – and avoiding the need for peripheral iridotomies are avoided with this new ICL.

4. To load and position the ICL, I use the Daya ICL Forceps (MicroSurgical Technology, Redmond, WA) – see “The Need for New Forceps.” This ICL loading system with a central opening enables good visualization of the ICL as it is grasped, ensuring centration between the footplates with little danger of rotation when being pulled through the cartridge. Rotation can lead to the lens unfolding upside down in the anterior chamber. The high-quality undulation within the graspers (see Figure 1) provides a secure hold of the ICL without risk of damage.
5. Following lens loading, the ICL (see “ICL Choice”) is slowly injected into the AC and correct unfolding is assisted where required by a second instrument, such as a Lester pusher or cannula. The lens is then rotated to its correct orientation and the footplates are very gently positioned under the iris.
6. The OVD is then removed by irrigation and aspiration, and wounds are checked to ensure there is no leak. Intracameral antibiotics are instilled, and if both eyes

## The Need for New Forceps

With traditional forceps design, I was unable to see how much of the lens I was holding or where it was being grasped. With the new MST Daya ICL Forceps, the viewing window (see Figure 1) allows maximum visibility of the optic during loading, thereby avoiding inaccurate positioning of the lens (see Figure 2), while clear distinction of the blue anterior portion

of the forceps (also Figure 1) enhances optic visualization, ensuring correct ICL orientation.

I previously found that when I grasped the lens, the top of the instrument had sharp edges that would scratch against the cartridge, taking off pieces of plastic and creating tiny loose plastic fragments. To solve that problem, we developed rounded edges (again, see Figure 1) on the tip and front of the forceps, ensuring gentle – and, crucially, non-abrasive – contact with the lens and injection cartridge.

are being operated sequentially, Cefuroxime is used in one eye and Moxifloxacin in the other.

7. Post operatively, patients are prescribed topical antibiotics for a week and corticosteroids tapering over a four-week period.
8. Visual recovery is quick, with most patients seeing very well within one- or two-days post-procedure and complete recovery occurring at about two weeks later.

### Conclusion

When I consider the current state of play in refractive surgery, the use of implantable contact lenses and the demand for customised vision are clear trends. Though LASIK remains a popular choice for many patients, ICL is rapidly gaining ground as an alternative – and, for many, a more attractive – option.

Looking far ahead to 2050, when half of the world's population are expected to be short-sighted (3), it is reassuring to see a great deal of effort being made in myopia control to try and reduce disease severity, which can be blinding. Meanwhile, options

for reliable correction of vision will evolve. For the time being, due to the additive – and, in turn, reversible – nature of ICLs, refractive surgeons – and their patients – have an increasingly attractive option.

*Sheraz Daya has no financial interest in the products discussed; however, the Centre for Sight has received an unrestricted grant from Staar Surgical in the past.*

*Sheraz Daya is Medical Director of the Centre for Sight, East Grinstead, UK. He was amongst the first in the UK to perform LASIK, and he has pioneered a number*

*of corneal and anterior segment techniques and invented several ophthalmic instruments. Daya was voted to the 2018 Power List.*

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Figure 2. Grasping of the ICL with the Daya ICL Forceps allows for enhanced visualization and scratch-free loading.



# Dry Eye Debate: A Driver for Practice Recovery and Growth

During a live roundtable, an international panel of leading ocular surface experts discussed steps practices can take to effectively manage patients' dry eye disease

How do you explain dry eye disease (DED) to your patients, especially if they are asymptomatic?

**Jennifer Loh:** When I tell patients they have DED, they sometimes give me this incredulous look – especially when they have told me that they've been tearing and I explain that they suffer from dry eye. It takes time and patience to explain exactly what DED is, that it can be multifactorial, and that different people have different symptoms. Their eyes might not actually feel dry. I usually try to get beyond the barrier of the name – “dry eye disease” – and explain that, sometimes, there is a disconnect between what patients feel and what I see during their exams. Sometimes, they might not even feel the symptoms, but DED is responsible for the vision loss they have come to see me about. Once I establish the ground-level understanding, patients are much more accepting of further discussion and treatment.

**Christophe Baudouin:** Most of my patients complain of symptoms – except for those

whose corneas have become anesthetized – but those symptoms can differ widely. Some complain of burning, others of discomfort; some will describe pain, although that is not common. Some patients also have feelings of fatigue. Studies have shown that the nature of complaints can also depend on the location and culture – and patients may use different words to describe the same symptoms.

One of my approaches has been to move from a simple description of symptoms to something more heterogeneous focusing on the consequences of dry eye related to quality of life. The Ocular Surface Disease Index (OSDI) can be helpful – I still use it. Questions are based around the intensity of symptoms, the type of symptoms, their frequency – whether they are acute-but-rare or mild-but-continuous – because quality of life may be impaired in the same way. Focusing more on consequences of symptoms – how it feels when driving or watching TV – can be useful.

**Alice Epitropoulos:** As Bill Trattler and colleagues from the PHACO Study Group described, visual complaints, such as strange vision, can be more likely than typical symptoms of discomfort or foreign body sensation (1). Paying attention to patients' complaints – for example, when they describe their vision as blurry when using a computer – is crucial.

Patients who are asymptomatic are sometimes the most challenging to treat, because they don't realize they have DED. We can educate them by showing them their meibography and their abnormal tear osmolarity and explaining that this disease is progressive and chronic, and that it can start to affect their visual quality in a significant way.

**Cynthia Matossian:** I agree completely. Without our input and education, patients are unlikely to understand the condition, and therefore they won't adhere to any of our recommendations.

## Meet the panel

Alice T. Epitropoulos  
Partner at Ophthalmic  
Surgeons & Consultants  
of Ohio, and a cofounder  
of The Eye Center of  
Columbus in Columbus,  
Ohio, USA



Christophe Baudouin  
Professor of  
Ophthalmology, chairing  
the department  
at Quinze-  
Vingts National  
Ophthalmology  
Hospital in Paris,  
France



Cynthia Matossian  
Founder and Medical  
Director of Matossian  
Eye Associates, Mercer  
County, New Jersey,  
and Bucks County,  
Pennsylvania,  
USA, who chaired  
and moderated the  
discussion



Jennifer Loh  
Founder of Loh  
Ophthalmology  
Associates in Coral  
Gables, Florida, USA



What impact has the pandemic had on your patients? Has mask-wearing had an impact on DED?

*Matossian:* I recently published a study on the impact of continuous positive airway pressure (CPAP) devices and DED prevalence. There is always

a little bit of air that escapes the seal of the mask and there is definitely a correlation between CPAP users and DED sufferers. I'm wondering if, as you mentioned, there is mechanical air flow (almost like being in front of a fan) when exhaling while wearing a mask. The stream of air that is being forced up past the nasal bridge can impact the ocular surface. We are very eager to see definite results.

*Epitropoulos:* With the aging population and the generally poor American diet, the prevalence of DED has been increasing anyway, but many of us feel that the COVID-19 pandemic is also contributing to the increase in prevalence of ocular surface disease.

Many experts noticed the exacerbation of dry eye symptoms, along with increased chalazia and hordeola, during early lockdown. In fact, chalazion was the number one reason for the patient-initiated telehealth calls we received during the mandatory lockdown and I continue to see the condition

in my clinic. Many of my patients who had never had dry eye symptoms are now complaining of them. Theoretical contributing factors may include increased digital device use, with people working from home and using virtual meetings; masks may

be contributing to increased ocular inflammation, reduced tears or tear evaporation, and potential changes in the microbial flora on lids, lashes, and conjunctiva, with a possible shift toward nasal, oral, and respiratory organisms. Another variable that I think might be contributing to this is the mechanics of the blink while mask wearing, particularly that of the lower lid.

A group of us, including Cynthia and Jennifer, have been trying to develop a study design to prove this hypothesis of a pandemic-associated phenomenon with significant increases in the prevalence of DED, chalazia, and hordeola, but the obvious challenge to proving this hypothesis is the huge number of variables. It is difficult to get an accurate baseline for comparison and even more difficult to prove the methodology, but we are investigating it.

I actually looked at the diagnosis codes this year compared with the same period over the last two years. I noticed a 42 percent increase in dry eye codes and a 101 percent increase in chalazia and hordeola.

*Loh:* It's amazing data. I have always had a very high population with chalazia in my dry eye practice, but now even more patients are coming in, and, as Alice said, most of the telehealth calls in 2020 were about chalazia. Patients who come in with this complaint sense that it's due to mask use – they never used to suffer with these symptoms and it is really distressing for them. The psychological impact of not only dry eye, but also chalazion in particular, has been undervalued, in my opinion; these are some of the most upset patients we see.

I'm very excited to be part of this study and to have definite results, because I have seen a change. It could be a combination of things, but I would like to know why more of our patients are experiencing these symptoms.

*Baudouin:* It has been the same here



in Paris. I recently saw good data that showed a clear difference in dry eye between people who wore masks for less than three hours a day, and those who wore them for more than six hours a day. Clearly, airflow plays a role, and it is further exacerbated by the compression of the mask and the increase in screen time. It all increases the rate of dry eye and aggravates existing conditions.

Why is it important to diagnose and treat ocular surface disease (OSD) and DED?

**Loh:** Without treating dry eye, we're not helping our patients get the best possible visual results, whether it be with glasses, contact lenses, or cataract or refractive surgery. We know that these results rely on the health and stability of the ocular surface. As ophthalmologists, when we're helping our patients see better, we have to treat the underlying cause – and one of the most common reasons for blurred vision is dry eye.

