JUNE 2020 # 45

the Ophthalmologist™

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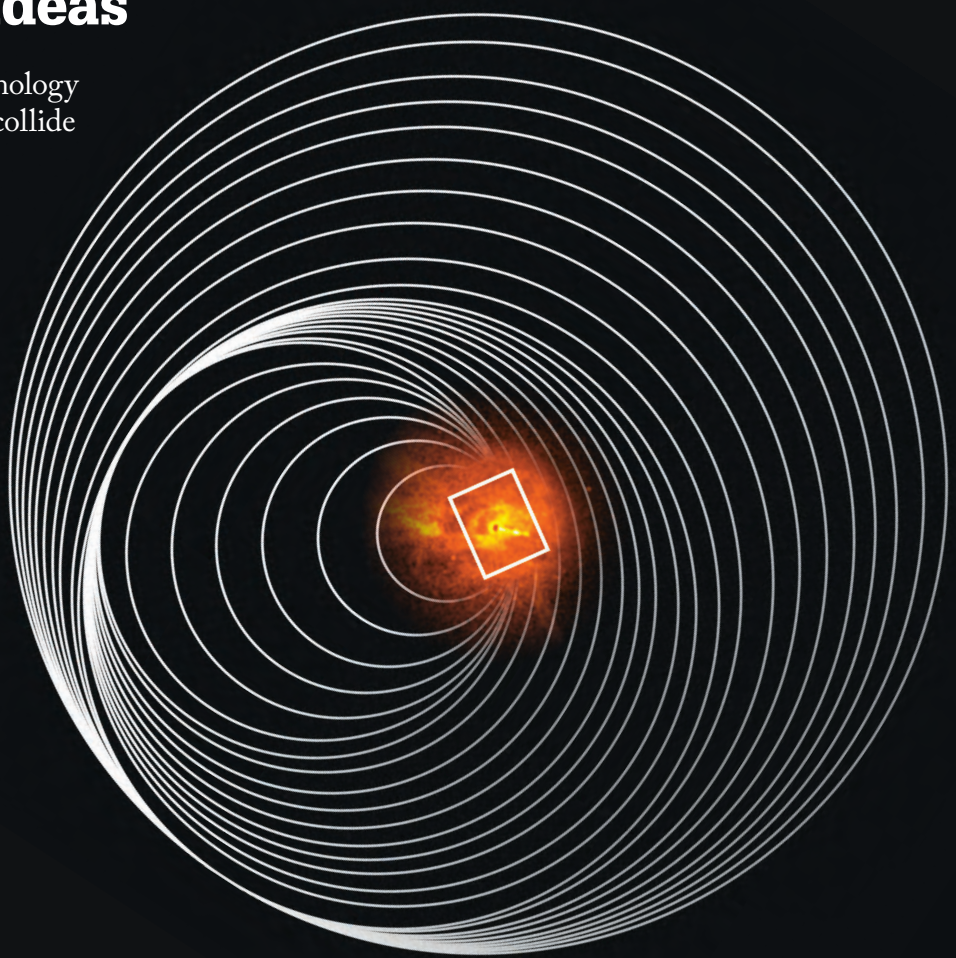

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Dextenza®
(dexamethasone ophthalmic insert) 0.4 mg
for intracanalicular use

A DOSE OF CONFIDENCE GOES A LONG WAY.

Once you're back to caring for patients, they'll appreciate that one DEXTENZA insert gives them their post-op ophthalmic steroid dose, completely hands-free.[1,2]

DEXTENZA is designed to:

- Allow for physician-controlled administration[1]
- Provide preservative-free, sustained coverage for up to 30 days[2]

INDICATION

DEXTENZA is a corticosteroid indicated for the treatment of ocular inflammation and pain following ophthalmic surgery.

IMPORTANT SAFETY INFORMATION

CONTRAINDICATIONS

DEXTENZA is contraindicated in patients with active corneal, conjunctival or canalicular infections, including epithelial herpes simplex keratitis (dendritic keratitis), vaccinia, varicella; mycobacterial infections; fungal diseases of the eye, and dacryocystitis.

WARNINGS AND PRECAUTIONS

Prolonged use of corticosteroids may result in glaucoma with damage to the optic nerve, defects in visual acuity and fields of vision. Steroids should be used with caution in the presence of glaucoma. Intraocular pressure should be monitored during treatment.

Corticosteroids may suppress the host response and thus increase the hazard for secondary ocular infections. In acute purulent conditions, steroids may mask infection and enhance existing infection.

Use of ocular steroids may prolong the course and may exacerbate the severity of many viral infections of the eye (including herpes simplex).

Fungus invasion must be considered in any persistent corneal ulceration where a steroid has been used or is in use. Fungal culture should be taken when appropriate.

Use of steroids after cataract surgery may delay healing and increase the incidence of bleb formation.

ADVERSE REACTIONS

The most common ocular adverse reactions that occurred in patients treated with DEXTENZA were: anterior chamber inflammation including iritis and iridocyclitis (10%); intraocular pressure increased (6%); visual acuity reduced (2%); cystoid macular edema (1%); corneal edema (1%); eye pain (1%) and conjunctival hyperemia (1%).

The most common non-ocular adverse reaction that occurred in patients treated with DEXTENZA was headache (1%).

Please see brief summary of full Prescribing Information on adjacent page.

References: 1. Sawhney AS, Jarrett P, Bassett M, Blizzard C, inventors; Incept, LLC, assignee. Drug delivery through hydrogel plugs. US patent 8,409,606 B2. April 2, 2013. **2.** DEXTENZA [package insert]. Bedford. MA: Ocular Therapeutlx, Inc: 2019.

Ocular Therapeutix™

Dextenza®

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for intracanalicular use

BRIEF SUMMARY: Please see the DEXTENZA Package Insert for full prescribing information for DEXTENZA (06/2019)

1 INDICATIONS AND USAGE

DEXTENZA® (dexamethasone ophthalmic insert) is a corticosteroid indicated for the treatment of ocular inflammation and pain following ophthalmic surgery.

4 CONTRAINDICATIONS

DEXTENZA is contraindicated in patients with active corneal, conjunctival or canalicular infections, including epithelial herpes simplex keratitis (dendritic keratitis), vaccinia, varicella; mycobacterial infections; fungal diseases of the eye, and dacryocystitis.

5 WARNINGS AND PRECAUTIONS

5.1 Intraocular Pressure Increase

Prolonged use of corticosteroids may result in glaucoma with damage to the optic nerve, defects in visual acuity and fields of vision. Steroids should be used with caution in the presence of glaucoma. Intraocular pressure should be monitored during the course of
the treatment.

5.2 Bacterial Infection

Corticosteroids may suppress the host response and thus increase the hazard for secondary ocular infections. In acute purulent conditions, steroids may mask infection and enhance existing infection *[see Contraindications (4)]*.

5.3 Viral Infections

Use of ocular steroids may prolong the course and may exacerbate the severity of many viral infections of the eye (including herpes simplex) *[see Contraindications (4)]*.

5.4 Fungal Infections

Fungus invasion must be considered in any persistent corneal ulceration where a steroid has been used or is in use. Fungal culture should be taken when appropriate *[see Contraindications (4)]*.

5.5 Delayed Healing

The use of steroids after cataract surgery may delay healing and increase the incidence of bleb formation.

6 ADVERSE REACTIONS

The following serious adverse reactions are described elsewhere in the labeling:

- Intraocular Pressure Increase *[see Warnings and Precautions (5.1)]*
- Bacterial Infection *[see Warnings and Precautions (5.2)]*
- Viral Infection *[see Warnings and Precautions (5.3)]*
- Fungal Infection *[see Warnings and Precautions (5.4)]*
- Delayed Healing *[see Warnings and Precautions (5.5)]*

6.1 Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice. Adverse reactions associated with ophthalmic steroids include elevated intraocular pressure, which may be associated with optic nerve damage, visual acuity and field defects, posterior subcapsular cataract formation; delayed wound healing; secondary ocular infection from pathogens including herpes simplex, and perforation of the globe where there is thinning of the cornea or sclera *[see Warnings and Precautions (5)]*.

DEXTENZA was studied in four randomized, vehicle-controlled studies (n = 567). The mean age of the population was 68 years (range 35 to 87 years), 59% were female, and 83% were white. Forty-seven percent had brown iris color and 30% had blue iris color. The most common ocular adverse reactions that occurred in patients treated with DEXTENZA were: anterior chamber inflammation including iritis and iridocyclitis (10%); intraocular pressure increased (6%); visual acuity reduced (2%); cystoid macular edema (1%); corneal edema (1%); eye pain (1%) and conjunctival hyperemia (1%).

The most common non-ocular adverse reaction that occurred in patients treated with DEXTENZA was headache (1%).

8 USE IN SPECIFIC POPULATIONS

8.1 Pregnancy

Risk Summary

There are no adequate or well-controlled studies with DEXTENZA in pregnant women to inform a drug-associated risk for major birth defects and miscarriage. In animal reproduction studies, administration of topical ocular dexamethasone to pregnant mice and rabbits during organogenesis produced embryofetal lethality, cleft palate and multiple visceral malformations *[see Animal Data]*.

Data

Animal Data

Topical ocular administration of 0.15% dexamethasone (0.75 mg/kg/day) on gestational days 10 to 13 produced embryofetal lethality and a high incidence of cleft palate in a mouse study. A daily dose of 0.75 mg/kg/day in the mouse is approximately 5 times the entire dose of dexamethasone in the DEXTENZA product, on a mg/m^2 basis. In a rabbit study, topical ocular administration of 0.1% dexamethasone throughout organogenesis (0.36 mg /day, on gestational day 6 followed by 0.24 mg/day on gestational days 7-18) produced intestinal anomalies, intestinal aplasia, gastroschisis and hypoplastic kidneys. A daily dose of 0.24 mg/day is approximately 6 times the entire dose of dexamethasone in the DEXTENZA product,
on a mg/m^2 basis.

8.2 Lactation

Systemically administered corticosteroids appear in human milk and could suppress growth and interfere with endogenous corticosteroid production; however the systemic concentration of dexamethasone following administration of DEXTENZA is low *[see Clinical Pharmacology (12.3)]*. There is no information regarding the presence of DEXTENZA in human milk, the effects of the drug on the breastfed infant or the effects of the drug on milk production to inform risk of DEXTENZA to an infant during lactation. The developmental and health benefits of breastfeeding should be considered along with the mother's clinical need for DEXTENZA and any potential adverse effects on the breastfed child from DEXTENZA.

8.4 Pediatric Use

Safety and effectiveness in pediatric patients have not been established.

8.5 Geriatric Use

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

17 PATIENT COUNSELING INFORMATION

Advise patients to consult their surgeon if pain, redness, or itching develops.

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PP-US-DX-0072-V2

Special congratulations

to the CorneaGen Medical Advisory Board members recognized on this year's Power List

John Berdahl, M.D.

Eric Donnenfeld, M.D.

Terry Kim, M.D.

Richard Lindstrom, M.D.

Elizabeth Yeu, M.D.

The CorneaGen team thanks all the incredible physicians on our Medical Advisory Board for their leadership, passion, and help as we craft the future of cornea care.

Learn more at **CorneaGen.com**

CorneaGen™

A Woman's Work

It is time we recognized ophthalmology's most influential women – starting with our 2021 Power List...

Lockdown invites reflection. Over the last two months, I have spent a lot of time thinking, my mind often wandering to the halcyon days "before COVID-19." It is easy to romanticize the past when the present is uncertain. But it would be naive to pretend things were perfect before SARS-CoV-2 changed our lives. The pandemic has exposed inequalities in our society and confirmed what we have always known – that life is not always fair.

Crises remind us that, though we may (sometimes) feel like masters of our destiny, there is much we cannot control – and perhaps that's why so many of us are turning our attention to things we can: exercise, volunteering, baking... At The Ophthalmologist, it has also meant looking elsewhere. You may know that we are currently an all-female editorial team – and it has been disappointing for us to see so few women on the Power List. We always strive to make content as representative as possible, reflecting the diversity of the specialty – but somehow our Power Lists fall short when it comes to gender parity. Every year, we ask for our readers to nominate their most extraordinary peers. Every year, the list is published and we are again asked: where are the women?

For seven years, we have left it up to the ophthalmology community and independent judges to decide who makes the list. But, for reasons simple and complicated, the Top 100 is always dominated by men. In 2014, there were 13 women on the list, a result repeated in 2018. In 2020 – there are 17, with just one in the Top 10. And that is why we have now decided to address the issue directly. In 2021, the Power List will take on a singular focus: The Top 50 Women in Ophthalmology. We hope that our efforts are not seen as tokenism or condescension, but rather an attempt to balance the scales – necessary until meritocracy becomes more practice than theory. We look forward to receiving your nominations.

If history has taught us anything, it is that this current crisis will pass and the world will be changed. We may not have a say in when, but we have some control in how. Let us play our part – however small – in making it fairer.

Phoebe Harkin
Deputy Editor

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What do ophthalmology and astronomy have in common? Credit for the central part of the image: NASA/CXC/Villanova University/J. Neilsen

the Ophthalmologist

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Upfront

Research
Innovation
Trends

Short-Sighted Control

A new literature analysis evaluates myopia management strategies

In a recent review – "Myopia Control 2020: Where Are We and Where Are We Heading?" – Mark Bullimore and Kathryn Richdale of the College of Optometry, University of Houston, Texas, comprehensively explore the efficacy and safety of various behavioral, pharmaceutical, and optical approaches (1). Moreover, the two professors address when to stop or modify treatments.

Reviewing key studies from the last two decades, the authors note that a lot has changed since the publication of the Cochrane review in 2011 (2). Indeed, their analysis covers a lot of ground, including the most important papers on progressive addition spectacle lenses (PALS), pharmaceutical solutions such as atropine, overnight orthokeratology, and soft contact lenses. Children's age, ethnicity, parental myopia history, and other criteria are all explored when offering recommendations on appropriate implementation of myopia control.

Future predictions for myopia management point to the importance of creating a continuum of care, starting with preventive measures, which can help delay onset, followed by optical and pharmaceutical approaches slowing progression.

Bullimore and Richdale stated in the review: "Myopia has functional consequences in terms of reliance on optical or surgical correction, and an accompanying economic burden. Furthermore, increasing levels of myopia are associated with higher risk of ocular disease, some of which is untreatable."

Overall, the authors hope the open-access paper offers practical advice to help eyecare practitioners follow the latest evidence-based research when managing pediatric patients – advice that may be crucial given the increasing global prevalence of myopia (3).

References

1. *MA Bullimore, K Richdale, "Myopia Control 2020: Where are we and where are we heading?", Ophthalmic Physiol Opt, 40, 254 (2020). PMID: 32338775.*
2. *JJ Walline et al., "Interventions to slow progression of myopia in children", Cochrane Database Syst Rev, 7 (2011). PMID: 22161388.*
3. *BA Holden et al., "Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050", Ophthalmology, 123, 1036 (2016). PMID: 26875007.*

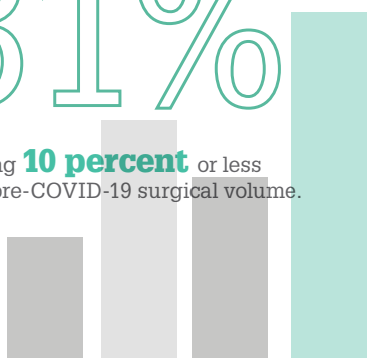
INFOGRAPHIC

Bend or Break

The pandemic's impact on US private practice

95%
of practices in the US are seeing
25%
or less of their pre-COVID-19 patient volume

81%
are seeing **10 percent** or less of their pre-COVID-19 surgical volume.



BUSINESS IN BRIEF

The latest industry news, appointments, mergers and acquisitions – in 50 words or less

- John M. Nolan, Professor at the Nutrition Research Centre Ireland, has received the Heidelberg Engineering Xtreme Research Award 2020. The award was given in recognition of his work on macular pigment for vision health and function, and as a biomarker for brain nutrition.
- Biotech company jCyte Inc has entered into a licensing agreement with Santen Pharmaceutical to develop and commercialize its first-in-class, investigational therapy for rare degenerative retinal disease retinitis pigmentosa. The treatment – jCell – will be available to patients in Europe and Asia.
- After almost four years at Avedro, Rajesh Rajpal has joined Johnson & Johnson Vision as chief medical officer. Rajpal said: "I am looking forward to guiding and contributing to the continued development of leading-edge products and technology that clinicians [...] can use to provide the highest level of care to patients globally."
- Kala Pharmaceuticals has resubmitted its NDA for EYSUVIS, a product candidate for the short-term treatment of the signs and symptoms of dry eye disease based on the positive results from STRIDE 3 and previous clinical trials.
- CorneaGen has named David Rostov its new chief financial officer. Rostov has more than 20 years of C-suite experience in scaling, mergers and acquisitions, and corporate fundraising, and is eager to help the company in its mission to eliminate corneal blindness by 2040.
- Accelmed Partners II has entered into a definitive agreement pursuant to acquiring ocular surface specialist, TearLab Corporation. AP-II has agreed to an investment of $25 million, provided the company delist from the "over the counter" OTCQB market.

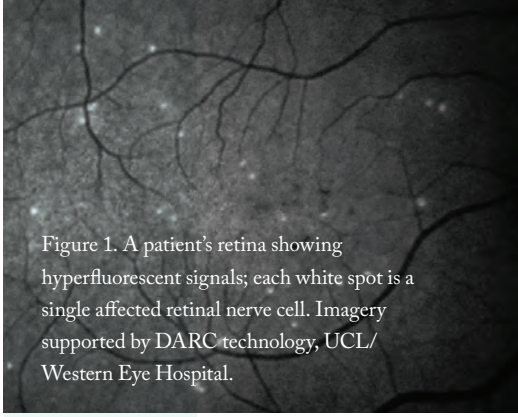


Figure 1. A patient's retina showing hyperfluorescent signals; each white spot is a single affected retinal nerve cell. Imagery supported by DARC technology, UCL/ Western Eye Hospital.

Early Days

The AI algorithm that can detect glaucomatous damage in retinal scans

How useful would it be to have a test capable of picking up signs of glaucoma even 18 months earlier than with current methods, such as OCT? A new way of visualizing retinal cells, called DARC (Detection-of-Apoptosing-Retinal-Cells), developed as part of a clinical trial sponsored by the UCL Institute of Ophthalmology in London, UK, uses a fluorescent dye to illuminate cells in the process of apoptosis. Then, an AI-aided algorithm analyzes patients' retinal scans and refers those with higher DARC counts for further diagnosis. The trial found a significantly raised DARC number in patients who later progressed. The new method could also be used to test patients with AMD, as well as other neurodegenerative diseases.

Reference

1. *EM Normando et al., Expert Rev Mol Diagn, [Epub ahead of print] (2020). PMID: 32310684.*

AAO MEMBERS BELIEVE THAT THE MAJORITY OF THEIR PRE-COVID PATIENT VOLUME WILL NOT BE BILLABLE AS TELEMEDICINE SERVICES.

- **37%** indicated none of their patient volume can be handled through telemedicine and be billable
- **61%** indicated **10%** or less of their patient volume can be converted to telemedicine and be billable

Practices anticipate being closed

3 TO 5
MONTHS

and have concerns about when and how they will be able to resume patient care.

89%

of practices have applied for payroll protection.

Source: AAO (2020).