It is a lifetime care for the eye. Many patients who come in for routine exams ask how to best take care of their eyes. I tell them that the best thing to do is take care of their ocular surface. Just as dentists have done a phenomenal job educating the public on the concept of dental hygiene from birth, I believe that we must do the same for our patients with regard to the need for appropriate ocular hygiene. When I see elderly patients with terrible gland and ocular surface disease, I feel that one of my purposes in life is to educate patients about this. These changes don't happen overnight, so early prevention can really make a big change.

**Baudouin:** Quality of life complaints are the main reason patients come to see us, but vision is also very important. If the quality of the tear film is poor, then the quality of vision and visual results after cataract procedures will be impaired – and we know that one of our patients' most frequent complaints

is dissatisfaction after refractive surgery. I have also seen many patients with severe meibomian gland disease (MGD) who don't complain a lot (or, sometimes, at all), but who are at risk of developing DED after cataract surgery. It is important to diagnose this early to avoid complaints after surgery.

**Epitropoulos:** In my opinion, there are three compelling reasons why correctly diagnosing and treating DED is important. First, we know that the tear film is the most important refractive surface of the eye; an unstable tear film can result in inaccurate biometry and keratometry readings, which can give suboptimal refractive outcomes (2). All the technologies we have available today – advanced femtosecond lasers, wavefront aberrometry, toric lenses – have higher failure rates in patients with compromised ocular surfaces.

Second, cataract surgery is likely to induce or exacerbate pre-existing DED in a high percentage of patients. If surgery doesn't live up to their expectations, patients are much more likely to blame their surgeon than pre-existing DED – that's why it's critical to diagnose and treat it prior to surgery.

Last, treating lid disease and blepharitis to eliminate bacterial overgrowth helps reduce the risk of endophthalmitis postoperatively. Again, if left untreated, DED can have an impact not only on vision and comfort, but also on long-term ocular health and surgical outcomes.

**Matossian:** I tell my cataract patients that they have two issues: one is the cataract, and once it's removed, they will never grow another one; the other one is lifelong, chronic, and progressive – their DED/MGD – and they have to participate in taking care of the condition forever. I always use words like "forever" or "there is no cure," so they understand that, even when their cataracts are gone, this is a lifelong issue.

How do you work up your DED patients?

**Baudouin:** At my practice, we are lucky to have almost everything that is available in terms of technological solutions. For me, the most appropriate tool is the ComfortCam microscope, which I have been using for almost 20 years. In my opinion, just a single drop of fluorescein is extremely efficient for getting a lot of information about the cornea, conjunctiva, and tear film to observe the way in which instability occurs. I might be biased, though, because most of my patients are referred for very severe DED.

*“Quality of life complaints are the main reason why patients come to see us, but vision is also very important.”*

**Epitropoulos:** If patients are symptomatic, I empower my technicians to proceed with testing prior to my seeing them, which really improves workflow and helps diagnose patients quickly. My team uses InflammDry, which detects MMP-9, an inflammatory marker elevated in the tears of dry eye patients. We also obtain tear osmolality to help determine the severity of the condition and the right therapeutic response. Meibography has been a game-changer for me when it comes to diagnosing, treating, and educating



## Christophe Baudouin on defining DED

Defining DED is not easy; in fact, it has been the subject of major debate. It really depends on the way we understand dry eye. It can be seen as a multifactorial disease in which stress, inflammation, and nerves all play a role. Another definition points to the fact that it's an imbalance or impairment of normal stasis – so dry eye would not be a disease of the tears, but a disease of the way in which the eye is protected against the environment. According to this definition, the loss of normal stasis could be the core definition of dry eye.

patients about MGD. I see it as a really important screening tool, considering 86 percent of dry eye patients have a marker for DED. It really helps to identify DED before there's irreversible damage.

Recently, I have also trained my technicians to evaluate tear breakup time and signs of keratitis. I used to do it myself, but we have been trying to further improve workflow efficiency and minimize the amount of time patients spend in the office.

*Loh:* We always like to start by taking a detailed patient history; we often use a questionnaire, such as the Speed or the OSDI questionnaires. I like to use fluorescein strips because I think they help better evaluate tear breakup time. I use meibography when needed but, before that (and after evaluating the cornea and conjunctiva), I focus on the lids and lashes. I look at signs of blepharitis and collarettes – possible Demodex. This is something every

ophthalmologist can do at the slit lamp. I also look specifically at the meibomian gland orifices, and gently press on the lid margin with a cotton tip applicator. You can see if the meibum is clear and flowing; unfortunately, I often see a capped gland with thick, toothpaste-like oil secretion coming out. I feel like this exam yields a lot of information and can guide me down the correct diagnosis path.

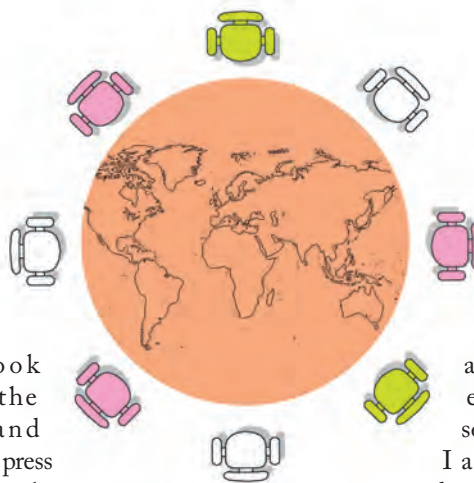
*Matossian:* We have cut our questionnaire down to three questions – we don't go through the formal OSDI or Speed questionnaires to minimize the time patients spend in the office. My technicians are trained to ask the patients: "Do your eyes feel tired?" "Does your vision change throughout the day?" (We previously asked "Does your vision fluctuate throughout the day?" and found that some patients didn't know what it meant and were embarrassed to ask. A simple word change can make a huge difference!) "How many times a day do you use artificial tears?" We ask specifically about how many times a day, not just whether or not they use artificial tears, because the quantity is very important. We also do MMP-9 testing, meibography, and tear osmolarity. When I see patients after all these tests

are done, I use lissamine green and fluorescein; each dye tells me something different. I also look at the lid margin and conjunctiva using the new ASCRS recommendations to look, lift, pull, push.

In an ophthalmologist's office, time is of the essence. How much more time do you spend with a patient when performing a DED protocol?

*Loh:* Trying to do too much can really lead you down the rabbit hole – every test adds time. In my setting, I see more general patients initially, not just severe DED cases, so I don't do all the available tests straight away. Where I have been able to streamline care is after making the diagnosis; I used to discuss every possible treatment and dry eye theory with patients, which took a lot of time and often left them overwhelmed. These days, I stick to a brief description to make sure they understand the problem and start with my preferred initial treatment if they are happy with it. I have found it works better than explaining every possibility at the start.

*Baudouin:* Indeed, the protocol is time-consuming. I do the slit lamp exam with staining myself, because I sometimes find



a hint of something that a technician may have missed, which I address at the end of the exam. It's crucial that the whole protocol is done at the first visit and a detailed history is taken. The first visit is like a police investigation in my clinic! One good question can give you an instant answer to a problem, such as a history of allergy or systemic medication. Also, you can identify some conditions, like rosacea, just by looking at the patient's face. Even though the first examination with the series of questions may take five to 10 minutes, it can solve the patient's problem and avoid the need for subsequent visits, improving the patient's mental health and quality of life.

*Epitropoulos:* In a busy practice, patients represent both an opportunity and a challenge. The opportunity is providing better, life-enhancing care, but the challenge is that it takes time. Understanding patients, diagnosing them correctly, and educating them on available treatment options can really put doctors and staff on schedule. We recently implemented a new software system, MD Backline, that automates patient communication and history collection. It has been a game-changer

for our practice and our dry eye protocol – it makes the process more efficient, patient histories more accurate, and our use of advanced therapies more widely accepted because patients are aware of these solutions before they even come into the office. It allows us to focus on diagnostic testing and educating patients when they make it into the office.

*Matossian:* Bidirectional communication with a patient ahead of a visit through a platform like MD Backline (and I have seen others that provide a similar service) really helps – patients have the time in the comfort of their homes to answer all the questions fully. Then we can incorporate their responses into the EMR and save a few minutes of patients' time in the office.

Where do you start with DED treatment?

*Loh:* It depends on how advanced the disease is and how much other treatment they have had, but I will focus on the newly diagnosed mild DED patients who have never been on any type of treatment, including artificial tears. If I find MGD, I start with a course of lubrication, warm compresses, and possibly cleansing solutions for the lids and lashes to get a baseline. This process is easy and cost-effective for patients and doesn't seem intimidating.

If the condition is more exacerbated and patients are in more acute distress, I often add a prescription medication. Usually, it's a corticosteroid to begin with, followed by basic lid hygiene and lubrication with artificial tears. I talk to patients about environmental factors, explain that it is a chronic condition, and ask them not to expect to get better in a couple of days' time. I make sure they understand that it's a team effort and we have to work together. If I decide to use a corticosteroid drop, I check back a few weeks later and follow their IOP. Then I move the patients on to the next stage, such as thermal therapy or a prescription

medication drop.

*Baudouin:* My approach is very similar, but I need to emphasize two ideas. The first is to collect all possible information about the previous treatment. Some patients come in with, for example, preserved eye drops. They tend to put more drops in when their eyes feel dry, and the more drops with preservatives they use, the worse their DED gets.

My other important point is to make sure where the disease comes from; whether it's tear deficiency, most likely associated with corneal damage, or from the eyelid. In the first case, I propose artificial tears or gels or a steroid spray. In the second, where it is most likely tear instability, I focus more on the lid hygiene; in severe cases, such as rosacea, I use specific therapeutic strategies to decrease inflammation.

With regard to artificial tears, some patients prefer liquid artificial tears and others are more comfortable with gels; we must consider their preferences.

*Epitropoulos:* It's important to establish that patients don't have any conditions such as membrane dystrophy. My threshold for starting patients on an immune modulator is very low, because we know most DED patients have some inflammation. We also know that MGD is the most prominent of dry eye diseases, so it's important to treat this early, before gland loss limits the effectiveness of the treatment. There are several exciting options for treating MGD these days: thermal pulsation, iLux, TearCare, and others.

*Matossian:* I always feel that layering or stacking treatments – with each one more complex than the last – and a mixture of in-office procedures and home remedies works well.

What in-office procedures do you offer your DED patients?

*Loh:* If this is a new diagnosis and I notice issues such as MGD or blepharitis, I start patients with home remedies and then offer



*"We are very fortunate to have many options available to us now, and around the corner, and the patients are the real beneficiaries of this."*

a treatment called Blephex, which is micro-buffer exfoliation of the lids and lashes. I also perform thermal pulsation (such as LipiFlow) and TearCare; both procedures specifically target the meibomian gland to treat the evaporative component. If patients note an improvement, it is easier to then offer them other options, as the cost of these procedures is covered by the patient. Patients have to believe in these procedures, so I explain I've seen the difference they make firsthand and I think it's of great value to them.

*Epitropoulos:* We schedule in-office procedures on dedicated days. I typically do thermal pulsation combined with a Blephex treatment, followed by an expression. I then give patients follow-up instructions, because I think all treatments work better once the meibomian glands are unobstructed and functioning, so even if hot compresses didn't previously work, they might be helpful after the in-office treatment. I advise blinking exercises, hot compresses, lid scrubs using hypochlorous acid, omega 3 fatty acids, and preservative-free artificial tears and gels at night. An overwhelming majority of patients notice an improvement when they follow these steps.

*Matossian:* Yes, the key is to let patients know that they have to keep doing all those things: using their heated masks at night, taking omega 3, using artificial tears, and lid hygiene. I also agree with the need to bring the patients back once they've seen improvement and then adding new procedures or using them to complement one another.

*Baudouin:* I have been focusing on intense pulsed light (IPL) therapy, which seems to give really interesting results.

*Matossian:* Indeed, I am hoping to do a study combining IPL therapy with thermal pulsation. The mechanisms of action are different – one heats and evacuates; the other treats inflammation in periocular lymphatic and vascular systems.

What new technologies excite you?

*Baudouin:* Let me start from the beginning: the first magic moment in my career was removing the preservatives from therapy. It solved almost 50 percent of my patients' problems! That's how I got a reputation for being good with DED. I was just stopping part of the treatment; honestly, it wasn't as clever as I was given credit for, but it worked wonders.

The second magic moment was when we started using cyclosporine (in Europe, this was the late 1990s). I was facing patients for whom nothing worked, despite their trying many different tear substitutes. When I started using cyclosporine, I was able to give 50 percent of patients relief and noticed some improvement in a further 25 percent.

I got the same feeling when I discovered that doxycycline improved

patient outcomes. It was reserved for patients with severe disease, but really improved their condition. These days, I'm excited about the warming devices I mentioned.

*Lob:* I don't have personal experience with IPL, so I'm really interested in Christophe's and Cynthia's perspectives. I see a lot of potential in that area. There's also a treatment similar to IPL – an easier point-of-care test – that I have heard good things about.

*Epitropoulos:* I'm getting ready to enrol patients in a new study looking into a proprietary, preservative-free solution that may help patients with meibomian gland secretions. I'm very excited to start this.

*Matossian:* Many technologies are coming down the pipeline – new compounds for eye drops; a Demodex treatment... I'm also looking forward to trying a nasal spray that will hopefully help with tear stimulation and fight inflammation.

We are very fortunate to have many options available to us now and around the corner, but the patients are the real beneficiaries! Seven or eight years ago, these options weren't available at all. It's great that we can share and compare our knowledge and disseminate this to other professionals to help every patient suffering from dry eye disease.

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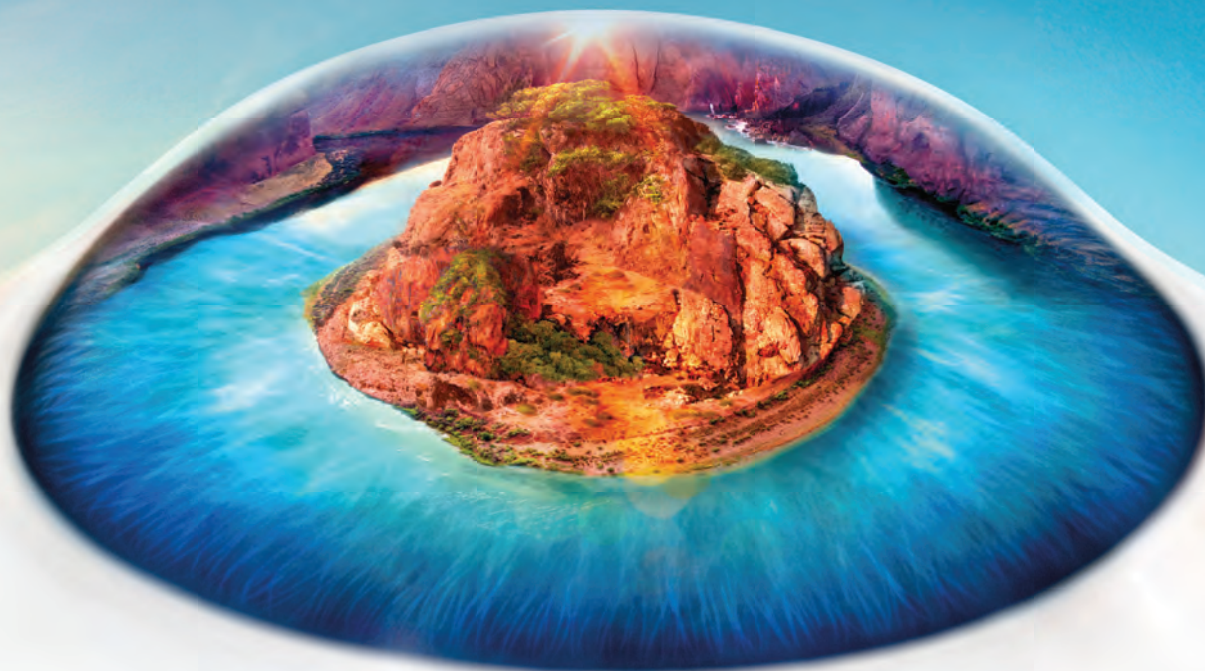
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DRY EYELAND

# Journey to a world

WHERE A LOSS OF TEAR FILM  
HOMEOSTASIS LEADS TO DRY EYE<sup>1</sup>



When it comes to dry eye disease and the loss of tear film homeostasis, there's a broader integrated system that needs exploring. We call it Dry Eyeland.<sup>2,3</sup>

**Come travel this anatomical landscape, where:**

- Loss of tear film homeostasis is the unifying characteristic of all dry eye<sup>1</sup>
- The parasympathetic nervous system plays a major role in tear film homeostasis<sup>2</sup>
- The lacrimal functional unit (LFU) is far more than just the lacrimal gland<sup>3</sup>

**Allow us to be your guide to dry eye—visit [DryEyeland.com](http://DryEyeland.com) to see the sights.  
Because a whole world awaits beyond the ocular surface.**



**References:** 1. Craig JP, Nelson JD, Azar DT, et al. *Ocul Surf.* 2017;15(4):802-812. 2. Efron N, Jones L, Bron AJ, et al. *Invest Ophthalmol Vis Sci.* 2013;54(11):TFOS98-TFOS122. 3. *Ocul Surf.* 2007;5(2):75-92.

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# No Pain, No Gain?

Is argon-microchip technology for retinal photocoagulation really less painful than a frequency doubled Nd:YAG laser?

*By Norbert Schrage, Daniel Uthoff, and Andreas Cordes*

The path of technological advancement is not always driven by what is “best,” but rather by what is easier to implement and economically more profitable. Seldom do these two goals coincide. When coagulative retinal surgery moved from the original Gas-tube laser with Argon 514 nm to frequency doubled Nd:YAG lasers with a wavelength of 532 nm, it was not for therapeutic benefits, but for practical reasons. Now, to complete the circle, the shift back to 514 nm is possible with the most technologically advanced system – one that provides better patient-comfort with the time-tested benefits of the first 514 nm argon laser systems of ophthalmology.

## Evolution

For simplicity, the evolution of coagulative retinal surgery will be limited to systems offered by a single company, A.R.C. Laser GmbH (Nuremberg, Germany). Their first 514 nm laser system was an

Argon Gas laser, which had an overall dimension of 96 x 46 x 62cm and required an external water-cooling system and dual power supplies. Such systems entered the ophthalmic laser market in the 1970s. Three pulse spot sizes (0.25, 0.5 and 1 mm) could be achieved by focusing through the slit-lamp. Next came a 532 nm system (frequency doubled Nd:YAG laser) that was 47 x 18 x 27 cm with a small control panel. This was not because the latter was safer or more efficient, but because of the size, which meant that a separate room for the water-cooling of the laser system was no longer required. These systems were introduced in the 1990s. This shift was met with an increase in patients reporting greater pain during treatment, often requiring the entire treatment to be divided into two or more sessions.