Under the Lid

Bringing clarity to the mechanisms behind AMD

Researchers have shed new light on the link between type 1 choroidal neovascularization (CNV) and the localized progression of atrophy in AMD. The team from the University of Bonn, Germany, analyzed a total of 98 eyes subdivided into three categories: RPE atrophy with treatment-naive quiescent CNV, RPE atrophy with a history of exudative CNV, and RPE atrophy without evidence of coexisting CNV. In the study, odds for future RPE atrophy were reduced by a factor of 0.21 in the presence of treatment-naïve quiescent type 1 CNV and 0.46 in the presence of exudative Type 1 CNV. Atrophy was delineated on the basis of serial fundus-autofluorescence and infrared-reflectance images, with researchers finding markedly reduced RPE atrophy progression in areas co-localizing with type 1 CNV.

The takeaway? Type 1 CNV may have a protective effect on the RPE. Study author Monika Fleckenstein from the University of Bonn, Germany, and the University of Utah, Salt Lake City, USA, says that the findings are another step towards understanding the mechanisms behind AMD: "It is not a new concept that the development of 'neovascularization' may represent a 'rescue' mechanism of the body. What we have learned in the past is that not all new vessels leak and not all leakage is equally harmful. However, we are only beginning to understand all the underlying mechanisms and their consequences." She goes on: "We need to better understand the consequences of new vessel ingrowths in AMD, in general. To keep new vessel leakage in check by means of anti-VEGF is certainly an essential component in the concept of a protective effect of neovascularization." Fleckenstein and her team are currently analyzing morphological and systemic factors with a potential impact on this protective effect in a large patient cohort at the Moran Eye Center, University of Utah, with the hope of refining our understanding of neovascularization in AMD and supporting the development of innovative therapeutic approaches.

Reference

1. *M Pfau et al., Ophthalmol Retina, 4, 238 (2020). PMID: 31753808.*

Root of the Problem

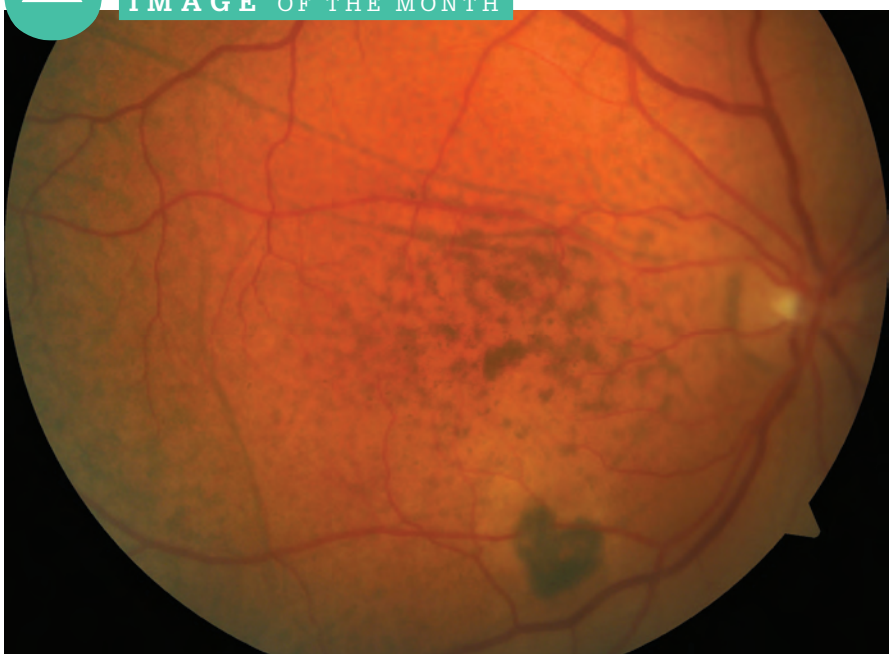
Researchers uncover potential drug target in Sjögren's syndrome

A study has uncovered a potential therapeutic target for one of ophthalmology's most unusual conditions: Sjögren's syndrome. Most common in women between the ages of 40 and 60, the disease sees the exocrine glands become infiltrated with lymphocytes, instigating severe damage to the salivary and lacrimal glands. The researchers compared samples from patients with Sjögren's syndrome and healthy controls, and found that those with the condition had abnormally high levels of microRNA-744 – a molecule blocking the production of anti-inflammatory mediator Pellino3 (PELI3). By downregulating microRNA-744 expression, the researchers were able to reduce ocular inflammation. "Our research provides the opportunity to treat the root cause of the disease, rather than just the symptoms," said co-author Joan Ní Gabhann-Dromgoole, Senior Scientist at the Royal College of Surgeons in Dublin, Ireland.

Reference

1. *Q Pilson et al., Nature, 10, 7484 (2020). PMID: 32366870.*

IMAGE OF THE MONTH



From Fundus with Love

This month's image – a fundus view of an eye with primary intraocular lymphoma (PIOL) – shows alterations at the retinal pigment epithelium (RPE) level, with fine to coarse clumping of pigment epithelium.

Credit: Maselos Stelios, Ophthalmologist, Ocular Inflammation Medical Center, Greece.

Would you like your photo featured in Image of the Month? Send it to edit@theophthalmologist.com

QUOTE OF THE MONTH

"We've made the difficult decision to ground the Orbis Flying Eye Hospital for the remainder of 2020. Despite this setback, we're finding ways to work effectively with the local eye health professionals we support, equipping them with the resources they need to save and restore vision in their communities."

Rebecca Cronin, Chief Executive of Orbis UK

Bulge, Begone

An end to thyroid-related eye bulging?

Thyroid eye disease is rare, but its effects are significant. The condition is associated with outward bulging of the eye and can cause eye pain, double vision, and light sensitivity, which can be severe enough to affect daily activities. But there is hope. Teprotumumab has become the first FDA-approved medicine for thyroid eye disease after a study found that it improves eye bulging, regardless of patient gender, age, or smoking status. Researchers analyzed data from 170 patients with thyroid eye disease, over two 24-week studies. The combined results from the two studies showed that 77.4 percent of patients had a reduction in eye bulging, compared with 14.9 percent of those receiving a placebo. In new data that was to be presented at a now-canceled endocrinology conference in March, the researchers also looked at whether patients' gender, smoking status, and age influenced the drug's response rate. At week 24, significantly more patients receiving teprotumumab had significant improvements in their eye bulging compared with those who received a placebo, regardless of these outside factors.

Reference

1. *U.S. Food & Drug (2020). Available at: https://bit.ly/2LE7bvV.*
2. *Horizon (2020). Available at: https://bit.ly/2zwL5Jl.*

In My View

Experts from across the world share a single strongly held opinion or key idea.

Education Without Borders

From the podium to the webinar platform: providing access to learning for everyone

By Farhad Hafezi, Professor of Ophthalmology at the University of Geneva, Switzerland; Research Group Leader at the CABMM of the University of Zurich, Switzerland; Chief Medical Officer of the ELZA Institute, Zurich, Switzerland; Adjunct Clinical Professor of Ophthalmology at the USC Roski Eye Institute, Los Angeles, USA; and Visiting Professor at the Wenzhou Medical University, Wenzhou, China

The COVID-19 lockdown introduced a new term for many: "social distancing" – a phrase that is now used and understood in every household. Social distancing is abnormal behavior for human beings. However, we as humans have quickly evolved, at least in terms of communication; in other words, we're a pragmatic species, and thus, social interaction has continued online – indeed, the phrase physical distancing is perhaps more appropriate. The same thought holds true when it comes to medical education. In the absence of conferences and live congress exhibitions, we turned our attention and efforts to webinars.

Webinars (and the replay of pre-recorded presentations) have, for a long time, formed an important part of medical education. But, in these surreal times, they have become the centerpiece. Comparing the physical podium to the "online version," the work and time needed to individualize each of my presentations to meet the demands and expectations of my audience remain the same. The only apparent differences are that I am not jet-lagged, I can wear Levi's while presenting, and I am now reaching several hundreds of new people for each and every talk.

However, some webinar challenges will only be overcome over time. Though feedback from the audience instantly appears on the screen, getting acquainted with this whole new multi-tasking process is not easy – especially if you are a moderator; you may need to not only listen to the talks, be able to propose provocative questions to stimulate discussion among the panelists, but also prioritize and sort questions that are streaming in from the audience. But there is also a positive: I find that many more questions are submitted in the webinar format compared with the congress hall, possibly because it is easier to type a question than publicly speak...

One of the benefits of speaking at and participating in congresses is the time spent discussing with the other speakers after each session; in a virtual meeting, these conversations tend not to happen. In other words, you do not get the chance to casually catch friends and colleagues in-between speaking and meeting obligations, like at a congress. But, despite these missed fringe benefits, the overarching goal of sharing knowledge works.

If we look back only six months ago, attending congresses was already difficult for colleagues from war-torn countries, and even to young ophthalmologists due to visa restrictions or financial burdens. Now, the whole world is facing similar difficulties; all congresses have been canceled, and travel bans are enforced regardless of what passport you hold.

As a result of the travel and social restrictions, many of us have worked together to build a platform to enable access to education. Colleagues, who otherwise would not have the chance to attend these national and international meetings under "normal" circumstances, now have a chance to participate because these webinars are (mostly) free of charge, require minimal infrastructure, do not require a travel visa, can be watched at the participant's leisure, and scheduled at times to be convenient for colleagues to participate.

Therefore, I am determined and dedicated to continuing to provide free online education courses in my area of specialty because – once the travel bans are lifted – we should not forget how difficult it was before. The restrictions that we are all currently experiencing are limitations that other colleagues have faced, and will continue to face for decades. Our less fortunate colleagues should have access to high-level education despite financial burdens or political restrictions. With the current hype in webinars, I am very curious to see what the post-COVID-19 ophthalmic education world will look like.

PPE, or Not PPE...

With guidelines unclear, we must each decide how best to protect our patients – and ourselves

By Daniel Ting, Vitreoretinal Specialist at the Singapore National Eye Center, Assistant Professor of Ophthalmology at Duke-NUS Medical School, Singapore, and Adjunct Professor at the State Key Laboratory of Ophthalmology at Zhongshan Ophthalmic Center in China

With a vaccine out of reach – for now – plans to minimize the spread of COVID-19 focus, by necessity, on prevention. Whether in the community or in the healthcare environment, performance of regular hand hygiene, avoidance of touching the eyes, nose and mouth, and maintenance of social distancing of at least one meter, form the basis of current preventative measures. When taking care of patients, healthcare workers may require additional personal protective equipment (PPE) – a subject that has come under much scrutiny in recent weeks. In the case of a suspected or confirmed COVID-19 patient, or a patient with respiratory symptoms, the WHO's advisory guidelines suggest the use of a medical mask, gown, gloves, and eye protection, such as goggles or face shield. Unfortunately, when caring for patients with no respiratory symptoms, the guidelines become less clear, simply stating to use PPE "according to risk assessment."

As an ophthalmological examination may often involve contact with the patient's eyes, frequent hand hygiene in between seeing patients and avoidance of contact with mucous membranes are necessary. Alternatively, lifting of the eyelid could be performed using orange sticks or long cotton buds to avoid direct contact with the ocular surface. With ophthalmologists' close proximity to patients during physical examination, the decision to wear a mask is dependent on the rigor of screening for respiratory symptoms before consultation, patients' transparent disclosure of symptoms, patients' compliance to mask-wearing if symptomatic, and availability of slit-lamp breath shields, whilst also recognizing that asymptomatic spread occurs. Thus, consideration has to be made on an institutional and case-by-case basis, with the understanding of resource stewardship.

In a randomized control trial, the effectiveness of N95 respirators was found to be comparable with medical masks in preventing laboratory-confirmed influenza in an outpatient setting (1). To minimize transmission to patients, the AAO has advised that ophthalmologists postpone non-urgent outpatient visits and procedures, encouraging patients at-risk of COVID-19 to avoid entering the outpatient setting and to seek appropriate help in a hospital-based facility. This advice is consistent with that from the UK's Royal College of Ophthalmologists, which also highlights the need to minimize the duration of examinations, as well as prolonged treatments such as pan-retinal photocoagulation.

"Despite the fear perpetuated by the increasing number of cases and deaths, this period of adversity has demonstrated our humanity."

But despite the fear perpetuated by the increasing number of cases and deaths, this period of adversity has demonstrated our humanity. We see countries providing reciprocal aid. And research groups collaborate on the development of treatment and vaccines. Meanwhile, the outbreak will naturally follow a course of peak and decline, as evidenced by the decrease in the number of new cases in China in March. Minimizing deaths, therefore, will depend on individual precautionary measures, national-driven policies to identify, isolate, and reduce the spread within community and at-risk groups, and, ultimately, the healthcare sectors' resources and resilience.

Reference

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Charity Versus COVID-19

How the outbreak has affected the activities of organizations trying to save sight

By Kola Ogundimu, Senior Global Technical Lead at Sightsavers, based in Abuja, Nigeria.

My personal and professional life in Nigeria has changed drastically since COVID-19 became a part of it. As with other African countries, the threat raised the spectre of massively overwhelmed health systems, huge morbidity and mortality rates, leading to panic and major social upheaval. As people in Nigeria's largest city, Lagos, and the capital, Abuja, began getting ill with COVID-19 and as community transmission became evident, steps had to be taken to minimize the scale and impact of the coming tide. The government-enforced lockdown began in March and I, like millions of people in Nigeria and all over the world, have since been working from home. I also had the personal challenge of quickly gathering my family together (scattered over four cities in three states at the time), in addition to preparing for the lockdown, and getting various projects ready for suspension of activities. Since then, I have been helping to manage the impact of the pandemic on Sightsavers' eye health programs.

Meanwhile, we continue with all activities possible without travel, field work or direct contact with people. And Sightsavers is as busy as ever! It has been interesting to see and hear how we are all coping with the challenges. From Internet glitches due to excessive residential demand, to stocking up on groceries, to trying to keep youngsters happy and occupied for days on end at home. A photo of a cat lying down on a table, partly covering a colleague's laptop says it all; apparently, the family pet got fed up, jumped on the table and asserted her "right" to the place. It seems it had been the cat's favorite afternoon nap spot, now being used by the owner as a worktable. And the cat was ready to challenge it!

The COVID-19 situation is truly unprecedented. There have been pandemics before, (and we won't truly know how this one compares until it is over), but never has mankind locked down so many people and so many economies simultaneously. The sheer scale of it has reached across all of our work in over 30 countries in Africa and Asia. It does have some parallels to our experience in the geographically more limited, but locally devastating, 2014–2016 Ebola outbreak in West Africa, and we have been able to adapt some of our learnings to the current crisis. Just as it was then, our focus has been on doing everything we can to put our resources, program management experience, and expertise at the disposal of states, partners, and ministries of health to support their response to COVID-19. We are reviewing protective equipment supplies with partners treating emergencies to ensure they have what they need to keep safe, protecting staff and communities while maintaining the ability to deliver our mission as far as possible.

Many aspects of our eye health programs are suspended following guidance from the WHO and national governments. We learned from the Ebola crisis that when routine services and operations were not closed down quickly enough, suspicions of contagion from those sources led to a loss of trust in communities, so we stopped our regular services and fieldwork very early on.

"The COVID-19 situation is truly unprecedented. There have been pandemics before, but never has mankind locked down so many people and so many economies simultaneously."

We are now looking at each program on a case-by-case basis to assess the impact of COVID-19 – and what we can do to support the response. And that means helping protect health workers and reducing the spread of the virus by minimizing mass gatherings. In all countries, elective surgeries and outreach camps have been suspended, but partners will be able to treat and operate in emergency situations when there is a threat to vision or life – in line with national ministry of health guidance.

Neglected tropical disease (NTD) community-based surveys, active case-finding activities, and mass treatment campaigns have been postponed until

further notice. Clearly, such decisions affect our work on blinding diseases, such as trachoma and river blindness in the short term. To be clear, we are not canceling NTD programs, but rather delaying some activities. However, we still encourage prompt care and treatment of patients with NTDs presenting to healthcare facilities with debilitating complications of their condition (with appropriate protection for all parties). We believe that if this is handled in the right manner, the overall numbers will be relatively small.

We are also looking into how to make sure health messages are inclusive and reach everyone, particularly marginalized groups, such as those with disabilities, who can often be left behind in crises.

One other area where our NTD work has remained relevant is the strong focus on educating communities on how to keep hands and faces clean, and the need to strengthen health systems, which will be even more vital as COVID-19 spreads.

At present, it is impossible to say what the medium- and long-term impact will be on our programs, but we are planning for different eventualities and exploring many different response options. We hope to be able to resume programs rapidly once restrictions are lifted, but only if and when communities and local partners are also ready. Fortunately, we have a strong infrastructure and solid systems in place, and a resilient workforce; my colleagues across the world are adapting very quickly to new ways of working. It has been heartening to work with such a committed and dynamic team, despite all the challenges we are facing right now.

Long term, I believe this pandemic shows the need for stronger healthcare systems across the world – systems that are inclusive and affordable for all. Sightsavers' work contributes to that aim and we will continue to adapt to this new reality, continuing our mission to prevent avoidable blindness.

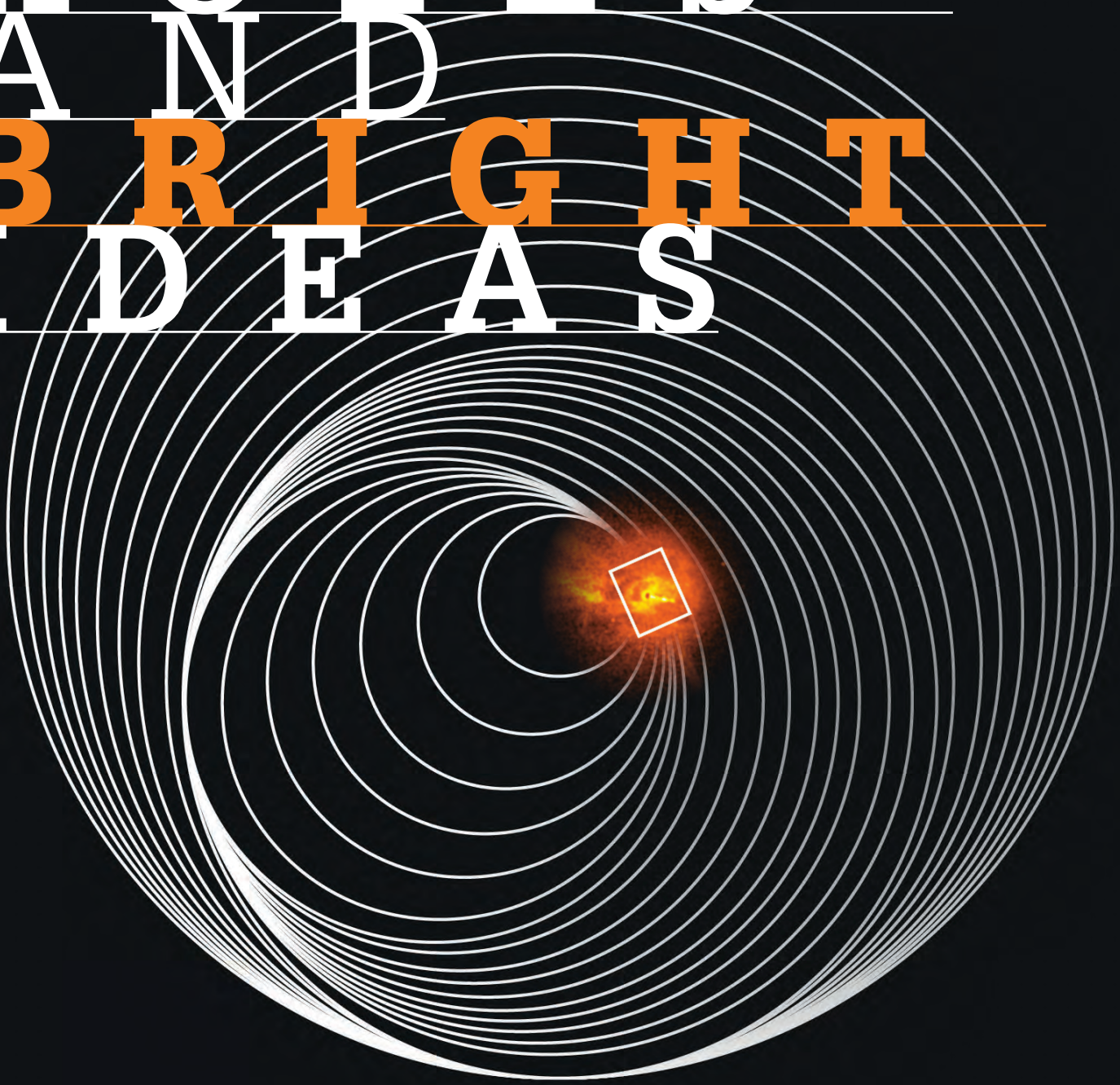
Pandemic Perspectives

Remote diagnoses are part of the new reality during the COVID-19 crisis

David A. Goldman, Founder, Goldman Eye, Palm Beach Gardens, Florida, and Ophthalmology Team Lead, Anterior Segment, Modernizing Medicine, USA

During the COVID-19 pandemic, the majority of services my practice offers have been stopped. However, patients still call with concerns, and to allow us to offer advice safely, we are expanding our use of telemedicine solutions. One technology that we have recently introduced is modmed Telehealth. We encourage patients to log into the PocketPatient app on their phones and engage with us via a virtual visit. While some diagnoses might require the use of specialist equipment such as OCT, we have found that many patient concerns can be addressed in a video call. Often, a red or irritated eye turns out to be a subconjunctival hemorrhage or a chalazion. By allowing us to diagnose these conditions remotely, telemedicine minimizes any potential exposure to COVID-19 for patients and staff, while still providing sound medical care.

BLACK HOLES AND BRIGHT IDEAS



WHAT HAPPENS WHEN ASTRONOMY AND OPHTHALMOLOGY COLLIDE

By Kian Madjedi, Samuel Cabot and Damien Gatinel

In 2007, Damien Gatinel had a conversation with astronomer Jean-Pierre Rivet about astronomy principles and how they relate to ophthalmology (1). Though a connection between the two disciplines may not be immediately apparent to some, there are similarities. In particular, technologies borne from astronomy have influenced the development of tools and techniques that have had a game-changing impact on the diagnosis and treatment of ocular diseases. Rapid advances have occurred since that conversation more than a decade ago, so we felt that it was an ideal time to re-examine the links – and emphasize ways in which one discipline can learn from the other to drive change and innovation.

WHERE IT ALL BEGAN

Original theories linking astronomy and ophthalmology can be traced back to antiquity and the Middle Ages, when the incremental understanding of optics led Ptolemy, Euclid, and Ibn al-Haytham to first propose hypotheses on refraction and the trajectory of light. The Renaissance era further strengthened this relationship, when important research studies, such as those of Kepler, demonstrated direct applications of optics to astronomy and the formed the idea that the image generated on the retina was an inverted one. The works of Descartes, Newton, Snellen, and Fermat gave rise to the modern principles of reflection and refraction, while our contemporary view of light as a wave was described by Christiaan Huygens, and later demonstrated experimentally by Thomas Young in his double slit experiment.

With each era came a deeper understanding of optical systems, our perception of starlight, and the inner workings of the eye. Since ophthalmology and astronomy both rely on the direction and movement of light, the overlap between the two scientific disciplines began to make sense.

THE EYE IS A WINDOW TO THE UNIVERSE

In fact, the eye influenced the development of the first telescope – you may have noticed the striking resemblance between the two. The eye actually served as a major astronomical instrument right up until the invention of the telescope in the 17th century.

Just as the cornea and crystalline lens focus light onto the photoreceptors of the retina, which absorb photons and converts them into a neural impulse, a (modern) telescope uses a sequence of lens elements that focus light from distant sources into a detector, which absorbs photons and ejects electrons – the electrical signal. Unlike the eye, differences in materials and electronics make telescopes sensitive to various wavelengths, from gamma rays to radio.

TWO BEAMS, TWO GAMECHANGERS

Moving to the present day, if you take a look at some of the devices that are commonly used in an ophthalmic practice, there are some great examples of astronomy's influence.

The interferometer is an instrument used to probe distances and make measurements of tiny astronomical objects. In most basic terms, the Michelson interferometer splits laser light into two beams, each traveling different distances before recombining and being recorded by a camera. The instrument leverages the wave-like nature of light; the two beams constructively or destructively interfere, depending on how far one traveled compared with the other. Is this beginning to sound familiar?

Based on these principles, optical coherence tomography (OCT) has today become a standard of care in ophthalmology, providing real-time information on structure and function – diagnosing disease, evaluating progression, and assessing response to therapy. Like interferometry, it's an instrument that uses two beams of light: one which travels a pre-set distance, while the other varies based on the distance to a patient's eye. The light reflects off tissue at different depths within the retina, allowing its structure to be probed. In monitoring the progression of glaucoma, for example, an ophthalmologist might use OCT to resolve the layers of the retina to micron-level detail, and identify subtle thinning of the retinal nerve fiber layer (RNFL). It is also commonly used to identify neovascularization and other vascular diseases of the

"OCT HAS *become* A STANDARD OF CARE IN OPHTHALMOLOGY, PROVIDING *real-time information* ON STRUCTURE AND FUNCTION – DIAGNOSING DISEASE, *evaluating* PROGRESSION, AND ASSESSING RESPONSE TO THERAPY."

Image credit: European Southern Observatory (ESO).

"MICROSCOPIC DISTANCES PROBED BY *interferometry* WERE RESPONSIBLE FOR REVEALING SIGNS OF A *black hole* MERGER, MARKING THE FIRST-EVER DIRECT OBSERVATION OF *gravitational* WAVES."

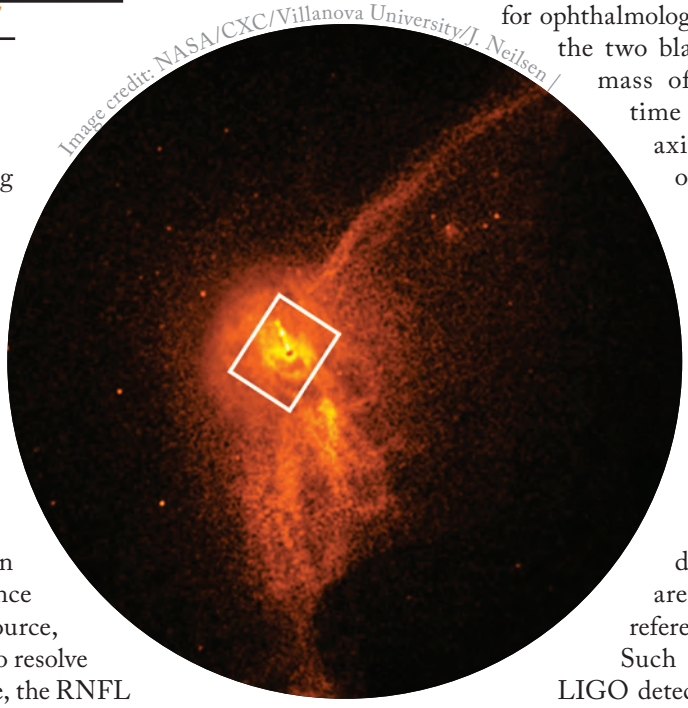


Image credit: NASA/CXC/Villanova University/J. Neilsen /

retina, and is increasingly being used to better visualize anterior segment structures (2).

Interferometry principles work well for ophthalmology applications because the distances probed by the former are comparable to the wavelength of light employed by the latter. For example, OCT primarily relies on optical light (in the range of 400-700 nm). Given properties of wave interference and coherence of the light source, this allows ophthalmologists to resolve layers of the retina (for example, the RNFL is approximately 90 µm thick), and structures as small as ~10 µm in conventional OCT and ~5 µm in confocal OCT (3, 4). Time-Domain (TD-) OCT uses a moving mirror for the reference beam, whereas more modern Fourier Domain (FD-) or Swept-Source (SS-) OCT eliminate the moving mirror in favor of spectral decomposition.

NOBEL-WORTHY DISCOVERIES

The importance of this approach cannot be understated to astronomers. On 14 September 2015, the microscopic distances probed by interferometry were responsible for revealing signs of a black hole merger (5), marking the first-ever direct observation of gravitational waves – a component of Albert Einstein's theory of relativity, efforts to prove the existence of which had been ongoing for decades. The discovery was made using the Laser Interferometer Gravitational-Wave Observatory (LIGO), which, at the time, was the largest and most ambitious project ever funded by the National Science Foundation (NSF) in the USA. The LIGO detector consists of two arms – each 4 km in length – along which a laser beam travels before recombining (through a special design the beams are reflected hundreds of times along these arms before recombining, giving LIGO an effective length of ~1,600 km).

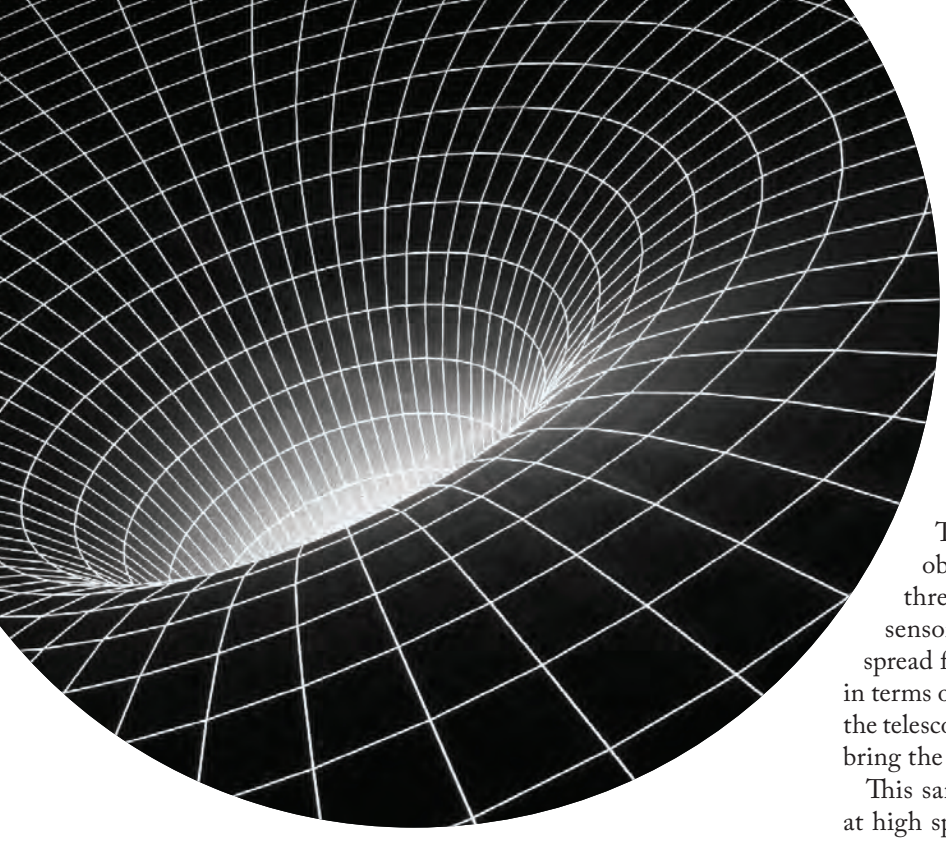
Although the scale of LIGO is markedly different to that of an ophthalmic OCT, surprisingly, its 4 km arms enable even higher precision measurements than those required for ophthalmology. The merger event involving the two black holes, each 30 times the mass of the Sun, distorted space-time via compression along one axis and expansion along the other, oscillating in time. This multiplicative effect changes lengths of one part by 1022, or, in the case of a LIGO arm, ~10–18 m. Assuming laser light in standard OCT travels a slightly longer distance than the typical axial length, LIGO is analogous to a TD-OCT machine, but 700,000 times larger in size, and in which distortions in space-time are responsible for moving the reference mirror.

Such was the importance of the LIGO detection of gravitational waves, it was awarded the 2017 Nobel Prize in Physics.

SEEKING VISUAL CLARITY

Another parallel between ophthalmology and astronomy can be drawn from a technique that is used to enhance the spatial resolution of images.

Let's examine the theory. Ideally, the resolution of an optical system is diffraction limited and governed by the Rayleigh Criterion: $\theta \approx 1.22 \lambda/D$. Using this formula, optical systems with larger apertures (D) imaging at shorter wavelengths of light (λ) can resolve finer structures. So for reference, the human eye can resolve about one arc-minute, or one-sixtieth of a degree (that's the apparent size of Jupiter in the sky, which one can see as a disk rather than a point); telescopes can resolve galaxies about 100-1,000 times smaller; and the



Event Horizon Telescope, with an effective aperture the size of the Earth, can image a faraway black hole 1,000,000 times smaller (6). Astronomical cameras are matched to telescopes accordingly so that each pixel covers one-half of the size of the smallest resolvable structure (this is called Nyquist sampling). More pixels would not resolve any more detail, and fewer pixels would degrade the resolution.

The human foveola is optimized for the Rayleigh criterion: cones are spaced ~3 µm apart, or about 0.5 arc-minutes of the eye's field of view (7). In practice, however, optical images from telescopes on Earth incur blurriness from factors such as turbulence, temperature fluctuations, and water vapor in the Earth's atmosphere, which distort the incoming wavefront and reduce the resolution of the image (wavefronts are sets of light rays emanating from a source, all at the same phase; they are analogous to the concentric circles of ripples after dropping a pebble in water).

"IT *should* COME AS NO SURPRISE THAT ADAPTIVE OPTICS ARE PLAYING AN *increasingly* IMPORTANT ROLE IN BOTH ANTERIOR AND POSTERIOR SEGMENT IMAGING AND SURGERY."

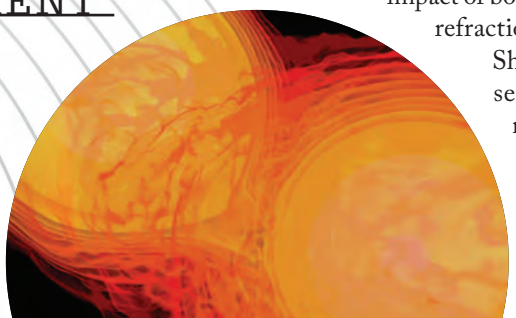
ADAPTING TO ADAPTIVE OPTICS

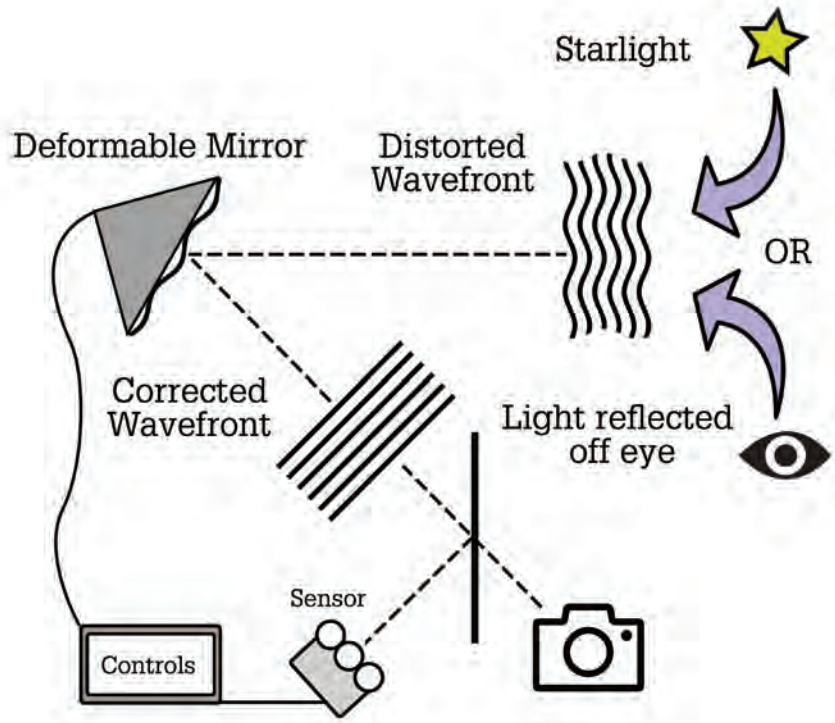
To counter this blurring effect, most modern observatories feature adaptive optics that consist of three key components: i) a Shack Hartmann wavefront sensor, which detects aberrations from an ideal point spread function; ii) software that expresses the aberrations in terms of Zernike polynomials; and iii) pistons that deform the telescope mirror in real-time to negate the aberrations, and bring the optical system closer to its diffraction limit (8, 9).

This same technology can be applied to imaging the eye at high spatial resolution. Akin to the flaws observed with telescopic images of Earth, light reflecting off the eye is subject to imperfections in the eye's optical train and its various transparent media, and these collectively produce wavefront distortions that limit the finest resolvable detail. By applying adaptive optics, wavefront sensors can be employed to determine the aberration in the eye, while a series of deformable mirrors correct the aberrations and sharpen the resulting image. It should come as no surprise then that adaptive optics are playing an increasingly important role in both anterior and posterior segment imaging and surgery.