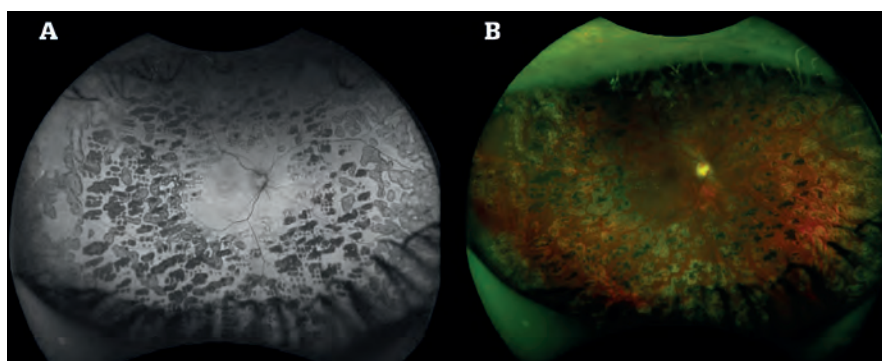
Despite the widespread use of the 532 nm system, scientific literature was skewed in favor of the 514 nm systems for the treatment of a wider range of retinal

pathologies (1). Furthermore, although the results achieved during short-term follow-ups for both systems were similar (2), one study evaluated a 10-year follow-up period for only the 514 nm laser system and found it to be safe and effective for 96 percent of patients (3).

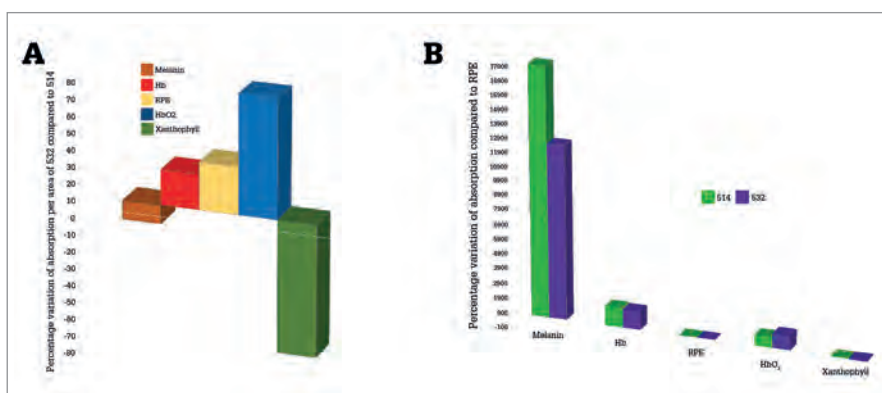
Currently, the newest option is the CLASSIC 514 retinal photocoagulation laser system. Based on argon-microchip technology, it permits pulses in the range of nanoseconds to milliseconds. This system can be run off a rechargeable battery and has an overall dimension of 25 x 17 x 22 cm. In my experience, the new system provides the same level of patient satisfaction as the original 514 nm laser systems in terms of decreased pain and longer therapy sessions, with greater collaboration, yielding comparable treatment results.

## The science of pain

But why do patients report feeling more pain with 532 nm lasers?



Right eye of a 33-year-old woman with decompensated glaucoma and persistent vitreous hemorrhage. Surgery was suggested following two injections of Lucentis and panretinal laser coagulation on both sides six times per eye during the previous year. The visual acuity in the right eye was hand motion at the time of treatment. A pars plana vitrectomy with heme ex, endo-LC, air-endotamponade, triamcinolone, and trabecular aspirate was performed. During surgery, after a detailed vitrectomy, the retina was treated panretinal with 1600 foci (temporal with argon 532 nm and nasal with argon 514 nm). Postoperatively, no differences were reported nor observed, although the 514 nm laser spots appear slightly softer when laser pulses were administered.



A. Comparison of the percentage variation of absorption for surface areas between 514 and 532 nm lasers with positive values indicating a greater absorption with a 532 nm laser. B. Absorption standardized for that of the RPE for each of the laser systems individually. Data digitally extracted from the figure initially presented in Mainster MA (7) and subsequently modified by Lock JHJ and F KCS (8).

The retina does not possess nociceptive receptors, except for the thermoreceptors found especially around the entry of the long ciliary nerves (non-specialized nerve endings located near blood vessels). They are generally divided into low- and high-threshold receptors conducted mostly via slowly conducting unmyelinated C fibers. Low-threshold receptors provide non-painful perception at temperatures below 45 °C, while high-threshold receptors give a perception of pain at temperatures higher than 45 °C. Although there is a variable individual component to what temperature is

perceived as painful, temperatures above 45 °C are generally perceived as such (4).

Although the two laser systems differ slightly in wavelength, their absorption spectra for the principal components of the retina are different (see Figure 2). When delivering the same amount of laser energy with the two different wavelengths to the pigmented retinal epithelium, 45 percent more 514 nm energy is absorbed by the melanin, while 40 percent more 532 nm energy is absorbed by the oxygenated hemoglobin and a negligible difference for deoxygenated hemoglobin. Given that the distribution of nerve fibers usually mimics that of blood vessels

(5), it is reasonable to hypothesize that the greater energy absorption with 532 nm of faster moving blood would result in a greater nociceptive stimulation, and thus a greater sensation of pain.

This hypothesis is especially important when considering that the energy accumulation required to reach the threshold for coagulation is not instantaneous. For example, using a pulse duration of 100 ms would result in the movement of the oxygenated hemoglobin of between 25 and 100  $\mu$ m – well outside the spot generated by the laser. The validity of this hypothesis is supported by Jain and colleagues (6), who report that the volume of the spot size does not increase in proportion with laser power or pulse duration. Further studies are required to confirm this hypothesis.

#### The lesser of evils

In summary, the novel argon-microchip technology (514 nm) laser system for retinal photocoagulation has the same advantages as the older, clunkier 514 nm systems but with a significant reduction in size and on battery power! Although the short-term results should be similar to those obtained with 532 nm systems, the reduced pain inflicted on patients during treatment increases the probability of completing the entire treatment in one session – increasingly important in a post-COVID world. Also, the softer generation of spots during pulses increases operator-control of spot size, permitting greater customization of therapy of both size and positioning for individual patients.

*Norbert Schrage is Prof. Dr.h.c. Dr.med. at Augenklinik Köln-Merheim, Köln, Germany*  
*Daniel Uthoff is Dr. med at Augenklinik Köln-Merheim, Köln, Germany*  
*Andreas Cordes is Dr. med. at MVZ Sehwerk Augenzentrum GmbH, Bonn, Germany*

See references online at:  
[top.txp.to/no/pain/no/gain](http://top.txp.to/no/pain/no/gain)



# Putting Glaucoma into Perspective

Increasing awareness of glaucoma with a new application designed for patients

*David Crabb, Professor of Statistics and Vision Research and Director of the Centre for Applied Vision Research at City, University of London, UK, talks about a tablet/smartphone app that has been designed to increase patient awareness of glaucoma and its symptoms.*

Tell us about the app your team developed...

Our intention was to improve the kind of information that we give to people with glaucoma and their families. We found that the information provided to patients with glaucoma (and patients with eye diseases, generally) tends to be quite poor – for several reasons. First of all, the language used in leaflets given to patients is complicated, with too many technical terms used. In the past five years, I've seen leaflets using terms such as lamina cribrosa or trabecular meshwork – and though these are important clinical terms, they are not ones that patients need to be familiar with. The second problem is the complexity of diagrams and figures that are often used. When talking about eye diseases, publications tend to use a cross-sectional picture of an eye – the kind you can



see in a biology textbook. And that's too complicated for the average patient to understand. The third problem with glaucoma materials available is that the focus is often on the fear of blindness. Of course, it is a risk, but many patients who are treated are not going to lose vision in their lifetime. Finally, the imagery used to suggest what patients with glaucoma might be seeing is quite wrong; we frequently see the use of black patches in the field of view or tunnel vision – but we know from our research that this is not what glaucoma looks like to patients. In reality, glaucoma is often asymptomatic, which is important for patients to understand.

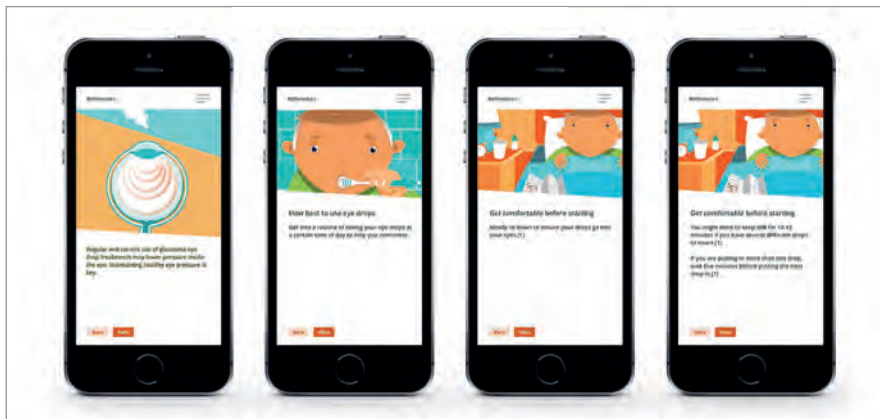
We have tried to use this knowledge to create a new kind of patient information source, and it is now available through an application – developed with and funded by Allergan, an AbbVie company, and the support

*“The unique aspect of the app is its capability of demonstrating what it might be like to have visual field loss as a consequence of glaucoma.”*

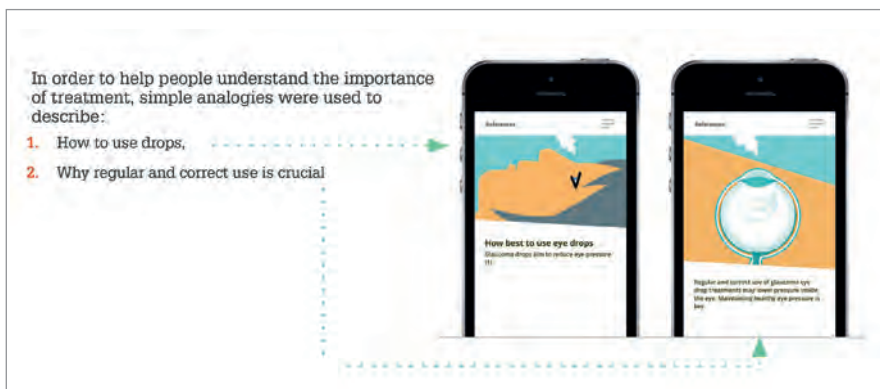
of Glaucoma UK – called “Glaucoma in Perspective.” The app should ideally be used on a tablet, with a larger screen, but it can also be used on a smartphone. We tried to make the available information accessible, simple, and easy to read. The unique aspect of the app is its capability of demonstrating what it might be like to have visual field loss







Maintenance of a good treatment routine is critical to keeping risk and impact on vision loss lower.

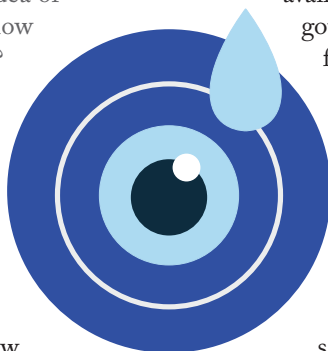


as a consequence of glaucoma. We have built a series of demonstrations and videos to see what the world looks like through the eyes of a patient with glaucoma.

Who came up with the idea of developing the app and how did things fall into place?

The original idea came a few years ago and originated in the Crabb Lab. We published a research paper to show that patients reject the idea that, if you have glaucoma, you have black patches in your field of view or tunnel vision. The effect of glaucoma on patients' visual function is much more subtle, especially in the early stages of the disease. Once the paper was

out, we thought it would be great to share this information with patients and we came up with the idea of developing an app. The original app was launched about four years ago, but then it stopped being available to the public. Allergan got involved in the project to fund and relaunch it.



What stage is it at now and what are the next steps?

The app is now available in the UK on various platforms – for free. It should provide simple information about glaucoma and how effective treatment can be. It also has a series of diagrams that can help advise patients about adherence to eye drops. In the

longer term, we would like to launch it in Europe and the rest of the world.

What feedback have you had so far?

We have had good reactions from patients through Glaucoma UK – an outstanding charity for glaucoma sufferers. Patients have expressed how pleased they were with the available material. We have run it by many of our clinical collaborators as well. All reactions so far have been positive!

*“We have had good reactions from patients through Glaucoma UK.”*

And your advice for ophthalmologists? As our conversation has been arranged to mark the Glaucoma Awareness Week, I would like to stress one point: ophthalmologists should ensure their patients know that glaucoma can be asymptomatic. This truth is an important aspect of the app – we need to make it clear that patients may not notice any problems with their vision, but this insidious condition might still be affecting them. Regular, routine eye checks are really important, not only for glaucoma, but also for all other conditions that can affect eyes.

*To download the app, search “Glaucoma in Perspective” in your app store.*

*To read more about the work of David Crabb’s team, the Crabb Lab, go to [staff.city.ac.uk/crabblab](http://staff.city.ac.uk/crabblab) or @crabblab on Twitter.*

*The application was produced and funded by Allergan, an AbbVie company.*



the  
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# **GLAUCOMA AND THE PANDEMIC:** *A Surgery-Led Approach Roundtable*

Watch our panel of glaucoma experts discuss the delays they have witnessed due to the COVID-19 pandemic, and the potential strategies to address them – including risk stratification, remote monitoring innovations, and new surgical methods. They also explore the topic of patient centricity in glaucoma and share their predictions for the future of glaucoma management.



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# The Next Big Thing?

Widely prevalent and commonly overlooked, demodex blepharitis is coming into view as a potential therapy moves through the pipeline

By Edward Holland

Demodex blepharitis is a common but underrecognized condition that is associated with significant discomfort, and can lead to a decreased quality of life for patients. Many eye care professionals may be overlooking demodex blepharitis due to a lack of recognition of the condition's prevalence and signs, as well as the shortcomings of current treatment options. There is currently no FDA-approved pharmaceutical specifically indicated for this common ocular surface disease (OSD).

A parallel can be drawn between where we are today with our understanding of the importance of diagnosing and treating Demodex blepharitis and where we were with our recognition of dry eye disease (DED) two decades ago, and even more recently, meibomian gland disease (MGD). Twenty years ago, most ophthalmologists, save for some cornea specialists, were not diagnosing DED – in fact, many did not believe they saw these patients in their practice at all. It wasn't until we had a prescription treatment – cyclosporine – and improved diagnostics that we started actively looking for dry eye, and we found it everywhere. We realized that this was an inflammatory disease process and that patients benefited from its treatment.

As time went on, diagnostic methods

further improved and we turned our attention to the meibomian glands. Once we had the tools to identify MGD, we began to understand its prevalence and the importance of managing it to improve the health of the tear film. The development of therapies like thermal pulsation followed. After DED and MGD, we could argue that blepharitis is the next horizon in OSD. Today, we are gaining a deeper understanding of the prevalence and impact of Demodex blepharitis and how to look for it now a promising prescription drop is waiting in the wings.

## Condition prevalence

Blepharitis is a chronic, progressive condition, characterized by inflammation, ocular irritation, and erythema (1). Extrapolations based on population and prevalence suggest that up to 20 million US adults may have blepharitis. When left untreated, the condition can lead to significant sequelae like lid and lash abnormalities, blurred vision, and corneal damage. Although blepharitis primarily affects the lid margin, it can affect the eyelid skin, base of the eyelashes, eyelash follicles, and the meibomian glands and gland orifices, with patients presenting with red, irritated, or itchy eyelids, and

## Key Terms

**Collarettes:** pathognomonic sign of Demodex blepharitis. Collarettes have also been referred to as dandruff-like material, cylindrical dandruff, scurf, and crust. While Demodex are common on the skin, the presence of collarettes indicates an overgrowth of mites. This clear to whiteish waxy build up is left by the proliferating Demodex mites; it is a combination of partially digested epithelial cells, keratin, waste, and mite eggs. The cuffs are typically seen at the base of the eyelashes, particularly on the upper lid. Collarettes are best observed on the upper eye lid when patients are looking down during the slit-lamp exam.

**Demodex folliculorum:** larger species of Demodex mite that burrows into eyelash follicles.

**Demodex brevis:** smaller species of Demodex mite that inhabits the sebaceous and meibomian glands.



A Demodex mite.

eyelash debris.

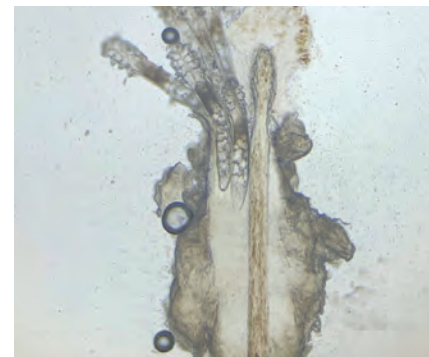
Many factors can be implicated in blepharitis, however studies exploring the association of blepharitis and Demodex infestation have shown a significant correlation between the two. In a meta-analysis of 13 controlled studies, it was reported that Demodex infestation occurs in 44.5 percent of blepharitis subjects versus 16.7 percent in normal controls (2). Biernat et al also reported that the prevalence of ocular Demodex infestation is significantly correlated with blepharitis (3).

Demodex mites are the most common ectoparasites found on humans. There are two species of Demodex – folliculorum and brevis – that live on the skin of the face and eyelids. The former burrows into eyelash follicles, and the later inhabits the sebaceous and meibomian glands (4,5). Although Demodex mites are common in

low numbers, an overpopulation or infestation of mites also called demodicosis is associated with blepharitis (6). Demodex infestation increases with age (3,7-9); present in 84 percent of patients 60 and older, and in nearly all patients by the time they reach 70 (8).

Recent observations reveal just how common Demodex infestation is. A multicenter, observational trial in eight ophthalmology and optometry practices quantified how many patients out of sequential patients presenting for any purpose, had collarettes, a pathognomonic sign of Demodex infestation (10). There were 1,121 patients examined and 58 percent had collarettes, meaning that as many as 25 million patients in the United States may have Demodex blepharitis (10).

Demodex mites contribute to blepharitis inflammation via mechanical,



Mite cluster.

chemical, and bacterial mechanisms (5). The overcrowded mites scrape the epithelial cell lining with their claws and lay eggs in the follicle causing follicular distention, misdirected lashes, madarosis, and irritation. Mites also excrete digestive enzymes as they feed and exude waste when they die, which causes inflammation, hyperemia, irritation, and epithelial hyperplasia. Lastly, bacteria living on the mite surface or in its gut cause inflammation of the surrounding ocular tissues. As the mites proliferate in this nutrient-rich environment, the partially digested epithelial cells, waste, and eggs form collarettes, sometimes referred to

*“Extrapolations  
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prevalence suggest  
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US adults may have  
blepharitis.”*





as cylindrical dandruff, visible at the base of the lashes. These collarettes are now recognized as pathognomonic for *Demodex* blepharitis (9,11).