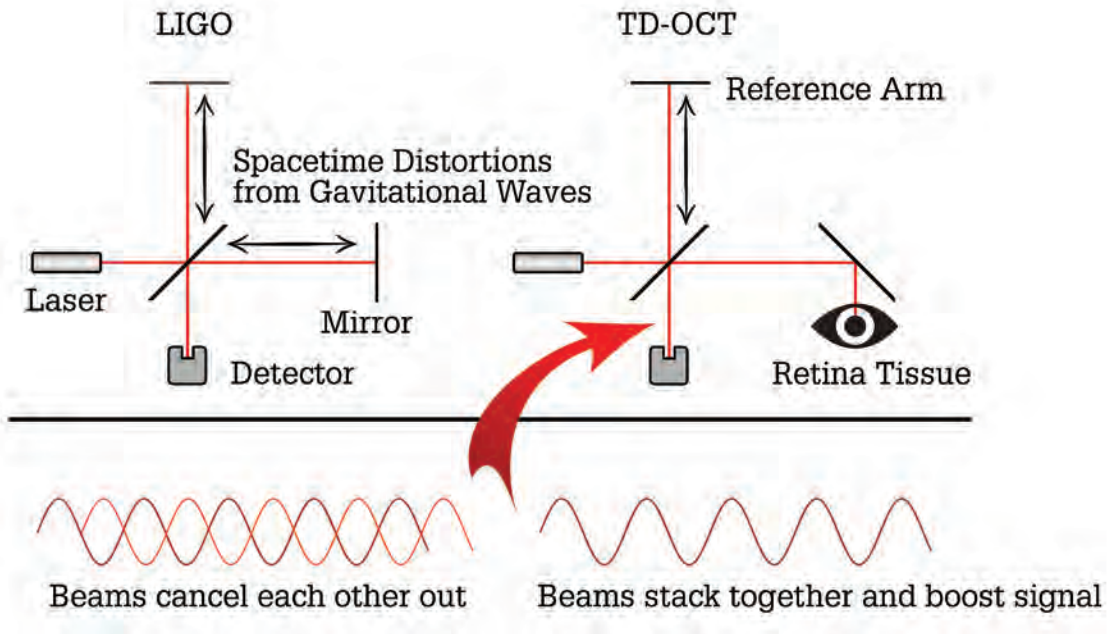
Advances in intraoperative aberrometry, for example, have been guided by these principles, allowing surgeons to more accurately identify and correct aberrations, resulting – for most cases – in better postoperative visual outcomes. These new ophthalmic applications may, however, warrant a different mathematical framework, since Zernike polynomials are a mathematical tool commonly used for describing and decomposing distortions to a flat disk only (such as spherical aberration, astigmatism, piston, tilt, tip, defocus, trefoil, coma). But in reality, high-order aberrations (HOAs) – like spherical aberration – also contain the shape and information of low-order ones, too, like defocus, which makes it more difficult to determine clinically significant aberrations. A recently proposed decomposition that treats low- and high-order aberrations separately – but takes both modes into account – may, however, provide a good assessment of the impact of both to allow for more accurate spectacle refraction (10).

Shifting our attention to the posterior segment, adaptive optics also offer many possibilities for improving the resolution of retinal imaging. Most

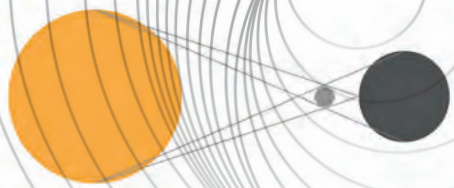




Adaptive Optics System



Applications of Michelson Interferometer



"WE ARE OPTIMISTIC THAT, AS *ophthalmic* ADVANCED OPTICS CONTINUE TO EVOLVE, WE WILL BE IN AN EVEN BETTER POSITION TO IDENTIFY INHERITED *retinal* DISEASES."

existing standard retinal imaging modalities do not have the resolving power to visualize individual photoreceptors. But the recent integration of adaptive optics modules into existing imaging platforms – such as OCT or scanning laser ophthalmoscopy – now make it possible to view much higher resolution images of microscopic structures in the retina (11). By measuring and "counteracting" the aberrations in light that would normally reduce resolution in the existing imaging platform, adaptive optics-integrated imaging modalities allow for practically direct visualization of foveal rod and cone photoreceptors (12), the retinal pigment epithelium (13), the bodies of retinal ganglion cells (14), and red blood cells (15). Since its capabilities also include indirect visualization of blood flow through retinal vessels, adaptive optics also has the potential to be a groundbreaking tool in monitoring retinal vascular disease (16, 17).

We are optimistic that, as ophthalmic advanced optics continues to evolve, we will be in an even better position to identify inherited retinal diseases – where RPE cells and photoreceptors are the predominantly affected cell types – even before functional changes in vision occur (18)!

LAST BUT NOT LEAST

We've discussed some of the techniques that have had a big impact on our understanding of, and innovation in, ophthalmology and astronomy, but there are others worth mentioning.

Earlier we mentioned FD-OCT – a technique based on interferometry principles – but there are also distinct parallels that can be drawn between the way that FD-OCT separates light to generate ocular structural information, and the way that astronomers analyze the physical properties of a target. To clarify, as well as relying on interferometry, FD-OCT is also reliant on the separation of light into its component wavelengths, whereby a broadband light source is separated by a diffraction grating into its component wavelengths, and distributed across a detector. The relative strengths of each wavelength of light (called a spectrum) encode the structural depth information of the OCT-A-scan. Keeping these principles in mind, in astronomy, a spectrum can help generate all sorts of important physical information, like how hot a star is, how fast a galaxy is moving away from us, whether there is water vapor in the atmosphere of another planet. The importance of this information has made diffraction gratings common components of instruments at many prominent observatories.

And finally, if we consider some of the computational analysis tools that are seeing a surge in interest today, those that are using large image databases for pattern matching and object classification are making a huge difference to both ophthalmologists and astronomers. In ophthalmology, we have witnessed an explosion in the use of machine learning algorithms, such as convolutional neural networks to detect and grade retinal diseases, like diabetic retinopathy. Astronomers use similar algorithms to find gravitational lensing events, whereby a massive object distorts the image of another, in sequences of photographs covering large portions of the sky, or for classifying signals (for example, supernovae, binary stars, luminous galaxies) in time-series data.

In both fields, scientists have turned to the public in making sense of these large datasets, for example, in the 2019 APTOS Blindness Detection (19) and 2018 PLAsTiCC Astronomical Classification challenges (20). These are great examples of multidisciplinary-led innovation.

ONWARDS AND UPWARDS

Our discussion has illustrated some of the key parallels between two distinctly different fields of science and how the evolution of both have guided the understanding of, and innovation within, the other. If we consider some basic facts, the link between ophthalmology and astronomy becomes much clearer. Both use different properties of light and its interaction with matter: its particle nature and the photoelectric effect for imaging sensors; its wave nature for interference patterns; ray tracing for optical system design; and Huygens wavelet theory for wavefront analysis. Despite the substantial differences in the scale of the matter with which they engage, the similarities between the ophthalmology and astronomy demonstrate the importance of interdisciplinary approaches to academic inquiry and how the overlap between fields truly informs growth and drives innovation.

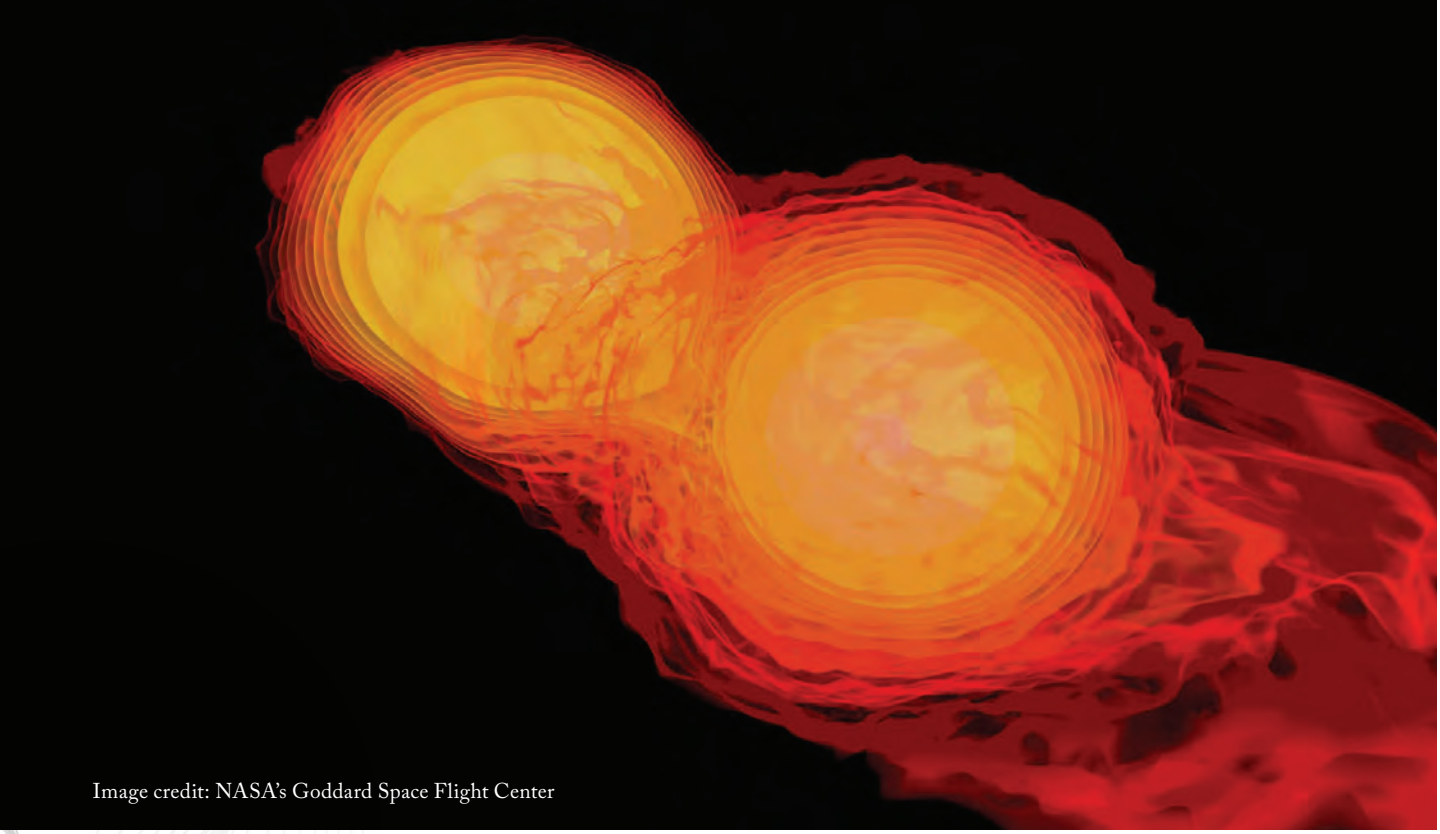


Image credit: NASA's Goddard Space Flight Center

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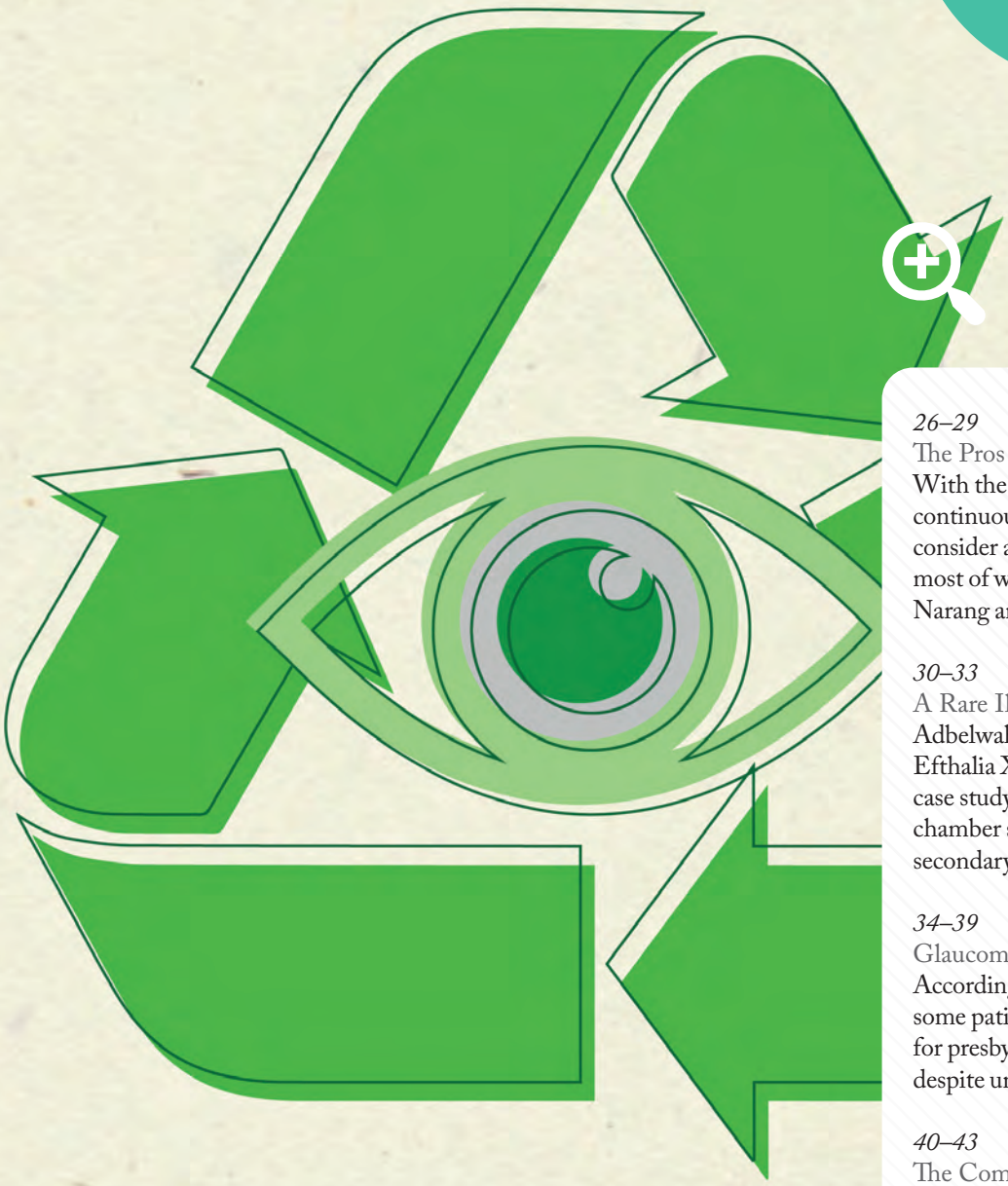
In Practice

Surgical Procedures
Diagnosis
New Drugs



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The Pros of PDEK

With the supply of corneal tissue continuously decreasing, we should consider approaches that not only make the most of what we've got but also expand the donor pool

By Priya Narang and Amar Agarwal

Blindness induced by corneal disease continues to be a huge public health burden, with estimates that it affects around 1.5 million people worldwide (1). Corneal transplantation is an effective treatment option for many patients and has a high success rate in restoring sight, but there's a catch: the severe shortage of donor corneas means that demand far outstrips supply. And even when donor corneas are available, contamination poses a real risk (2), further reducing the amount of viable tissue available. Much research has focused on improved methods for early corneal disease diagnosis, as well as on advanced surgical methods that optimize our use of the tissue that we have available to us. With that in mind, one such surgical method, pre-Descemet's endothelial keratoplasty (PDEK), is effective regardless of donor age (3-5).

Simply put, the PDEK technique transplants the pre-descemet's layer (PDL) along with descemet's membrane (DM) endothelium, which are separated from the residual donor stroma through the formation of a type-1 big bubble (BB). Here we describe the technique, which not only minimizes the use of donor tissue, but it can also be applied using adult and infant donor tissue, too, making it an important one for corneal surgeons to master.

Preparing the donor graft

The graft can be obtained from a dissected corneoscleral button; the donor corneoscleral rim is placed on the eye mount with the endothelial side facing up.

The creation of a type-1 BB is essential to this procedure. To do so, a 30-gauge needle is used, which is attached to an air-filled, 5 ml syringe (Figure 1a). The needle is introduced with a bevel up position from the periphery up to the mid-peripheral area at a considerable depth from the DM so as to create a plane of separation between the PDL and the residual stroma.

Worthy of note is that the air dissection is carried out manually by the surgeon, so it has the advantage of being cost-effective. It is typically dome-shaped and spreads from center to periphery, with its diameter usually varying from 7.5-8.5 mm. Importantly, this type of BB never extends to the extreme periphery to avoid any adhesions between the PDL and the residual stroma. Injection of air causes the PDL-DM-endothelium complex to separate from the residual stromal bed (see Figure 1b).

For improved visualization, the graft is stained with Trypan blue, which is injected using a side port blade at the extreme periphery of the BB (Figure 1c). The BB is then cut across the periphery using corneoscleral scissors and is placed in the storage media (see Figure 1d).

"Corneal transplantation is an effective treatment option for many patients, with a high success rate."

Preparing the recipient bed

The PDEK procedure is performed under local anesthesia. In cases of bullous

"Much research has focused on improved methods for early corneal disease diagnosis, and surgical methods optimizing the use of tissue."

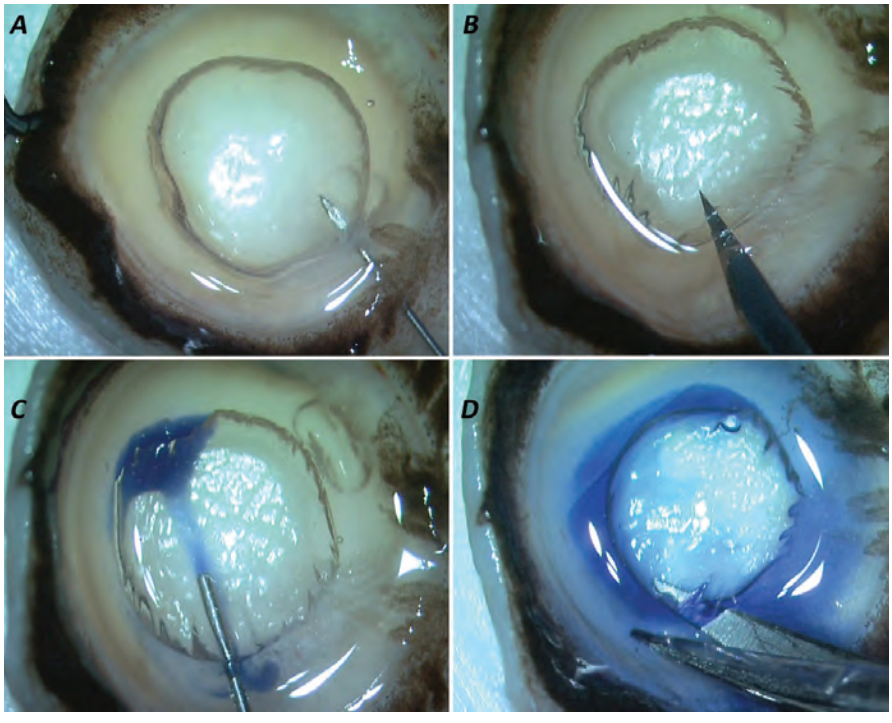


Figure 1. PDEK donor graft preparation.
a) An air-filled 30 G needle is introduced from the corneoscleral rim up to the mid-periphery and air is injected to create a type-1 BB.
b) The BB is punctured at the extreme periphery with the help of a side port blade.
c) Trypan blue is injected to stain the BB.
d) The graft is cut along the peripheral edge of the BB with corneoscleral scissors.

keratopathy, the initial step comprises scraping and debridement of epithelium to enhance the intraoperative view. An anterior chamber maintainer (ACM) or a Trocar ACM is introduced into the eye to help maintain adequate anterior chamber (AC) depth at all times, while also ensuring a smooth transition between air and fluid infusion, as and when required. A 2.8 mm corneal tunnel is made and two side port incisions are framed. With the AC completely inflated with air, the DM is scored and stripped using a reverse Sinskey hook. Inferior iridectomy is then performed, using a vitrectomy probe introduced from the corneal incision, which prevents pupillary block at a later stage.

Inserting the donor graft

The graft is held gently with non-toothed forceps and is placed into the cartridge of a foldable IOL filled with balanced salt solution. Air infusion is paused and the graft is gently injected into the AC through a clear corneal incision, taking extra care to avoid wound-assisted implantation. The orientation

of the graft is verified before being gently unfolded using air and fluidics. Corneal indentation and massaging are performed to facilitate the graft unrolling. Once the graft has partly unrolled, a small air BB is injected beneath the graft, which helps it to adhere to the corneal surface. The peripheral edges of the graft can then be unrolled by gently manipulating it with a reverse Sinskey hook; once it has fully unrolled, air infusion is initiated to facilitate complete adherence of the graft to the recipient bed. A well-formed AC is then achieved using corneal sutures and a complete closure of all wounds.

Discussion

Given our experience to date with this procedure, we predict that PDEK will have widespread acceptance. It is associated with rapid visual recovery, predictable wound strength, and good optical predictability, much like DMEK (see Figure 2). However, PDEK has some important added advantages: i) better graft maneuverability, resulting from the extra strength and splinting effect of the PDL to the DM-endothelium complex, ii) reduced risk of donor tissue loss. Furthermore, PDEK does not require greater financial investment.

Other differences between the two procedures include the thickness of the donor graft; PDEK involves the addition of the PDL, increasing the thickness of the graft to approximately 25-30 µm, which is comparatively thicker than that of the DMEK that is 10-15 microns, but is thinner when compared with DSEK/DSAEK (100-200 microns) or an ultra-thin DSAEK (UT-DSAEK) – approximately 90-100 microns thick.

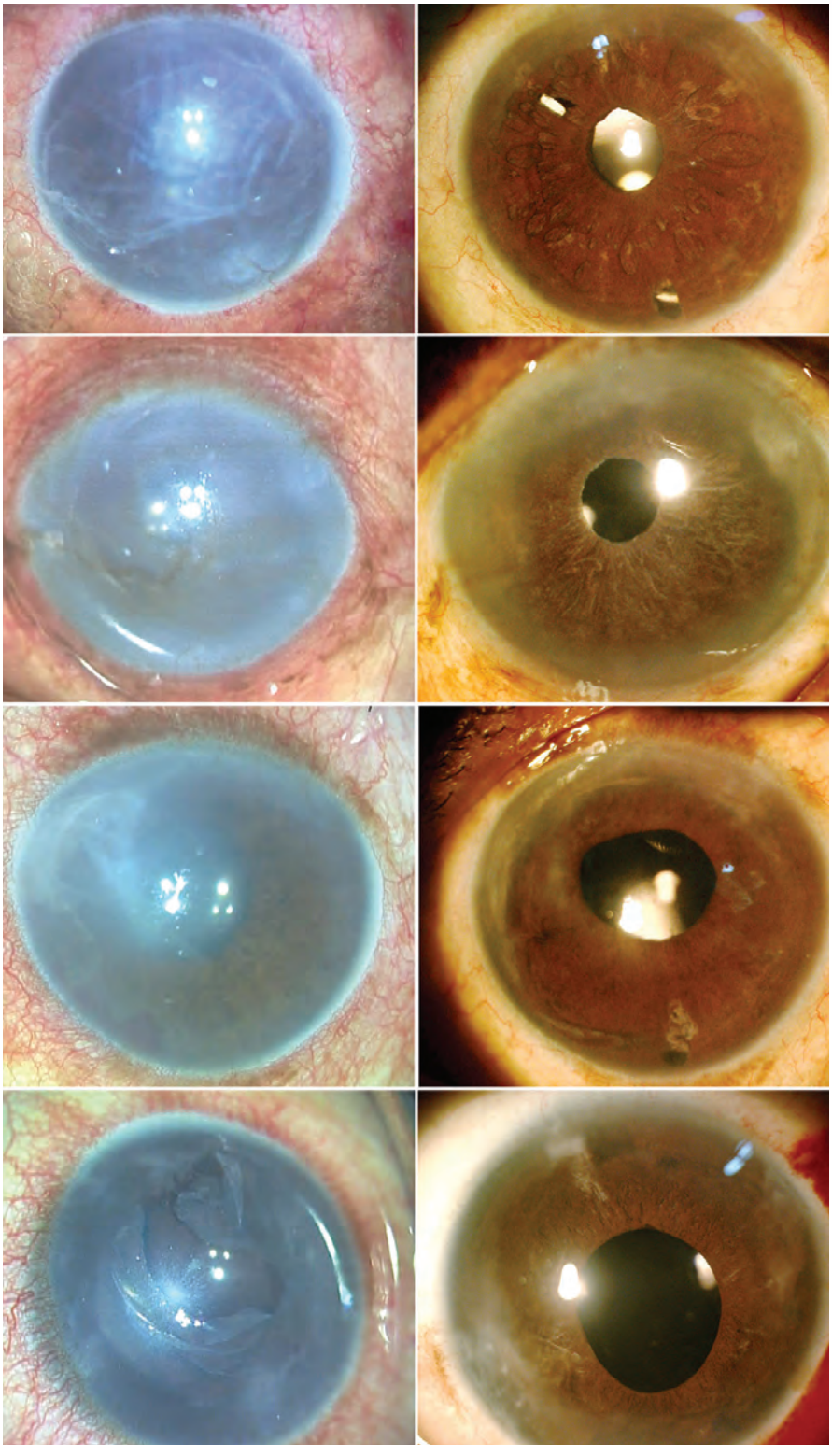
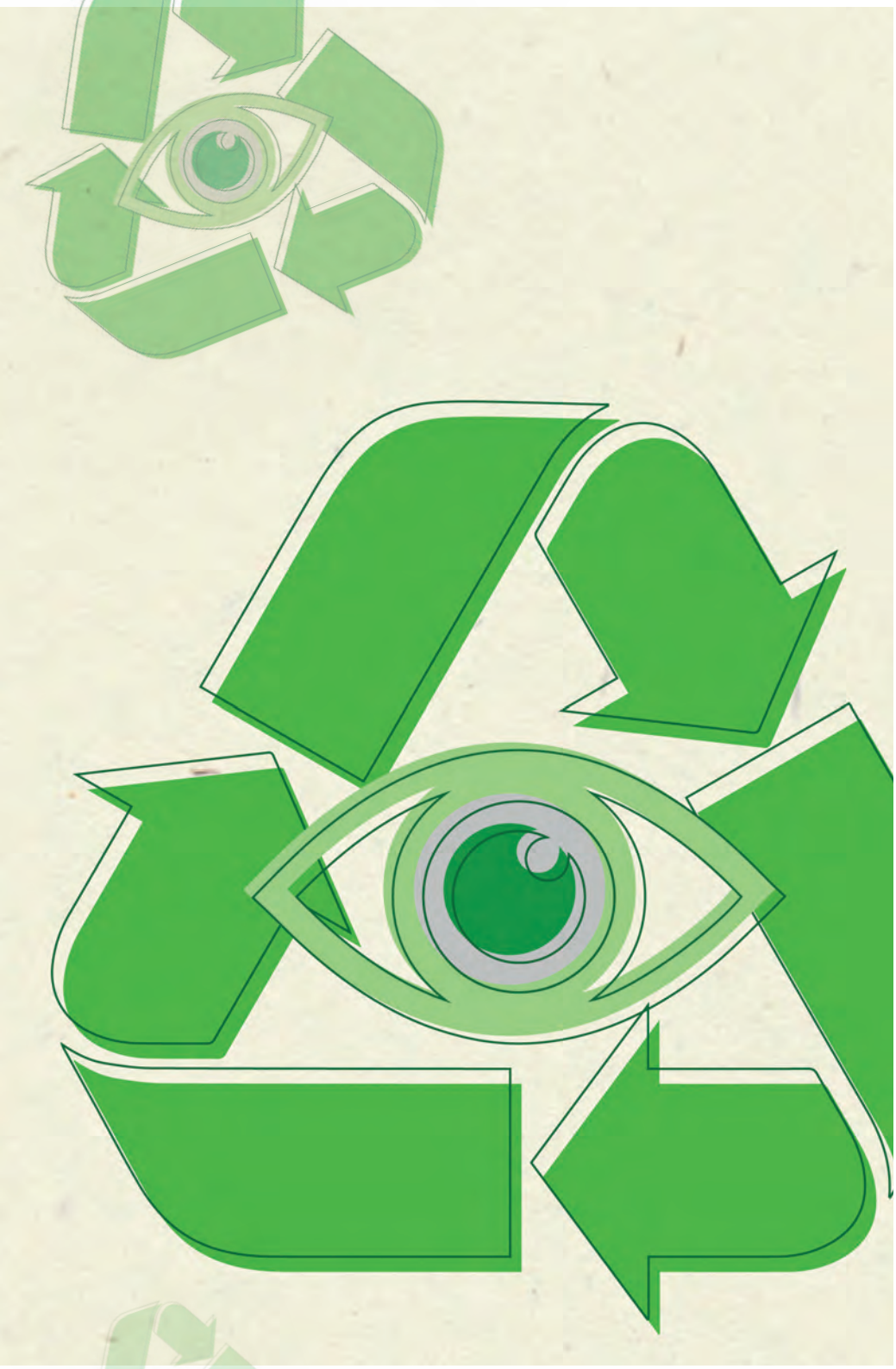


Figure 2. Images of preoperative (left) and postoperative (right) PDEK patient cases.



Visual rehabilitation after PDEK is faster than DSEK and its variants. In our experience as the graft is thinner than in DSEK, it takes comparatively less time to establish endothelial functionality, as less stroma is involved in the graft. Finally, the fact that it can be feasibly performed using both infant and young donor grafts is, of course, hugely advantageous. With the current supply of donor tissue worldwide ever-decreasing, expanding the pool of appropriate cornea donor tissue will become an increasingly important benefit.

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A Rare Illustration

Case study: a patient with anterior chamber synchysis scintillans after secondary glaucoma

By Adbelwahhab Azzawi and Efthalia Xanthopoulou

Occasionally, we see a patient whose case is so unusual that it is worth describing in more detail…

Six years ago, a 37-year-old man came to our clinic at the Department of Ophthalmology of the Universitaetsklinikum Giessen in Germany, complaining about decreased vision in both eyes. He had been diagnosed with intraocular optic neuritis and anterior uveitis due to co-infection with Treponema pallidum and HIV. The patient was diagnosed with insulin-dependent diabetes mellitus 30 years ago.

His best-corrected visual acuity (BCVA) at that time was 20/200 in his right eye and hand motions in his left eye. He was treated with intravenous ceftriaxone (Rocephin) and prednisolone (Decortin), in addition to topical application of prednisolone eye drops six times a day. After two days he was transferred to the Department of Infectious Diseases for further diagnostics, showing a vision improvement at discharge.

Glaucoma diagnosis

Four years later, the patient visited our department again, after suffering pain in his blind right eye for two months. His BCVA was no light perception in the right eye and 20/80 in the left eye. Slit-lamp examination of the right eye revealed conjunctival hyperemia, corneal endothelial precipitates, fibrin in a funnel-shaped anterior chamber (iris bombé), a mid-sized pupil, nonreactive to light, and a mature cataract (see Figure 1). IOP with Goldmann applanation tonometry measured at 42 mmHg, and B-scan ultrasonography showed complete retinal detachment (see Figure 2).

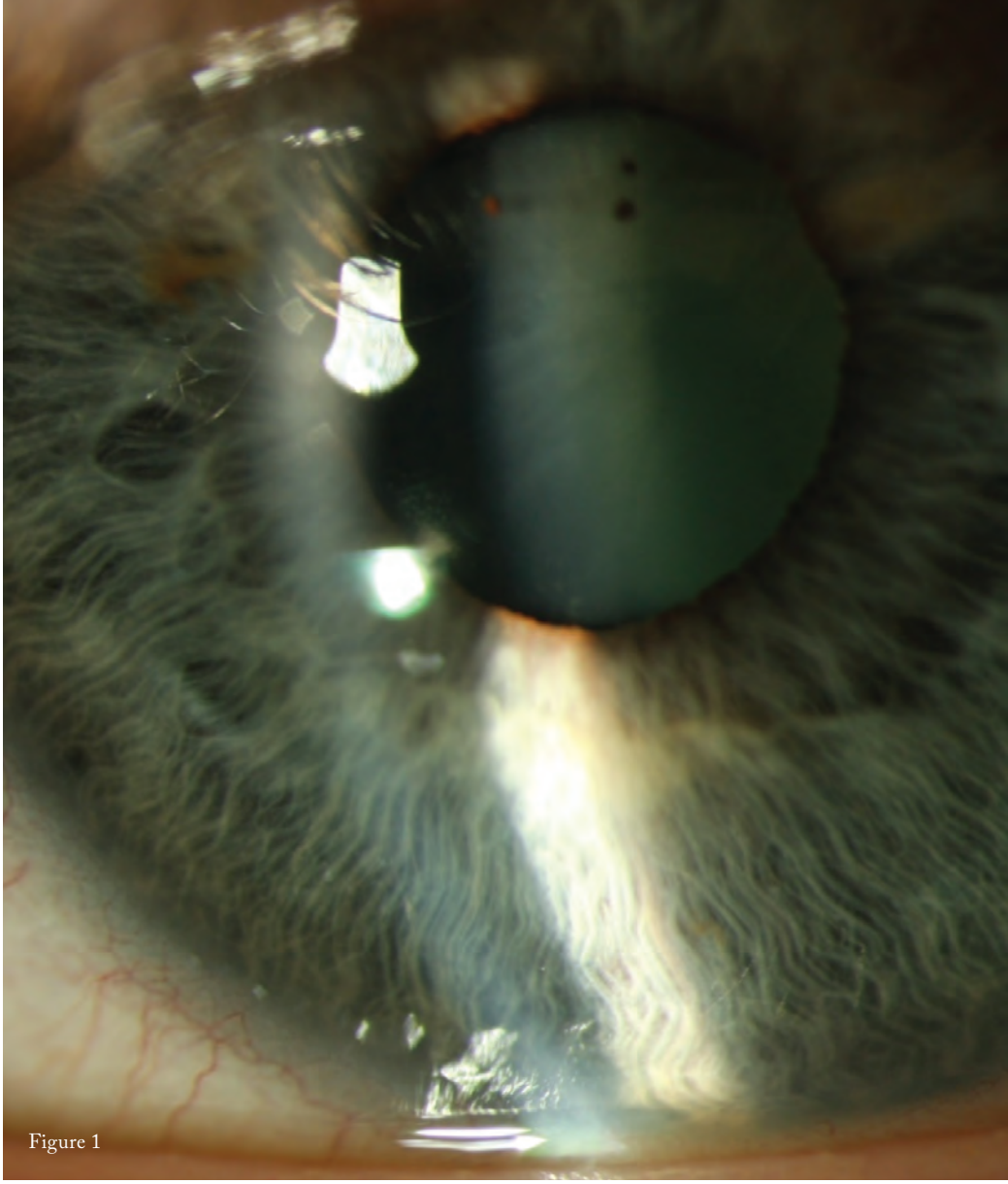


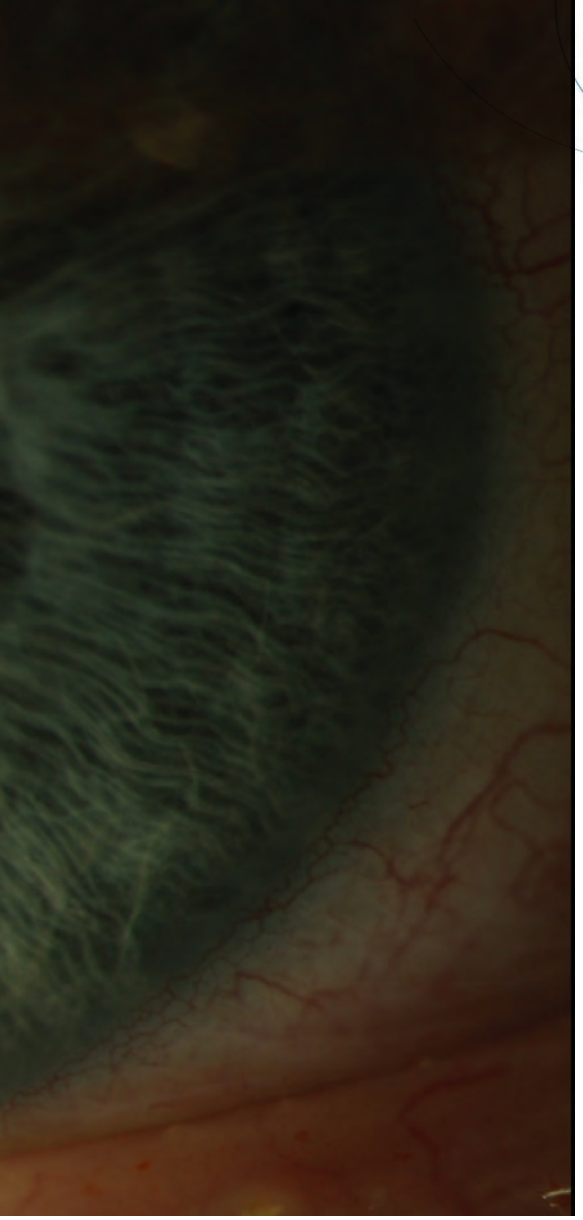
Figure 1

At that point, the patient was diagnosed with secondary neovascular glaucoma (NVG). He had laser peripheral iridotomy (PI) (30 exposures, at 3 o'clock and 1 o'clock positions, 1.2 mJ, Burst mode 1) to correct iris bombé, with IOP-lowering agents timolol, dorzolamide and brimonidine. Within one week, the pain in his right eye was markedly resolved, and IOP was under control.

The patient failed to keep the scheduled clinic appointments and revisited our clinic only five months later, showing an IOP of 48 mmHg in his right eye, corneal edema and severe iris rubeosis. The IOP in his left eye was recorded as 20 mmHg.

As the patient rejected the recommended surgical options (pars plana vitrectomy with cataract surgery or cyclophotocoagulation), we decided to administer atropine 0.5% twice a day, dexamethasone 1% twice a day, and IOP-lowering agents timolol, dorzolamide and brimonidine. Unfortunately, the patient also refused any further diagnostic procedures.

Three months later the eye examination showed that the IOP



in the right eye was 18 mmHg, with mild rubeosis and cholesterol crystals floating in the anterior chamber, as well as formation and accumulation of fibrin supratemporal, causing peripheral angle closure (see Figure 3) which partially regressed in the following months (see Figure 4). IOP in the left eye was 16 mmHg. Again, the patient refused all discussion regarding surgical treatment, so we have kept him under topical IOP lowering eye drops along with atropine 0.5% twice a day, until today.

A degenerative condition

Synchysis scintillans or cholesterosis bulbi is a degenerative process defined by the deposition of cholesterol crystals in the vitreous body, subretinal space, and rarely in the anterior chamber (1, 2, 3). The underlying conditions leading to this uncommon phenomenon can be eye trauma, vitreous hemorrhage, intraocular inflammation, hyphema, secondary NVG or chronic retinal detachment, and more rarely advanced Coats' disease, uveitis, neoplastic conditions or vascular disorders (1, 4, 5, 6). Many of these cases have been treated with enucleation due to non-manageable pain, and to prevent the development of sympathetic ophthalmia in the other eye.

Anterior chamber cholesterol accumulates in irregularly-shaped polychromatic crystals, larger in size than cells, which either float freely or are engulfed within foreign body granulomatous inflammation, macrophages or fibrous tissue (8). Sometimes they sediment to the inferior region, resembling pseudohypopyon when eye movement is limited (4, 9). Anterior chamber cholesterol is believed to be the breakdown product of intraocular blood or blood components (5, 8).