Currently, there are no FDA-approved treatments for blepharitis caused by *Demodex* infestation. The American Academy of Ophthalmology Preferred Practice Pattern (PPP) for blepharitis suggests a combination of antibiotics, topical anti-inflammatory agents, and daily lid hygiene (1). While these therapies can help manage the symptoms, to get to the root cause of the disease, the mite must be eradicated.

The most common lid hygiene approach involves the use of scrubs, wipes, or gels containing tea tree oil (TTO) or its major acaricidal component, terpinen-4-ol (T4O). TTO and T4O products are made in a variety of concentrations and many have been tested. A majority of the studies, however, were small and not

placebo controlled (12-17), and a recent Cochrane review found mixed evidence of their efficacy (17). Other work reveals that TTO can be toxic to epithelial cells and fibroblasts (18-20).

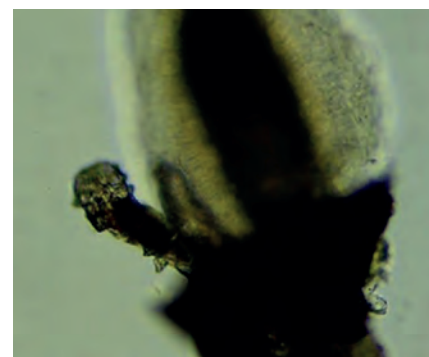
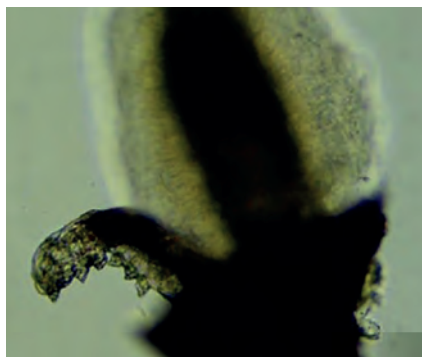
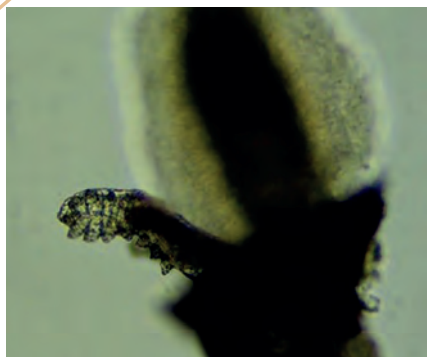
#### Clinical significance

Many of the symptoms of ocular surface diseases, whether it be MGD, DED, ocular allergies, or *Demodex* blepharitis, overlap. Like other inflammatory eye conditions, patients may have red eyes and feel discomfort, dryness, itching, or burning. Older patients in particular may not recognize or note any discomfort. Left unmanaged, *Demodex* blepharitis can lead to tear film instability with fluctuating and blurred vision, lid and lash abnormalities, inflammation of the conjunctiva and surrounding skin, suboptimal surgical outcomes, contact lens intolerance and reduced wear time, noticeable eye and eyelid erythema, and

a reduced quality of life. It is important for the clinician to ask specific questions to elicit more information and to screen for signs of the condition by initiating the key diagnostic steps.

To identify *Demodex* blepharitis, the physician should have the patient look down in order to examine the base of the lash on the upper lid. The upper lid is often overlooked and only partially visible when the patient is looking straight ahead. In that position, the base of the lashes is somewhat hidden and the collarettes present on the upper lid may be missed. Visualizing the lashes and the upper lid is key to the clinical exam.

Collarettes are the combination of partially digested epithelial cells, keratin, waste, and eggs that the mites leave in their wake. Typically found at the base of the lash, these collarettes can migrate up as the hair shaft grows. They appear as clear to whitish waxy cuffs encircling



A mite embedded within a collarette at the base of a lash. The images show a range of motion.

the base of the eyelashes on the upper lid. As mentioned earlier, the presence of collarettes is the sure sign of *Demodex* as they are known to be pathognomonic for *Demodex* infestation (9,11,21,22). It is therefore a straightforward diagnosis and does not require epilation and microscopic evaluation of eyelashes. Other signs include eyelash disorders, crusting and redness of the lid margin, and inflammation of the lid margin, conjunctiva, and cornea (blepharoconjunctivitis and blepharokeratitis).

I educate patients about *Demodex* mites and how they are highly prevalent on human skin. I explain that they have an overgrowth of the mites, that I identified by observing debris we call collarettes on the base of their lashes. I let them know that together we will develop a treatment plan. I also inform them that, in the near future, we hope to have a drop that eradicates *Demodex* mites.

#### Clinical approach

My treatment approach starts with teaching patients about lid hygiene, using lid scrubs, and washing the lashes, and I recommend various lid wipes that are available over the counter. For patients with extensive collarettes, I clean the biofilm from the lid margin and lashes using microblepharoexfoliation with a device like BlephEx (RySurg). In my

algorithm, the final step would be TTO. As mentioned earlier, it is not without its drawbacks, but there is some efficacy as well (23-25).

*Demodex* blepharitis patients may have an MGD component, which should be managed concurrently. In those cases, I use topical azithromycin or sometimes an antibiotic-steroid ointment such as Tobradex (tobramycin plus dexamethasone). I favor thermal pulsation to heat the lids and then express the glands. In cases of chronic MGD, I consider oral doxycycline. Doxycycline or minocycline is very effective for rosacea which often coexists in these patients as well.

Compliance with lid hygiene can be a challenge. When patients are more symptomatic, the more likely they are to adhere to their treatments. For many patients, the redness and other signs of *Demodex* blepharitis are a psychosocial concern, so I let them know that the more faithful they are to the lid hygiene protocol – morning and evening – the better their eyelids are going to look.

#### Changing the paradigm

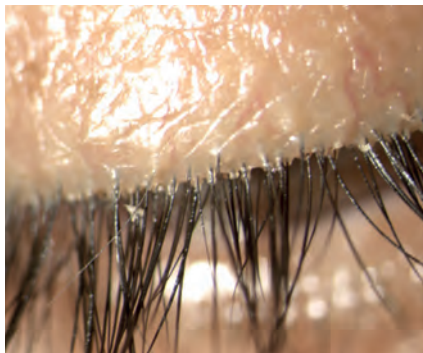
With dry eye, it took an FDA-approved prescription drug, and with MGD, enhanced diagnostic tools and approved treatment devices, to set in motion a sea change in our appreciation for these diseases. Now, we recognize their

prevalence, impact, and the importance of treatment to improve patient comfort, visual satisfaction, and overall quality of life. I see *Demodex* blepharitis as the next ocular surface disease to follow that trajectory. We have learned how prevalent it is and how to diagnose it based on evidence of collarettes. Soon, clinicians may have the first FDA-approved prescription drop specifically indicated for the treatment of *Demodex* blepharitis in their toolkit.

Tarsus Pharmaceuticals, Inc., is developing a novel therapeutic –TP-03 – based on the drug lotilaner. The new topical drop in development is designed to paralyze and eradicate *Demodex* mites through the inhibition of parasite-specific GABA-Cl channels (26). Preclinical, ex vivo testing demonstrated that lotilaner ophthalmic solution, 0.25% killed >95% of *Demodex* mites within 24 hours (27). The company has completed four Phase 2 clinical trials, two of which were randomized, controlled studies (28-30). Key efficacy endpoints for the first two, Phase 2a Mars and Phase 2b Jupiter (28,29) were collarette grade and mite density, and key efficacy endpoints for the next two, Phase 2a Io and Phase 2b Europa, included collarette cure rate (proportion of patients reaching 0-2 collarettes) and mite eradication rate (proportion of patients reaching 0



Collarettes.



mites) (30). TP-03 met its primary and secondary endpoints, and it was well tolerated throughout.

#### Clinical trials

Phase 2 studies Mars and Jupiter have shown TP-03 is well tolerated and effective at reducing collarettes and Demodex density with 28 days of treatment and maintaining results through 90 days (28,29). The two studies evaluated a total of 75 patients, showing statistically significant decreases in collarettes and Demodex density as early as day 14 of treatment. No treatment-related adverse events were observed, and patients reported the drop to be comfortable.

These results were further validated in the Phase 2a Io and the Phase 2b Europa studies that included a total of 72 patients (30,31). In the single-arm open-label trial Io, TP-03 was effective at achieving the primary and secondary endpoints, respectively, of collarette cure in 72 percent of participants and Demodex mite eradication in 78 percent of patients at day 42. The randomized vehicle-controlled Europa study achieved statistically significant results for the primary endpoint of collarette cure in 80 percent of participants on TP-03 compared to 16 percent on vehicle ( $P < .001$ ) at day 42, and the secondary endpoint of mite eradication

in 73 percent of participants on TP-03 compared to 21 percent on vehicle ( $P = .003$ ) at day 42. TP-03 was well tolerated and there were no reports of serious adverse events or treatment discontinuations due to adverse events in either study. Participants in Europa rated the eye drops as “neither comfortable nor uncomfortable,” “comfortable,” or “very comfortable” 87 percent of the time.