Ralph C. Eagle Jr. and Myron Yanoff reported such cases as a result of trauma or intraocular surgery, with an average interval between the trauma and the development of iridescent crystals of approximately 13 years. Elevated IOP and severely impaired visual acuity are often noted in such damaged eyes (5). Christopher Kennedy described three cases in which cholesterol appears to be the result of diffusion from the vitreous or from subretinal fluid through retinal breaks of a long-standing RD or, in the same sense, the result of an exudative RD due to Coats' disease (10). It can also derive primarily from the anterior chamber in case of hyphema or result from phacolysis (10, 11). It is also suggested that the entry of cholesterol in the anterior chamber or the vitreous could be predisposed by the existence of aphakia or lens subluxation or by

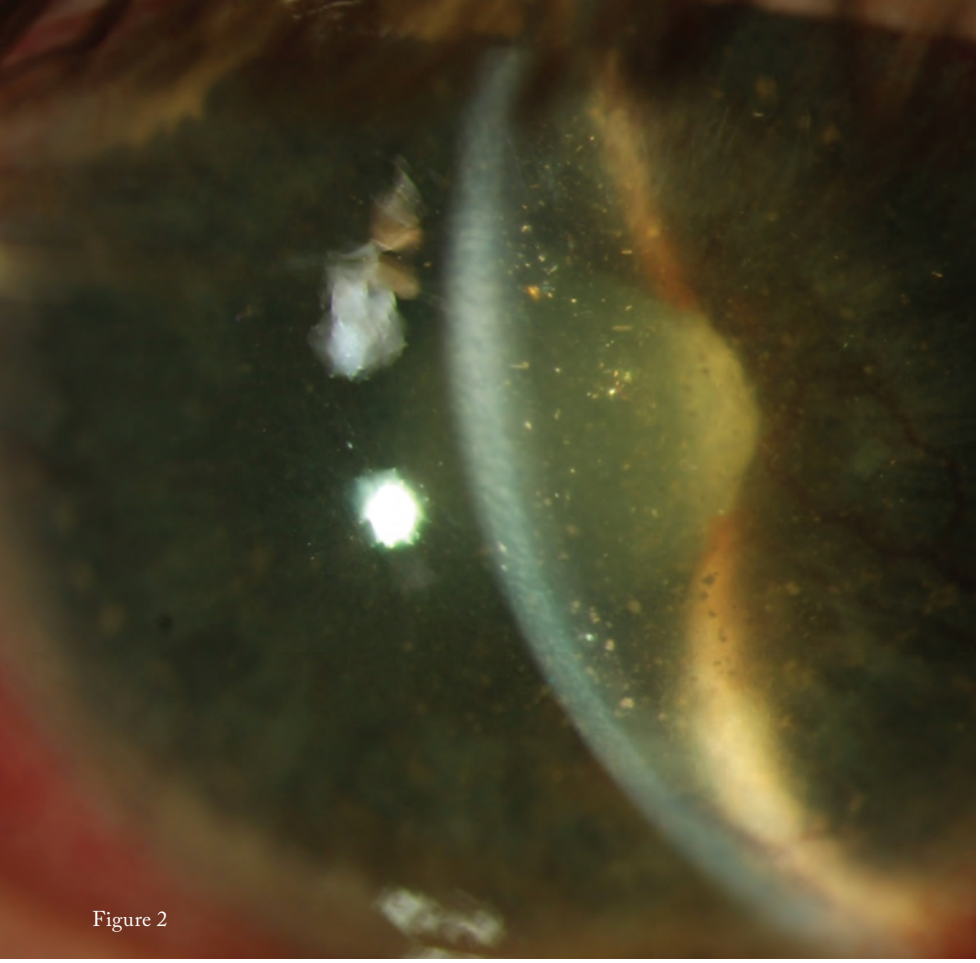


Figure 2

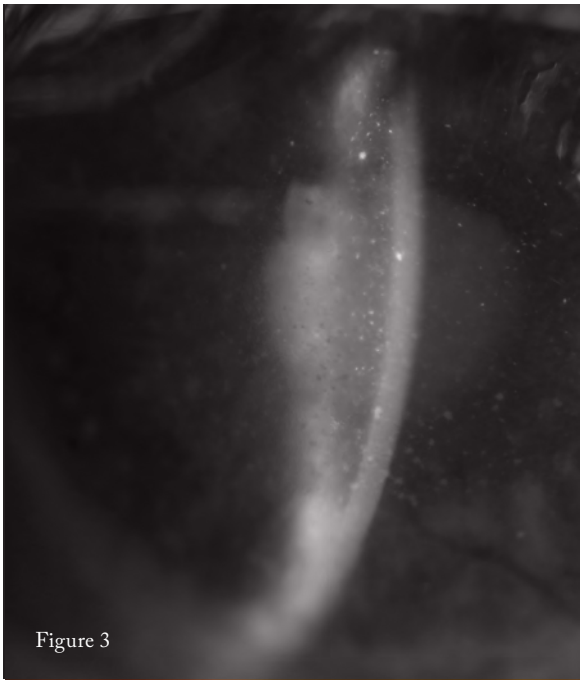


Figure 3

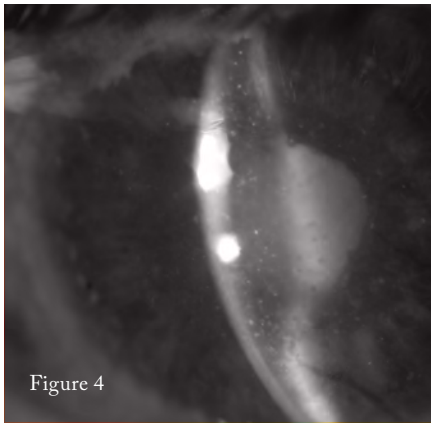


Figure 4

Figure 5

Figure 6

pathological changes of the blood-aqueous barrier (5, 12).

Surgical treatments

Jongseok Park reported a case similar to ours, with secondary glaucoma and elevated IOP, treated with pars plana vitrectomy and intravitreal bevacizumab, suggesting that this treatment may be an alternative to enucleation (7, 13).

We cannot exclude hyphema, either traumatic or spontaneous, as an associate cause of synchysis scintillans in our case, given that the condition could not be discovered when frank hemorrhage was no longer present and follow-up was very sparse, with long intervals in between. In our case, the intracameral injection of bevacizumab was sufficient to start regression of the neovascularization of the iris and angle, and subsequently critical for controlling the elevated IOP.

We suppose that the remission was sustained with atropine 0.5% and dexamethasone 1% eye drops, which reduced ocular congestion and inflammation in NVG. The removal of the mature cataract and the cholesterol crystals, and treating retinal detachment through pars plana vitrectomy and applying photocoagulation could possibly further help with managing the IOP.

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Glaucoma and IOL Selection

Some patients may be good candidates for presbyopia-correcting IOLs – despite underlying disease

By Paul Harasymowycz

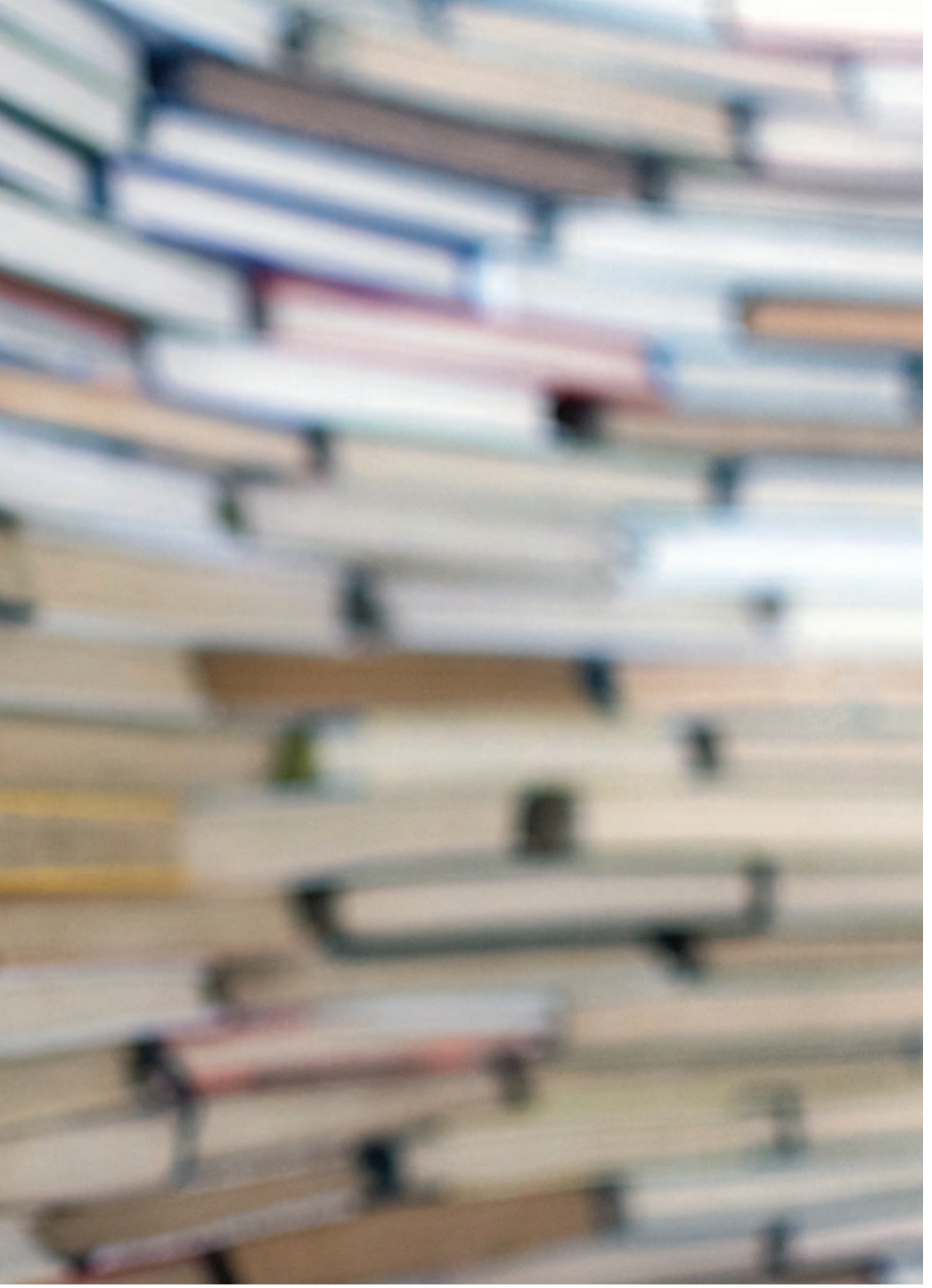
Historically, most surgeons have considered glaucoma to be a contraindication for implantation of a presbyopia-correcting IOL at the time of cataract surgery. For the most part that still holds true, although extended depth of focus (EDOF) IOLs may be considered for patients with mild, well-controlled glaucoma. Additionally, new IOLs in development may mean that we can offer a greater range of vision – even to those with more advanced disease.

Contrast sensitivity concerns

Early in the course of glaucoma, patients begin to lose retinal ganglion cells (RGCs) and retinal nerve fiber layer (RNFL) thickness. These structural changes are associated with functional change, in the form of contrast sensitivity loss, which occurs even before we can measure visual field loss. Contrast sensitivity (CS), while rarely measured in a standardized fashion in glaucoma exams, is likely implicated in a common patient complaint: "It's getting more difficult to see at night."

Most presbyopia-correcting IOLs also reduce CS by splitting the amount of light that reaches the retina for distance vision. Healthy individuals may not even notice the reduced contrast, but the combination of a significantly CS-reducing IOL with pre-existing, glaucoma-related CS loss is much more concerning.

Certainly, not all presbyopia-correcting IOLs are the same. The traditional, high-add multifocal IOLs decrease distance contrast by almost 20 percent. The more recent trifocal lenses (we have several available in Canada, including the Alcon PanOptix lens, the FineVision PhysIOL. and the Zeiss AT-Lisa) decrease distance contrast by about 15 percent. An EDOF lens like the Tecnis Symfony (or in countries where it is available, the Zeiss AT-Lara) reduces distance CS by only about 7 percent. With a 7 percent reduction in CS, I am comfortable implanting EDOF lenses in patients with glaucoma or ocular hypertension who have minimal damage, pressure in the low- to mid-teens and who are well controlled with one or two topical medications (see Figure 1). The product labeling also states that EDOF lenses may be used in patients with early, well-controlled glaucoma.



If these patients desire greater spectacle independence, an EDOF lens is an excellent option – with the caveat that they may require glasses for prolonged near work.

Angle-closure glaucoma

There are only a few situations in which I might consider a trifocal IOL for a glaucoma patient. The most common is in some patients with angle-closure, including primary angle closure suspect (PACS) and primary angle closure (PAC), both situations where there is no structural or functional damage. This form of the disease will be largely addressed by the lens removal itself. In fact, because of the EAGLE study's findings that lens removal was more cost-effective than laser peripheral iridotomy in primary angle closure glaucoma (PACG) and PAC (1), many

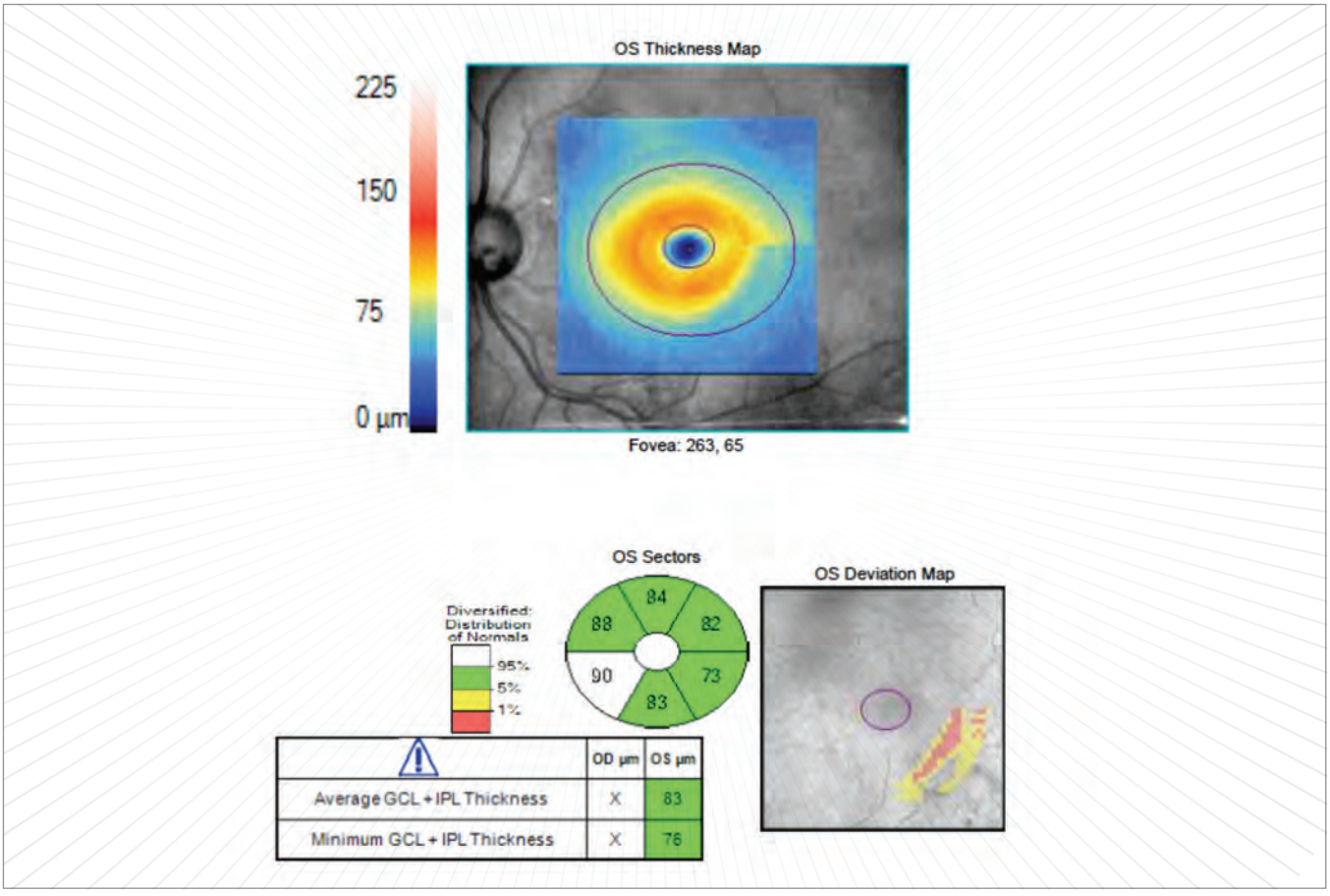


Figure 1. An OCT of the left eye demonstrates a loss of ganglion cells inferiorly in a patient with normal visual fields and well-controlled, mild glaucoma.

"Early in the course of glaucoma, patients begin to lose retinal ganglion cells and retinal nerve fiber layer thickness."

surgeons are offering early lens surgery to such patients.

In these cases, the patient may still have some accommodative ability that will be lost with lens surgery, so a presbyopia-correcting IOL may be attractive. There are still some reasons to lean toward an EDOF lens in this population. In angle closure, loose or missing zonules can make the effective lens position (ELP) less predictable, leading to residual refractive error. A highly hyperopic eye with a short axial length is even less likely to achieve emmetropia. Even though these eyes are not likely to see glaucoma progression after IOL surgery, the higher chance of refractive error still makes me more inclined to choose an EDOF lens that is more forgiving of residual error.

We also have to consider the patient's age when performing early lens surgery for angle closure glaucoma. A 45-year-old angle-closure patient will need that IOL for much longer than their 80-year-old counterpart. In these younger patients, I would prefer a material that is not associated with glistenings, because glistenings tend to worsen in both size and density over time (2).

Unilateral glaucoma

I will also consider mixing and matching a trifocal lens with an EDOF lens in a patient with unilateral glaucoma. I had a patient with mild, well-controlled

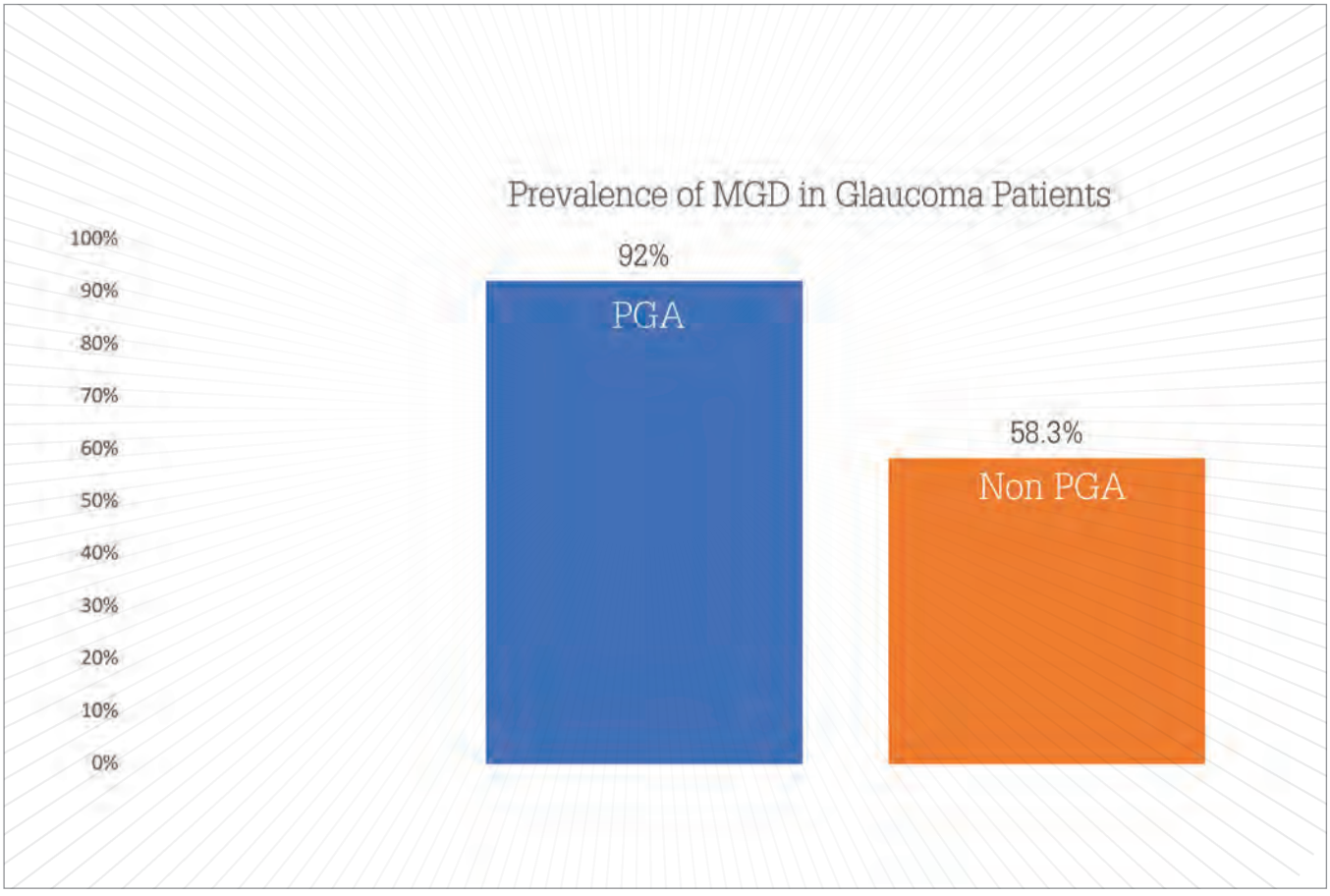


Figure 2. Meibomian gland dysfunction is common in glaucoma patients overall, and particularly in those on prostaglandin analog therapy (3).

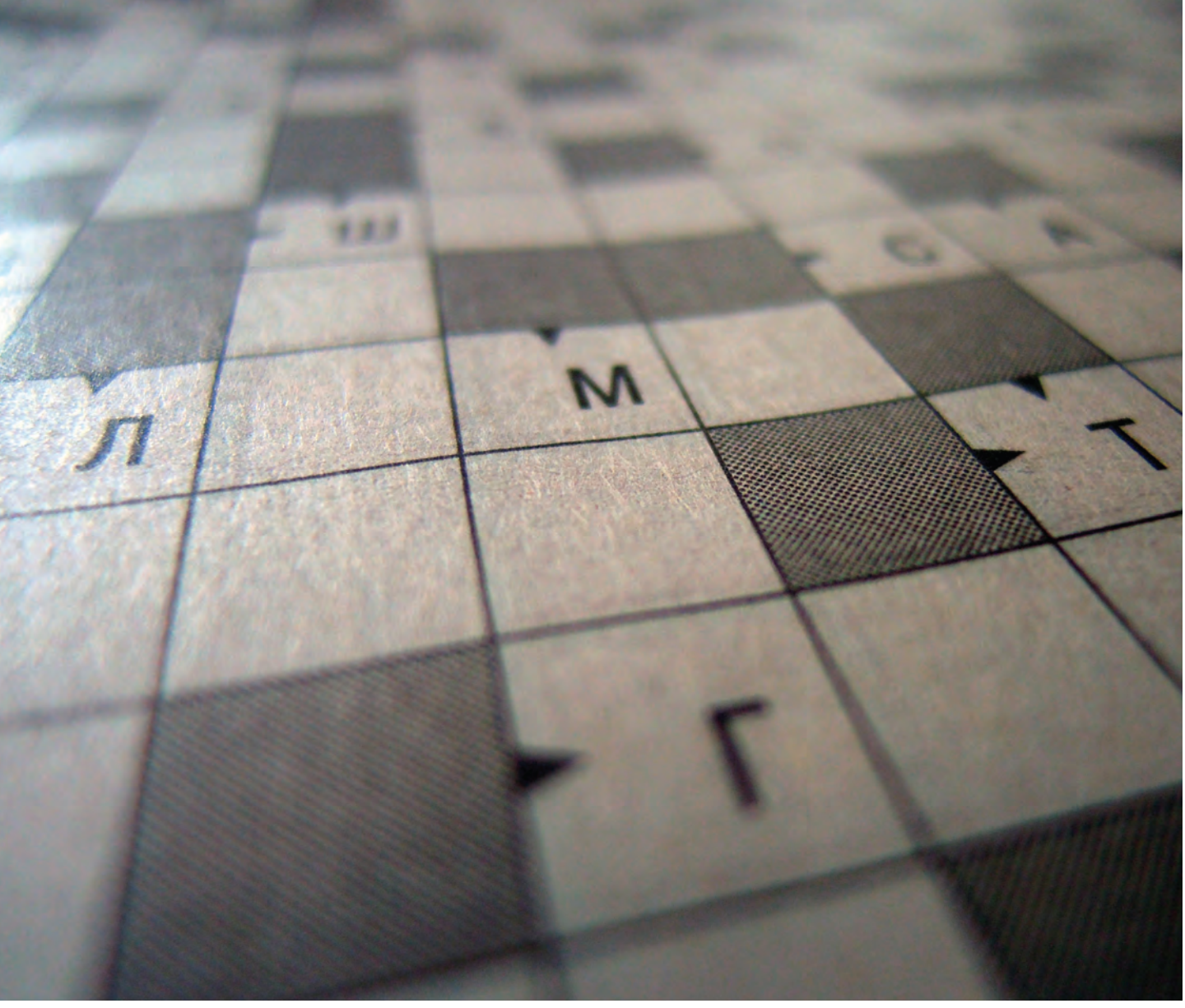
"In the near future, we may have some new options for patients with moderate to advanced glaucoma."

glaucoma in her left eye, with some RGC damage. In the fellow eye, she had zero damage, good IOP, and seemed not to have the genetic, progressive type of glaucoma. She was very enthusiastic about spectacle independence. I implanted an EDOF lens in the left eye. One week postoperatively, she was very happy with the distance and intermediate vision but (not surprisingly for a myope) liked the idea of better near vision.

I implanted a trifocal lens in her second eye, along with an iStent (Glaukos) for good measure. Although the patient is mostly happy, she has told me that she notices the difference and prefers the quality of her distance vision in the EDOF eye. Since this case, I have been more emphatic that even though trifocal IOLs correct near vision better, the EDOF lens often offers a better quality of distance vision. In cases where we use different IOL technologies in the same patient we'll often say, "We're very interested in the difference between the two initially, but in order for your brain to adapt, we don't want you to keep comparing the two eyes."

Moderate to advanced glaucoma

What about those patients with more than just mild glaucoma? If they have significant damage, are poorly controlled or on more than two classes of medication already, or have a strong family history



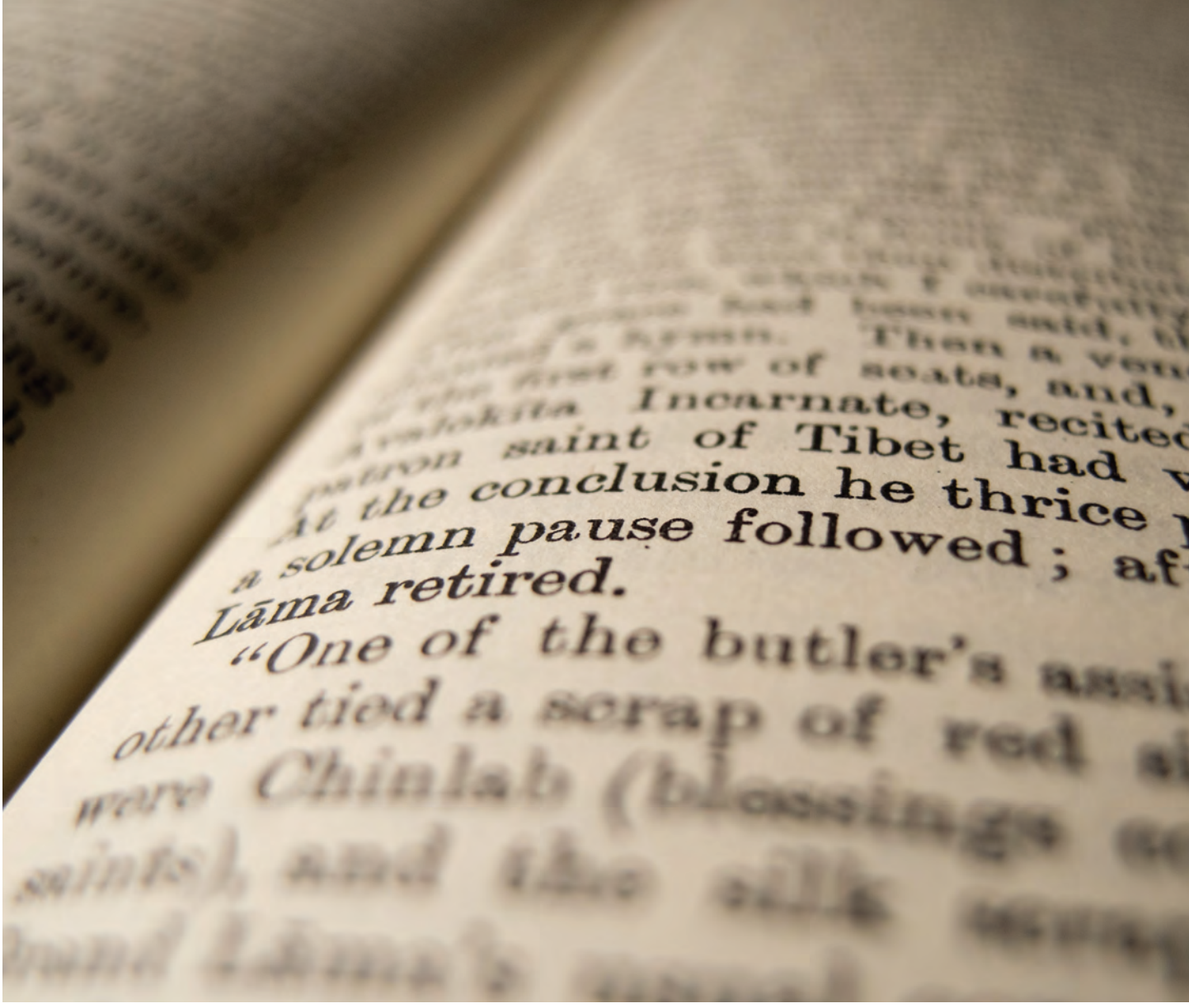
"A new generation of EDOF monofocal lenses that offer enhanced intermediate vision is under development."

of trabeculectomy, we already have proof that their glaucoma (and CS loss) is much more likely to progress. In these patients, I think any presbyopia-correcting IOLs are contraindicated. Even if they have a strong desire for spectacle independence, I will be frank and tell them, "Unfortunately, I think a monofocal IOL is in your best interest long-term."

In the near future, we may have some new options for patients with moderate to advanced glaucoma. A new generation of EDOF monofocal lenses that offer enhanced intermediate vision is under development. These lenses, which include the Johnson & Johnson Vision Eyhance lens and the Alcon Vivity IOL, do not have any diffractive rings, so they would not be expected to have any detrimental effect on contrast sensitivity or night vision symptoms. These could be a wonderful option for patients who may not be good candidates for EDOF or multifocal IOLs because of glaucoma (or other underlying retinal conditions) but still want to reduce dependence on glasses.

Ocular surface considerations

Finally, no matter which IOL we choose, it is very important to pay attention to the ocular surface and the meibomian glands in patients with glaucoma who desire spectacle independence. Prostaglandin analogs, our first-line



therapeutic class for lowering IOP, are closely associated with meibomian gland dystrophy (MGD, 3, see Figure 2). MGD can lead to an unstable tear film, fluctuating vision, and inaccurate biometry and topography, which may lead to improper IOL selection.

Most new biometers, such as the Lenstar and the IOLMaster700, provide an index of measurement quality; alternatively, clinicians can look at the standard deviation between measurements. Glaucoma patients who are going to get a premium lens in our practice have, on average, 2–3 biometry and topography measurements before IOL power calculation is finalized.

Careful evaluation and treatment of ocular surface problems can help ensure that astigmatic correction is accurate and that you meet your patients' visual goals. While this is true for all patients undergoing lens surgery, it is especially relevant to the glaucoma population with such a high prevalence of MGD.

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The Complexities of COVID-19 in Ophthalmology

Who, what, when, why, and how… A timeline of the pandemic's impact on our specialty

By Michelle YT Yip, Ji Peng Olivia Li, Jessica Shantha, Steven Yeh, James Chodosh, Adrian T Fung, Haotian Lin, Jod Mehta and Daniel SW Ting

We are currently living in the COVID-19 pandemic; a formal declaration by the World Health Organization (WHO) on March 11, 2020, and a public health emergency of international concern. Although the origin of this outbreak is still speculative, authorities in the WHO Country Office in China were first alerted to a "pneumonia of unknown etiology" on December 31, 2019, when a cluster of cases were detected in Wuhan, Hubei, China.

The virus isolated from these patients has not been previously isolated from humans, suggesting a novel pathogen. Since then, it has spread to over 150 countries and territories in the last few months. The rapid expansion and severity of the virus has alarmed citizens, heads of state, and WHO leaders across the globe. We explore the COVID-19 outbreak in relation to the role of the eye, risks to ophthalmologists, and measures to reduce transmission.

Global prevalence and virology

As of May 26, there have been more than 5.5 million cases worldwide, claiming almost 350,000 lives (1).

COVID-19 is a disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), belonging to the Coronaviridae family. This family is characterized as an enveloped, positive-sense, single-stranded ribonucleic acid (RNA) virus which, when visualized on electron microscopy, have unique characteristic surface projections resembling a corona, "crown" in Latin. SARS-CoV-2 is similar to the severe acute respiratory syndrome coronavirus (SARS-CoV) that plagued the East in 2003. Based on phylogeny, taxonomy and established practice, it has been determined to be the same species. Other viruses in this family include the Middle East respiratory syndrome coronavirus (MERS-CoV), the causative virus for the MERS outbreak that started in 2012 and was first isolated in Saudi Arabia. The COVID-19 pandemic is the third cross-species spillover of animal coronavirus to humans in the last two decades to result in outbreaks. Although these three coronaviruses have been at the center of attention in recent years, there are other human coronaviruses responsible for causing mild upper respiratory symptoms commonly reported as a cold.

"As COVID-19, SARS and MERS are largely thought to be respiratory diseases due to the symptoms and resulting pneumonia, the involvement of the eye is often overlooked."

The physicians affected

Li Wenliang, a 34-year-old ophthalmologist at the Central Hospital of Wuhan, gained worldwide publicity for his role as a whistle-blower, sparking outrage within China and globally, after reports of the Chinese government's dealings with him surfaced. He contracted the virus and subsequently passed away on February 7, 2020. Based on what has been reported thus far, two other ophthalmologists from the Central Hospital of Wuhan, Mei Zhongming and Zhu Heping, have also passed away from this virus.

Although the exact number of physician deaths from the virus is unclear, it is apparent that ophthalmologists have been particularly affected (2). The reasons why ophthalmologists might be more at risk include the proximity to patients during examination, predisposing them to droplet transmission, and the unavoidable physical contact they have with patients' eyes, resulting in susceptibility through direct contact. Wenliang speculated that he had contracted the virus from a glaucoma patient who was initially asymptomatic and only began to develop a fever the day after the clinic visit, possibly suggesting transmission via his ocular surface (3, 4).

Clinical features and ocular manifestations

Common symptoms in patients that have tested positive for COVID-19 include fever, cough, sputum production, fatigue, shortness of breath and gastrointestinal symptoms. However, a study published in the New England Journal of Medicine demonstrated that a small minority of patients (nine out of 1,099 patients) had clinical features of conjunctival congestion (5). In addition, a study in the Journal of Medical Virology reported PCR results from 30 patients hospitalized for COVID-19, one of whom had conjunctivitis (6), thus, it is important to consider COVID-19 in patients presenting with conjunctivitis, especially if they have risk factors such as respiratory symptoms, or contact or travel history. Although SARS and MERS also commonly presented with fever and cough as the predominant symptoms, no studies to our knowledge reported ocular manifestation in SARS or MERS patients.

Role of the eye in the spread of the disease

Although COVID-19, SARS and MERS are largely thought to be respiratory diseases due to the symptoms and resulting pneumonia, the involvement of the eye is often overlooked. Xia et al demonstrated polymerase chain reaction (PCR) detection of SARS-CoV2 from tears of a patient with COVID-19 that had conjunctivitis and conversely, the lack of detection in 29 COVID-19 patients without ocular symptoms (7). During the SARS outbreak in 2003, one study also demonstrated the presence of the virus through PCR in the tears of three SARS patients (8). On the other hand, other studies were not able to reproduce this detection of SARS-CoV from tears, suggesting further work may be necessary to confirm the role of the eye as an entry and exit point for transmission. However, with the nasolacrimal duct providing direct entry of tears into the nasopharynx, continuous with the respiratory tract, WHO's precautionary measures to avoid contact with the eye to reduce transmission are reasonable.

Protective measures

Whether in the community or in the healthcare environment, performance of regular hand hygiene, avoidance of touching the eyes, nose and mouth, and maintenance of social distancing of at least one meter, forms the basis of preventive measures. When taking care of patients, healthcare workers may require additional personal protective equipment (PPE); in the case of a suspected or confirmed COVID-19 patient, or a patient with respiratory symptoms, WHO advisory guidelines

suggest the use of a medical mask, gown, gloves and eye protection (goggles or face shield).

Unfortunately, when caring for patients with no respiratory symptoms, the guidelines become less clear, simply stating to put on PPE "according to risk assessment." As an ophthalmological examination may often involve contact with the patient's eyes, frequent hand hygiene in between patients and avoidance of contact with mucous membranes are necessary. Alternatively, lifting of the eyelid could be performed using orange sticks or long cotton buds to avoid direct contact with the hand and ocular surface. With ophthalmologists' close proximity to patients during physical examination, the decision to wear a mask is dependent on the rigor of screening for respiratory symptoms before consultation, patients' transparent disclosure of symptoms, patients' compliance to mask-wearing if symptomatic, and availability of slit-lamp breath shields, whilst also recognizing that asymptomatic spread occurs. Thus, consideration has to be made on an institutional and case-by-case basis, with the understanding of resource stewardship. In a randomized control trial, the effectiveness of N95 respirators was found to be comparable with medical masks in preventing laboratory-confirmed influenza in an outpatient setting (7). To minimize transmission to patients, the American Academy of Ophthalmology has advised that ophthalmologists postpone non-urgent outpatient visits and procedures, encouraging patients at-risk of COVID-19 to avoid entering the outpatient setting and to seek appropriate help in a hospital-based facility. This advice is consistent with that from the Royal College of Ophthalmologists, which also highlights the need to minimize the duration of examinations, as well as prolonged treatments such as pan-retinal photocoagulation.