Tarsus is now evaluating TP-03 in two pivotal registration trials, Saturn-1 and Saturn-2, the former of which is underway (30). The company expects the data will support the potential submission of an NDA for TP-03 for the treatment of Demodex blepharitis, meaning TP-03 has the potential to be the first FDA-approved therapeutic for the treatment of Demodex blepharitis.

#### Next steps

Demodex blepharitis is a highly prevalent disease that has the potential to cause significant sequelae. The current treatments have some efficacy, but they but they are not validated and are often cumbersome, uncomfortable and do not target the root cause. Blepharoexfoliation – which needs to be repeated – is the most effective approach for patients with severe collarettes. Some patients who are very vigorous with their lid hygiene may be able to

*“This new treatment has the potential to be a first-line therapy for all clinicians.”*

keep their lids clean, but Demodex is a recurrent problem.

Based on the mite eradication and the collarette cure rate I have seen reported by Tarsus with TP-03, when available, the drop will move to my initial therapy. As I get clinical experience, I will decide if I need to add other treatments. Excellent efficacy was seen in the clinical trials with lotilaner 0.25% drops. This new treatment has the potential to be a first-line therapy for all clinicians.

*Ed Holland is Director of Cornea Services at Cincinnati Eye Institute and Professor of Ophthalmology at the University of Cincinnati, USA.*

*See references online at: [top.txp.to/the/next/big/thing](http://top.txp.to/the/next/big/thing)*



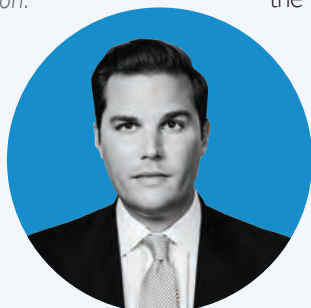
# Uncovering Ocular Comorbidity

## Using InflammDry® to diagnose pre-existing dry eye prior to refractive cataract surgery

Blake K. Williamson is a third-generation ophthalmologist at The Williamson Eye Center in Baton Rouge, LA, USA. He specializes in laser assisted cataract surgery with advanced IOLs and modern laser vision correction.

When considering InflammDry® (Quidel Corporation, San Diego, CA, USA) – the first commercially available, rapid result, in-office test that detects elevated levels of inflammatory marker MMP-9 – surgeons typically want an answer to a simple question: “How will MMP-9 testing change what I do?”

For Williamson, the role of MMP-9 testing is crucial – a positive test result indicates the need for pulsed steroids, preservative-free artificial tears, and cyclosporine. In short, MMP-9 positive equals steroids.



### Background

The patient is a healthy 60-year-old attorney who came to the clinic to discuss cataract surgery. She complained of tired eyes after long hours at work, but had no other ocular comorbidities. The patient desired freedom from bifocals and wanted to be able to see at distance without glasses. She was content to use reading glasses.

### Diagnosis

As part of our workup for all cataract surgeries, the patient received both osmolarity and MMP-9 testing, revealing the following:

- Positive MMP-9, indicating dry eye disease
- Mild cornea staining with trace inferior SPK
- Ocular surface disease revealed by corneal topography (see Figure 1)
- 2D irregular astigmatism at an axis of 6 degrees

### Intervention and treatment

A toric lens was considered, but ruled out due to concerns about how much of the patient's irregular cylinder was due to ocular surface changes. The patient was put

on a four-week course of loteprednol and cyclosporine, as well as preservative-free artificial tears.

### The role of MMP-9

When a patient is MMP-9 positive, both the magnitude and meridian of astigmatism will likely change from pre-op to post-ocular surface optimization, when the patient is ready for phacoemulsification. Clearly, MMP-9 testing is important – even in patients without dry eye symptoms, as many dry eye patients can be asymptomatic. In this patient case, if I had trusted the original topography, her astigmatism would have been overcorrected on the incorrect axis, and she would have been left with residual refractive error. And I would have been left with an unhappy patient.

### Patient outcome

After the four-week treatment plan, astigmatism had been reduced to 0.85 D at an axis of 66. Several serial topographies confirmed astigmatic stability, and the patient underwent successful femtosecond laser-assisted cataract surgery with a monofocal lens.

This case demonstrates the importance of optimizing the ocular surface prior to refractive cataract surgery. The patient now enjoys 20/20 uncorrected distance vision.

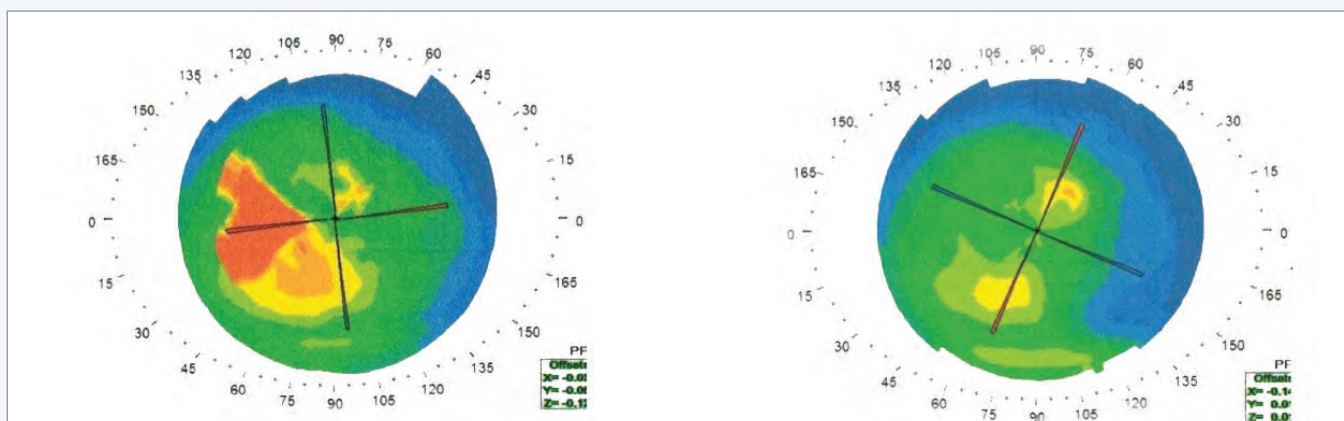


Figure 1. Corneal topography showing before (left) and after (right) treating with steroids and cyclosporine.

**NextGen**

*Research advances  
Experimental treatments  
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# Seeing – and Feeling – More

How can virtual reality simulations improve and standardize surgical training across the globe?

*Peter Rainger, Chief Learning Officer at FundamentalVR, has a very personal reason for pushing the company's involvement in ophthalmology (see final question). Here, he shares the story behind the technology and considers how VR could transform training for surgeons of all stripes.*



What's the FundamentalVR origin story in brief – and how did it get into the ophthalmic space?

Chris Scattergood and Richard Vincent started the company in 2014. They spotted an unmet need in the market for surgical simulations; the options at that time relied on expensive boxes that took up too much space and suffered high repair costs. Perhaps more importantly, they were not often useful to particular surgical specialties as there was insufficient variety among available simulations – and there was no option for easily growing the portfolio.

Early on, FundamentalVR brought in technologists from the virtual reality and gaming industries. We had a specific focus on haptics – the “technology of touch” – and developed a unique system: HapticVR; after all, users need to experience not only sights and sounds but also sensations for successful surgical skill acquisition, and in particular for building manual dexterity. Haptic cues are also helpful for physicians to practice clinical decision-making as they develop muscle memory, required for proficiency.

After originally focusing on orthopedics VR simulations, we started exploring other possibilities, landing on ophthalmology as one of the most exciting areas of precision medicine. It was also a great fit; the eye is highly complex and ophthalmic surgical procedures demand a great deal of training, but at the same time you're working with a rather small, contained anatomy, which works really well for our simulations. When we started working with Orbis International, the global vision charity, we realized how much potential our technology had on a global scale. We are now exploring other opportunities in the ophthalmic space, with the help of our global medical panel. We are looking for possibilities to solve various ophthalmic training needs and scale this project up to support surgical trainees worldwide.

How does virtual reality compare with working on models or enucleated eyes? It depends on the specific task and skill set required. Some pathologies are easier to model than others; some require different haptics or tissue modifications. But repeatability is certainly a big strength of virtual reality. You can also receive real-time feedback using objective measures, and focus specifically on the areas that need more deliberate, sustained practice. I can give you an example of an ophthalmic procedure we have been working on. It's an improved retinal procedure simulation that has been evaluated by 12 retinal surgery experts around the world. They told us that – in their view – this training method works so well that they are looking at reducing the use of wet labs, and introducing virtual reality simulations.

We see virtual reality as part of blended learning. There is space to combine online learning materials, such as lectures, videos of surgical cases, and even some physical models with virtual reality simulation, which provides repetitive opportunity to practice skills and rehearse scenarios without the need for resources. Using proprioception and developing muscle memory is a key component to being a successful surgeon, and virtual reality, particularly when combined with sophisticated haptics, can help develop that in a three-dimensional environment.

Our technology can be applied anywhere in the world, which is a big advantage for remote locations and surgeons training to work among underserved populations.

It's important to point out that technology is constantly changing and improving. The VR headset you tried on three years ago or a simulation you explored a year ago will be nothing like what you can experience now – or what it will be like in one or two more years' time. We produce regular updates, using machine learning to analyze data from systems already in use, enhancing and improving simulations all the time.

It's a great benefit of using software as a service – you always have access to the latest technology.

And presumably the COVID-19 pandemic puts an attractive spin on VR? Absolutely. Opportunities to observe and take part in real surgeries have been really limited in the past few months. We can provide a safe environment, without the need for classroom learning, meetings, and crowding operating rooms. Tissue-based wet lab training has been challenging to sustain since the COVID-19 pandemic started, so our system is a good alternative for ophthalmologists looking to hone their skills.

Before the pandemic, many people charged with training future surgeons saw simulation as useful, valuable and necessary, whereas now it is seen as an absolute necessity because of the lack of alternatives. People realize that, even when the current pandemic is over, the future is more uncertain than we'd imagined, and there is a need to invest in surgical simulations that can become a major aspect of training. COVID-19 has been a wake-up call for the industry; it became clear that the old ways of delivering training were not the most efficient ones. And other new benefits have come to light, such as standardization of techniques and practice, and setting clear patient safety records.

What's in the future for VR surgery simulations?

As I hinted above, I can see industrialized countries adopting VR as part of core surgical training within five years. We're planning to work closely with the industry to develop simulations for 10-20 percent of major procedures every year – an effort that can really help standardize surgical training in different parts of the world. The more embedded VR is in official residency programs, the more data we have to further improve training practices.

For low- and middle-income countries, the potential for using VR is huge – especially as equipment costs come down and as regular





Peter Rainger

laptops are able to run simulations. We need a range of consumer-ready scalable hardware technologies for which companies like ours can develop simulation software, which is made available as a license to large numbers of users.

Eventually, I would like to see surgical residents in all specialties having easy access to a VR headset at home, and a haptic VR system at their hospital or clinic, so they can work on developing their skills in their own time.

As new generations of surgeons come through their medical training, they'll be used to interactive and rich-media training elements. To them, VR might not have the same "wow" factor it might have for surgeons from previous generations, so it might be more natural for them to go straight to figuring out how this technology can help them hone their skills, learning from their mistakes in a safe way.

You mentioned the potential to level the playing field for residents from around the world...

That's right. We can accurately and objectively measure trainees' skills, which is the basis of a fair comparison. Using

these metrics, we have the capability to compare residency programs around the world. Access to training and expertise can be improved, with the possibility of bringing experts and KOLs virtually into every classroom and allowing trainees to work with them as if they were in the same room. Charities, societies and organizations can help make that happen. Another vital element is access to collaborative communication platforms, where surgeons can exchange their tips and outcomes.

For residents who currently do not have access to virtual reality simulations, we have a resident group email, where you can find out more about the training we already offer. We have a special surgical residents' advisory group as well as a global medical panel, with leaders across surgical specialties, including ophthalmology. Residents are encouraged to talk to institutions in charge of their training programs and ask them to check our portfolio of procedures, including the MICS simulation that we have recently released. There is also a clear role for industry to play in funding these simulations, so as to enable faster product adoption and use the precise measurement and auditable efficacy for data-driven compliance of their products.

*"It's important to point out that technology is constantly changing and improving."*

Finally, there is a personal reason behind your passion for improving ophthalmic care, tell us about that...

When I was 16, starting to work towards my final exams, I developed blurry vision, which was diagnosed as uveitis. I then realized I had cataracts, which at that age can be a sign of other diseases, including tumors. It turned out I had an overactive immune system. My cataracts matured very quickly, so I was soon severely visually impaired. When my first cataract was removed, it appeared my retina had detached. In the five years from age 16 to 21 I went through multiple surgeries. When I was at university, I took the position of officer for students with disabilities, and I got involved in campaigns for improved care and healthcare research. I became very interested in how technology can help students with disabilities, and I helped set up a national group of access centers for students with visual and hearing impairments. Since then, I have been educating professionals in various areas of healthcare. It is great to think that now, working with ophthalmic trainees, I can indirectly help patients in the same situation I was in as a teenager. I still remember losing my vision twice, being told that there was no guarantee I would regain my eyesight, wondering what my place in society would be. Now, from a senior position in medical research, I can pay forward the amazing care I received.

# WEEKLY NEWSLETTERS

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S U B S C R I B E



A professional headshot of a middle-aged man with short, dark hair, looking directly at the camera with a slight smile. He is wearing a dark suit jacket over a light blue and white checkered shirt and a dark red tie. The background is a soft, out-of-focus mix of light blue and white.

# Always Aiming Higher

Sitting Down With... Boris Malyugin,  
Professor of Ophthalmology and Deputy  
Director General at the S. Fyodorov  
Eye Microsurgery State Institution,  
Moscow, Russia



What inspired you to become an ophthalmologist?

I come from a medical family; my grandparents and parents were doctors. From early in my life, I knew I wanted to practice medicine, but I wasn't sure which specialty to choose. Every summer, I stayed at my grandmother's house in the countryside. She lost her eye when she was just 15 years old and my strongest memory of staying there is of her removing her glass eye. She would store it in a glass of liquid every evening and it obviously made a strong impression on a young mind. Perhaps this was part of my motivation to work with eyes. Surgery was an obvious choice for me – I like to work with my hands and see clear results in my work.

What was it like to be mentored by refractive surgery pioneer Svyatoslav Fyodorov?

When I first started in the cataract and corneal surgery department as a young doctor, I didn't have much contact with Fyodorov. He was like a god to us – unattainable; far in the distance. I trained under Zinaida Moroz (famous in Russia for her corneal work, including transplants) and I enthusiastically observed and took part in complicated surgeries. At the time, there were many opportunities for young ophthalmologists. Our teachers removed cataracts, implanted IOLs, and left the patients for us to do suturing. We did 15 of those cases a day so, after a couple of months, we were quite skilled. This helped me progress surgically in a very short time. Of course, this is no longer the case – there is a lot more regulation and residents are much more restricted. My younger colleagues have to put in much more time to get to that point.

As my surgical skills developed, Fyodorov noticed me and asked me to work with him. I started assisting with his surgeries and helping look after his

patients. He was enthusiastic about his work and full of ideas that he was willing to share with his younger colleagues. It was a very interesting time, with great advancements in IOLs, glaucoma, cataract surgery, corneal transplants... New materials, such as silicone and hydrogel, were starting to be used. We didn't know a lot of things about the anterior segment that we do now, but it was truly exciting work.

What do you need most to progress in your career – is it innate ability, hard work, or the right training?

It's a combination of these things, but the right mentor can motivate you and serve as a role model. Encouragement from them to explore the profession in depth is invaluable to a young person at the start of their career. The clinic's environment is also crucial – motivation to do research, ask questions, and challenge senior colleagues helps to grow great doctors. Clinics that consider younger physicians inferior are not conducive to such growth.

Young ophthalmologists often have interesting views, and it's important for them to feel like they can express those views freely. Experienced physicians should not take their junior colleagues for granted. As doctors, we must challenge the reality around us and strive to be better and do better.

You have designed surgical devices. How did you become an inventor?

A great thing about working at my clinic is that I have had access to manufacturing facilities. With the boom in new devices, lenses, and materials at the start of my career, it was easy to implement new ideas I had into my clinical practice. There was less regulation, so it was much easier then than it is now. The creative, innovative atmosphere at the clinic really helped me try different things, share ideas, and develop new devices.

What do you find inspiring these days?

When surgeons get really good results, they get great emotional feedback from the patient. It results in a huge endorphin rush that you want to repeat. You get "addicted" to it and you crave these positive emotions. This feeling drives most surgeons to keep going, getting better, and doing a great job every time.

These days, I'm not only a surgeon; I also supervise scientific research in the clinic. I try to identify potential areas for improvement and gaps in care and available solutions – whether it is a new IOL, a new suturing or surgery technique, or a new diagnostic. I encourage younger colleagues to work on addressing these unmet needs. It's a very important part of my current activities – identifying existing solutions that we haven't implemented yet.

How do you see your subspecialty changing in the future?

There are exciting frontiers on the horizon of refractive surgery, such as changing the refractive index of the cornea using lasers. Modifying the IOL after implantation is a great way to fine-tune the refractive result we can achieve. In the future, a lot of our work will be done by computers, so the physician's role will be very different. In diagnostics, there will be no need for physical contact between an ophthalmologist and a patient during an exam – it will all be done by machines. They can visualize subtle defects so much better than the human eye can! Robotics and semi-automatic systems are coming into surgery so, at some point, the role of the surgeon will also look very different. It has already happened to a large extent in other surgical specialties and it's coming to ophthalmology, too. An ophthalmologist's reality will be very different in a decade or two – but no less interesting! Knowing more about genetics will give us an even better understanding of many diseases. It will result in better outcomes for patients and for doctors, which makes me very excited.



Frank Bucci



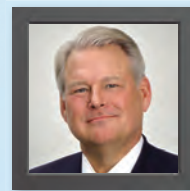
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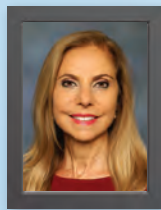
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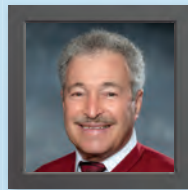
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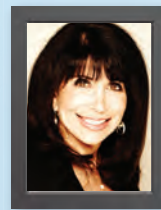
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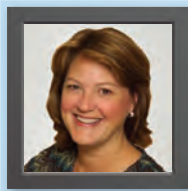
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**References:** 1. Omeros survey data on file. 2. OMIDRIA [package insert]. Seattle, WA: Omeros Corporation; 2017. 3. Al-Hashimi S, Donaldson K, Davidson R, et al; for ASCRS Refractive Cataract Surgery Subcommittee. Medical and surgical management of the small pupil during cataract surgery. *J Cataract Refract Surg*. 2018;44:1032-1041.

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