Looking to the future

Despite the fear perpetuated by the increasing number of cases and deaths, this period of adversity has also demonstrated our humanity. With countries providing reciprocal aid, with research groups collaborating to develop treatment and vaccines, this outbreak will naturally follow a course of peak and decline, as evidenced by the decrease in the number of new cases in China in March. Minimizing deaths will depend on individual precautionary measures, national-driven policies to identify, isolate, and reduce the spread within community and at-risk groups, and ultimately, the healthcare sectors' resources and resilience.

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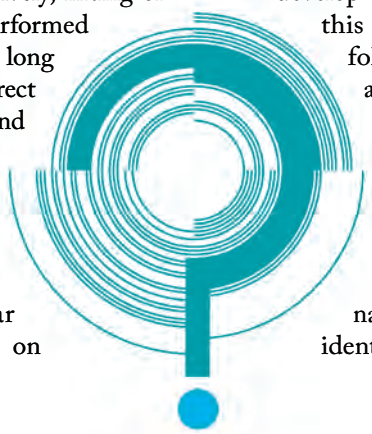

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Reflections on a Decade of Solo Practice
Starting your own practice in a period of economic uncertainty is not easy – but it can be done, as Ajit Nemi explains

Reflections on a Decade of Solo Practice

Starting your own practice in a period of economic uncertainty is not easy – but it can be done. All it takes is hard work, tenacity and courage.

By Ajit Nemi

After nearly 30 years of education, residency, fellowships and more, I found myself waking up on Monday mornings not wanting to go into work. I had spent many years dedicated to my training and education, including a fellowship at Emory Eye Center that I loved, but the "real world" was not living up to my expectations. I didn't feel inspired or fulfilled. After six months of working at a group ophthalmology practice, I realized I needed more control over my career – I wanted to be my own boss. I have always had an entrepreneurial spirit, and I knew I would not be satisfied until I took the leap and started my own ophthalmology clinic. Fast forward to the present day, and my solo practice, Lotus Vision, recently celebrated its 10-year anniversary.

Of course, it was not always easy. It took hard work and perseverance to get the practice to where it is today. The skills I gained from my combined medical degree/Master of Business Administration (MD/MBA) at the Tufts University School of Medicine and ongoing education and experience over the years has equipped me with the knowledge needed to pair my passion for ophthalmology with my mind for business. I have come to believe these degrees have ultimately made me into both a better doctor and a better businessman.

Building a successful practice from scratch comes with many challenges, lessons learned and numerous proud moments along the way. Anyone considering going solo should be armed with the knowledge of how to set themselves up for success, as well as an understanding of the challenges that lie ahead.

Going solo may not be for everyone

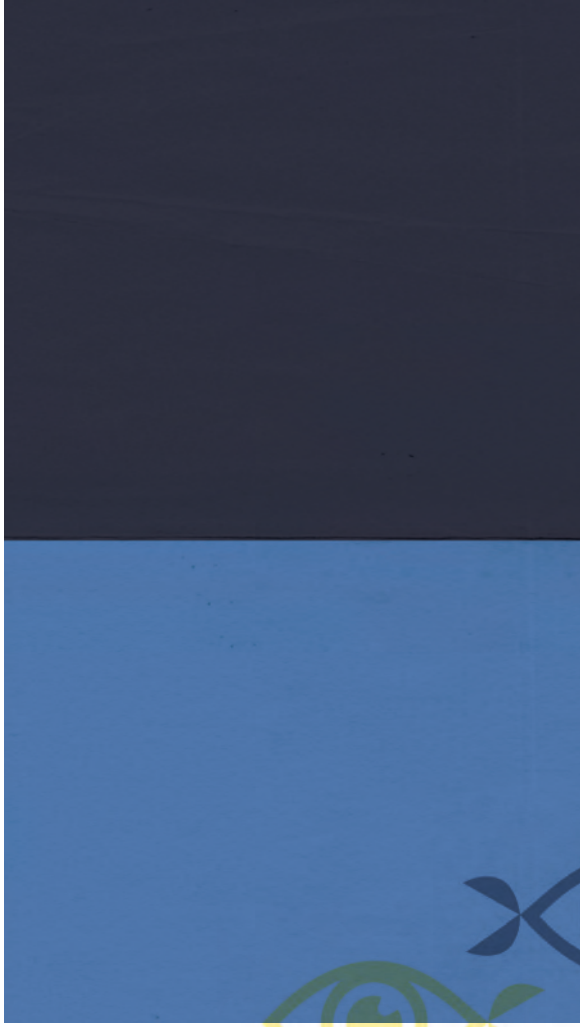
A survey of thousands of US-based physicians conducted by The Physicians Foundation found that the number of solo practices is decreasing, down from 24.9 percent in 2012 to 17.9 percent in 2018 (1). Before taking the leap, it helps to know some of the challenges you may face, as well as how you can effectively work through them:

- *Challenge:* Physician, CEO, marketer and more

Not only do solo practice physicians have to offer quality care for their patients, but they also need to lead all efforts including marketing, practice management, human resources, Merit-Based Incentive Payment System (MIPS), technology implementation, and much more. Balancing these multiple hats, when paired with inadequate technology, continues to be one of the leading causes of physician burnout, which is exacerbated in solo practices.

Solution: In order for your practice to have longevity, you must minimize your chances of burnout, including taking proactive steps to invest in the right people, processes, and technology. The combination of the right staff along with well-designed technology solutions when implemented correctly can help automate time-consuming and administrative tasks.

- *Challenge:* Missing out on the benefits of group practice



"In order for your practice to have longevity, you must minimize your chances of burnout, including taking proactive steps to invest in the right people, processes, and technology."

It's intimidating to start your own practice, particularly without a sense of financial or job security. In fact, more practices have been merging in recent years, creating larger practices that, among other benefits, offer physicians more security. I originally joined a group practice out West for this same reason.

Solution: When on your own, it is even more important to stay involved on a national and community level with what your peers are doing in medical practice and with managing clinical operations. By attending the national meetings and local physician lectures, I stay ahead of what is trending in practice patterns and new technologies. In addition, by attending the city and state ophthalmology meetings and maintaining friendships with colleagues in the area, we are able to assist each other in helping our practices run more efficiently.

- *Challenge:* Keeping up with regulatory shifts

Regulatory standards are always evolving, and it is nearly impossible to keep up with them manually. Often, established group practices have staff that are dedicated to keeping up with these shifts, making it easier to stay compliant.

Solution: Opt for a vendor who, along with forward-thinking technology, is equipped with professionals to help advise you on upcoming changes. One example is the MIPS. You should feel as though the health IT vendor you work with serves as an extension of your team.

- *Challenge:* Patient demand for technology

Patients seek doctors who use the best technology. It can help them feel their doctor is in tune with current trends – in tech and in medicine. Of course, implementing new technology can have significant costs and time investment – both of which solo practices, especially new solo practices, lack.

Solution: If you can, invest in a cloud-based electronic health record (EHR) that does not require investment in local servers and is customized to your specific practice and workflow. Find a company that is always innovating and updating its products. This can make your life easier and help establish trust among your patients.

It is no secret that being a solo practitioner is difficult. However, as the owner of a successful solo practice, I can tell you that these challenges are not insurmountable, and there are strategies you can take to overcome them.

Arming yourself for risk

When I first opened my clinic, Lotus Vision, in 2008, all the cards were stacked against me. It was a time of economic uncertainty – not unlike the period we are in now. The country was also entering a presidential election, and we were in a recession. It's safe to say I was taking a huge

"To me, the business of ophthalmology and the art of caring for patients are inextricably linked."

risk by going off on my own. On top of that, I was using a free EHR that was doing nothing but slowing me down.

Despite the hurdles the economic recession had created, I found that arming myself with the proper technology and tools helped streamline my business operations, and ultimately, helped me flourish. The key was to be humble and respect the process, opening the clinic with only the essential technology, staff and office space. I gradually introduced new equipment and additional team members as the practice grew and evolved.

In an era where healthcare continues to consolidate, ophthalmologists are rather unique among medical specialties in that solo practice is still very much a viable pursuit. Although this amplifies the need for an efficient business model, a successful solo ophthalmology practice can be achieved with the right mix of hard work, tenacity, and courage.

What tech does your practice need?

When I first started my practice, I wanted to have a paperless office, but because I did not have the capital to invest in an ophthalmology EHR platform at that time, I started with a free system. I quickly found that those sorts of general-use EHR systems are heavily dependent on the user inputting data—I found myself spending a lot of time after clinic hours manually entering notes. The solution was manageable for a time, but with increasing regulations, I knew this workaround wouldn't suffice forever.

A new solution became an even more pressing need in 2014 with the imminent transition to ICD-10. I knew I needed a better, more user-friendly system so I decided to make the jump and implement Modernizing Medicine's EMA, an ophthalmology EHR built by practicing ophthalmologists.

I preferred the ophthalmology-specific nature of EMA over the general technology of other systems. In practical terms, it means the system interface populates with complaints relevant to ophthalmology patients and suggests diagnostic codes, eye exam findings, counseling procedures, and billing requirements which you can select from. The second characteristic that I found to be incredibly important was the platform's design and ease of use. When you're using a technology in your daily workflow, you want to ensure it knows how you work and is easy to navigate.

When selecting software, ask yourself: will this help my practice grow? Look for a platform that helps streamline tedious tasks and improves efficiencies. Patient history is a vital part of most exams, but this seemingly simple task can become time-consuming without the right system in place. Having a platform that may be used to help you ask questions relevant to the purpose of the visit has made a huge difference. When I enter the exam room, I know in what order the visit will unfold and that my EHR will be there to back me up, allowing me to spend more face-to-face time with my patient.

I knew another huge hurdle for me would be keeping up with the evolving regulations. To my surprise, it is possible to stay compliant and keep up with regulations with the help of the right technology. A major concern I had with the ICD-10 changeover was how it would affect billing. However, by choosing a platform that worked for me, it was easy to generate a superbill based on the criteria from the patient's office note. Once the note is finalized, the information is sent directly to the practices' billing department, helping to save time and improve overall efficiency

"With more efficient clinical operations, I have more time for patient care, and when I focus on quality care delivery, I fulfil my personal and professional mandate – and you can, too."

in the clinic. MIPS is one of the more recent large-scale changes. Some EHR systems can gather your MIPS reporting data without adding additional time and clicks to your workflow.

Lastly, as a solo practitioner, you're always on the go. You continuously move around to different doctors' offices, meetings, and hospitals, and need to make sure your technology can keep up. My best piece of advice is to make sure patient information is accessible on a mobile phone and/or tablet. When you're traveling and a patient calls late at night, a cloud-based system allows you to answer questions, and refill a prescription instantly.

For those looking to take the leap

As I reflect on my past decade as a solo practitioner, I know taking the time to invest and implement proper technology has made all of the difference. I view being efficient in the clinic and improving care delivery as synergistic: efficiency affords me the ability to spend more quality time with patients.

Whether you're a new physician or a seasoned doctor, it's important to know it is possible to resist joining a large practice to pursue your own dreams. You can achieve financial security and a work-life balance on your own if you arm yourself with smart investments. To me, the business of ophthalmology and the art of caring for patients are inextricably linked. With more efficient clinical operations, I have more time for patient care, and when I focus on quality care delivery, I fulfil my personal and professional mandate – and you can, too.

Ajit Nemi is Director of Ophthalmology at Emory Johns Creek and North Fulton Hospitals, and Founder of Lotus Vision.

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Strategy – and Humanity

Sitting Down With… Jeanne Hecht, CEO of Ora

Tell us about your path to ophthalmology...

I actually spent 23 of my 25 years in pharma services within the field of oncology. I came over to ophthalmology in 2018, when I was approached by a head-hunter who was looking for external board members to support the evolution of Ora. I learned more about the company and came to adore the family who started it – the Abelsons. They are a special family; very passionate about advancing ophthalmology and supporting their pharmaceutical and device customers as they bring new medical interventions to the market. And that's what brought me over.

Right after I agreed to join, a long-time work colleague and friend of mine died of ocular melanoma. Christine was a larger-than-life woman who ran a non-profit group focused on advancing clinical research. We had spent a lot of time together trying to progress clinical research as a care option. I didn't even know that she was sick. It was heart-wrenching. There I was, about to start work in ophthalmology, and Christine died of ocular melanoma. It felt like the field was calling to me.

How do the two specialties compare?

There are a lot of differences. For one – and please forgive the wording – ophthalmology is a more "hopeful" field. In my 23 years in oncology, I dealt a lot with death. I worked at a Cancer Center in North Carolina and often found myself reading obituaries, looking for my patients because they were so sick.

I also find that ophthalmology moves at a faster pace and is more collaborative. Maybe it's because you're dealing with hope; you have the opportunity to help somebody to see better and people rally around that. The ophthalmology community is open to discussion, new ideas, and different people's perspectives and opinions. Communication is authentic – and I've found that very refreshing.

How did you transition from board member to CEO?

I joined the board in 2018, then took over the role of Chief Strategy Officer in January 2019. And finally assumed the role of CEO in August. The board, the family, and I were working behind the scenes to plan my move to CEO. We wanted to be careful because Ora is a special company; it is a 44-year-old, family-owned, privately-held organization, and many of the employees have been here for 10, 15, or even 20 plus years.

Can you tell us more about your work with OWL?

When I came over to Ora, I immediately became an active member – I even helped to set up a chapter in North Carolina, what an honor. A lot has happened in the last couple of years, some of it driven by the #MeToo movement. People in leadership positions are now spending more time understanding workforce metrics – myself included. I believe we're not doing enough for minorities and people with disabilities, and that's something I wanted to change at Ora. We're an ophthalmology company, but how many people in our company truly have vision impairments? What can we do to create opportunities for people with impaired vision?

We partnered with the Perkins School for the Blind, located about 45 minutes from our offices in Andover, to create an internship to help people get their first job and for those who have been underemployed – either underpaid or working below their grade level – to get more appropriate work. I wanted to create a sustainable pathway for women, people with disabilities and minorities to get adequate opportunities, and make sure Ora is more representative of the talent available. Hopefully these initiatives will reap dividends in years to come.

How is the partnership going so far?

We've actually just had our first hire, Thomas! We were supposed to start our second intern in March. However, due to the virus, we've had to put recruitment on hold because the offices aren't open. But when the world restarts, we will restart that program as well.

What were your biggest breaks professionally?

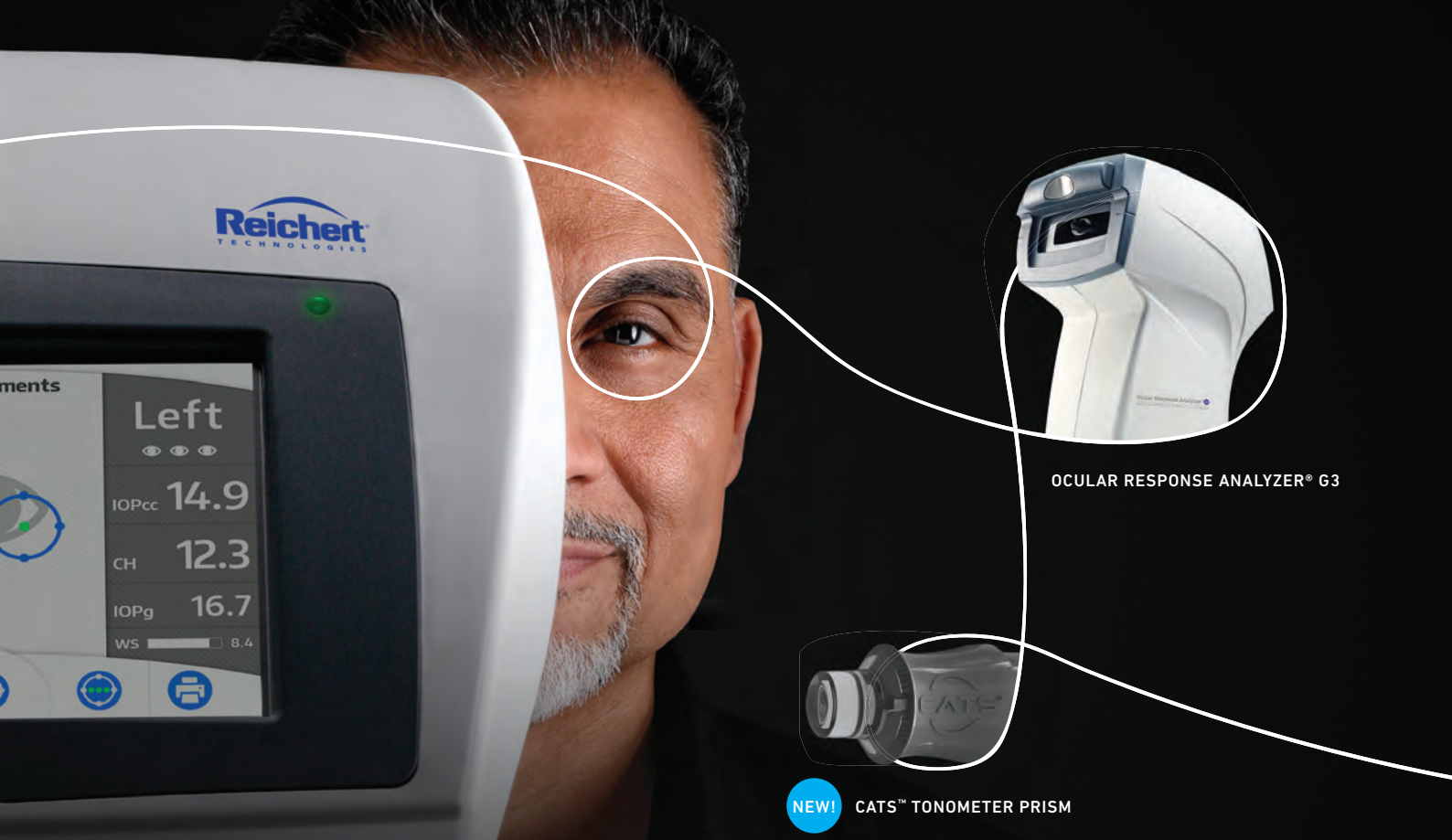
Back in 2010, when I was still at Quintiles, I was working on a project called "Project Asia." I moved to Singapore on my own, hired 50 people in under three months, set up a domestic sales team, along with strategic planning, marketing and communications, and grew it into a billion-dollar business in 18 months.

What did you take away from the experience?

You don't always have the right answer, so make sure that you talk to people who do. It also really taught me to respect cultural diversity – even more so than I ever had before. It was a great learning opportunity.

What do you do to unwind?

I love to listen to podcasts. I'm a true crime person, so Dr. Death, Dirty John – all of those. I also like Planet Money. They're good for when I need 20 or 25 minutes to myself after a stressful afternoon. I'm also a geek who likes to birdwatch. I cook a lot. I'm not a big baker, but since the pandemic started, I really got into making bread. I'm also active, so I like to play tennis, I hike, paddleboard, kayak, and I'm a certified scuba diver, which means I can go to caves and deep-water wrecks.



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